



## University of Vermont Research-Based Ideas at Work for Vermonters



## Annual Report 2014

A PUBLICATION OF THE VERMONT AGRICULTURAL EXPERIMENT STATION AND UNIVERSITY OF VERMONT EXTENSION





## UVM Research-Based Ideas at Work for Vermonters

For the past 24 years, this annual report has been released to great fanfare (apple pie and ice cream) at the Vermont's Statehouse amid a crowd of stateswomen and men led by the Governor; and the University of Vermont President, researchers, program leaders, students and staff. This year is no exception.

### Credits

#### CONTRIBUTORS & PHOTOGRAPHERS

Susan Brouillette, George Cook, Cindy Corkins, Erica Cummings, Gary Deziel, Cheryl Dorschner, Richard Fanus, Becky Gollin, Debra Heleba, Jeanne Keefe, Vern Grubinger, Sue Lang, Doug Lantagne, Katrina Light, Robin Lockerby, Stephen Mease, Jane Nevins, Jane O'Neil, Todd Pritchard, Robin Smith, Lauren Traister, Diane Trono, Tom Vogelman, Kirsten Workman, Cathy Yandow, Feng-Qi Zhao, Tina Zuk.

#### DESIGNER

Tom Baginski

### Advisory Boards

#### VERMONT AGRICULTURAL EXPERIMENT STATION

Tom Berry, Colchester; Megan Camp, Shelburne; Patricia Coates, Jericho; Cynthia Danaher, Winchester, MA; David Dunn, Queensbury, NY; Robert Foster, Weybridge; Leon Graves, Marcellus, NY; Patricia Heffernan, Shelburne; Peter Karnezos, Colchester; Krystina Kattermann, Branchville, NJ; Meghan McKeown, Seattle, WA; Jenny Nelson, Ryegate; Robert Paquin, Shelburne; Chuck Ross, Hinesburg; Robert Ullrich, Charlotte.

#### UVM EXTENSION

Ray Allen, South Hero; Tom Berry, Colchester; Joe Buley, Montpelier; Patricia Coates, Jericho; Maree Gaetani, Stowe; Jean Hamilton, Plainfield; Beth Kennett, Rochester; Leo Larocque, Brandon; Jack Manix, East Dummerston; Jenny Nelson, Ryegate; Suzi Pike, Stowe; Bill Rowell, Sheldon; Kyle Scott, Jericho; Katherine Sims, Westfield; Steven Sinclair, Montpelier; Catherine Thrasher, Rupert.



Vermont  
AGRICULTURAL  
EXPERIMENT STATION



The University  
of Vermont  
EXTENSION

Copyright: Vermont Agricultural Experiment Station and University of Vermont Extension. The Vermont Agricultural Experiment Station, UVM Extension and U.S. Department of Agriculture cooperate to offer education and employment to everyone without regard to race, color, national origin, gender, religion, age, disability, political beliefs, sexual orientation and marital or familial status. Any reference to commercial products, trade names, or brand names is for information only, and no endorsement or approval is intended. 2/2015.

# Three Questions On Why UVM Research Matters 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 oversee over \$19.1 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's why they publish this annual report.

## **Q: How do Vermonters see the effects of scientific research conducted at UVM?**

**A:** Science is an essential part of innovation and technology in Vermont's economy. VT-AES and UVM Extension faculty and staff work with farmers, communities and organizations throughout Vermont. UVM discoveries and knowledge help solve some of our most pressing issues surrounding 21st Century farming, planning for climate change, food systems that work and building Vermont communities. These pages highlight projects that will have real impact at home and in the world – just a few examples of UVM work across many disciplines. Find out more at the websites at the bottom of each page.

## **Q: Vermont is a small state. How can it have bragging rights against 50 states most much bigger in so many ways?**

**A:** "Vermont's stature as a leader is intrinsically linked to having world-class researchers and world-class outreach programs," says Lantagne. "But just as



Cheryl Dorschner

Tom Vogelmann, Dean  
Vt Agricultural Experiment Station

## **"UVM discoveries help solve our most pressing issues surrounding:**

- 21st century farming,
- Planning for climate change,
- Food systems that work and
- Building Vermont communities."



Cheryl Dorschner

Douglas Lantagne, Dean  
UVM Extension

important is Vermont's close working relationship among government, community, business and higher education leaders."

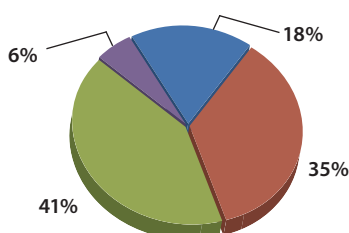
That's why, for example Vermont is synonymous with cheese, maple, hard cider, ice wine, artisan beers, ice cream, even kale. UVM scientists are developing the next generation of Vermont's signature products. Our hardworking state is also known for being among the first to take stands on many issues and for maintaining a beautiful working landscape. Likewise, UVM is renowned as one of the nation's pre-eminent small research universities. And Burlington is consistently top rated, including this year: #1 college town by "Travel & Leisure" magazine, "Outside" magazine ranked us one of 16 "best towns ever." And BTV is one of 15 hottest cities for 2015.

## **Q: With ever-stressed state and federal budgets, how do you aim to meet the research and program needs you just described?**

**A:** We don't ever aim to stay the course, because the research language is always changing. Witness Jill Preston's \$423,000 National Science foundation grant (page 3), Jeff Carter's \$500,000 National Institute of Food and Agriculture water quality grant, Heather Darby's \$150,000 UVM Dairy Center Excellence funding, and other pioneering ways of leveraging grant dollars through partnerships with farmers (page 2). "The key to our strong future is to increase the number partnerships at all levels," says Vogelmann.

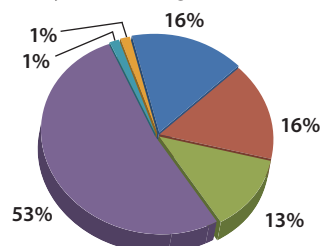
~ Cheryl Dorschner

VT Agricultural Experiment Station  
Budgeted Dollars FY 2013



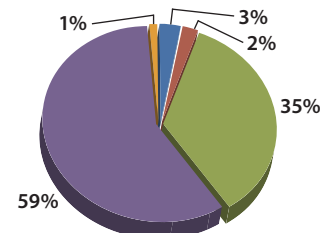
■ Hatch Federal Funds \$1,434,063  
■ State/UVM \$2,864,860  
■ Grants & Contracts \$3,346,143  
■ Multi-State Research Federal Funds \$442,757

VT Agricultural Experiment Station Budgeted  
Dollars by National Program Area FY 2013



■ Childhood Obesity \$1,323,589  
■ Climate Change \$1,266,540  
■ Food Safety \$1,036,878  
■ Global Food Security & Hunger \$4,238,481  
■ Sustainable Energy \$119,483  
■ Urban Non-Point Source Pollution \$102,852

UVM Extension Budgeted Dollars  
by National Goal Area FY 2013

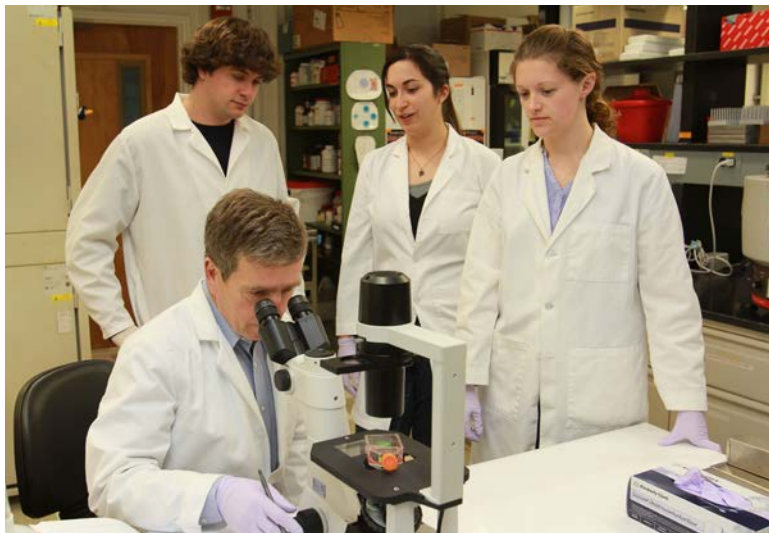


■ Childhood Obesity \$338,955  
■ Climate Change \$264,494  
■ Community Development \$3,846,343  
■ Global Food Security & Hunger \$6,491,370  
■ Sustainable Energy \$93,190



21<sup>ST</sup> CENTURY FARMING: DAVID KERR

## UVM Dairy Center of Excellence New Paradigm: On-Farm Research



Jane O'Neil

UVM Dairy Center of Excellence Interim Director David Kerr examines skin cells of cows exposed to mastitis-causing bacteria. Students, from left, Benjamin Green, Amanda Ochoa and Aimee Benjamin discuss how animals' ability to respond to pathogens is related to how their cells respond in the lab.

## TOP 10 THINGS YOU NEED TO KNOW

- 1 In 2009, UVM realized that the increasing operating costs of running an on-campus research farm far outspent income from research funding – to the tune of \$1.2 million a year.
- 2 Necessity is the Mother Cow of Invention.
- 3 By keeping the student-run dairy herd and selling UVM's research herd, the debt was eliminated, and \$150,000 in operating costs plus \$50,000 seed money was channeled to research.
- 4 Attracting matching investors, industry and grant funding, the UVM Dairy Center of Excellence (DCE) was launched with the idea that much research could be done on Vermont farms, with UVM's farm dedicated to specialized, intensive research on small groups of animals.
- 5 The number of partner farms has grown from 4 to 19 farms.
- 6 And the start-up \$200,000 investment has yielded more than \$1 million in research benefiting Vermont farmers.
- 7 Scientists can conduct larger and broader samples and tap into a greater gene pool than if they were restricted to UVM's herd.
- 8 Among the projects are identifying traits for milk production and mastitis and comparing forage crops in hopes of improving cattle health and lowering feed costs.
- 9 "Our new model of research is a much more efficient use of scarce research dollars," says David Kerr, DCE interim director.
- 10 Funding for two new proposals totaling \$300,000 was announced in February 2015.

**UVM PARTNERS WITH FARMS**  
Expands Reach and Depth of Research

Andersonville Dairy LLC, West Glover  
Audet's Blue Spruce Farm, Bridport  
Chaput Family Farms, North Troy  
Clifford Farm, Starksboro  
Fairmont Farm, Inc., East Montpelier  
Fitzgerald Dairy Farm, Colchester  
Foster Brothers Farm, Middlebury  
Four-Hills Farm, Bristol  
Green Mountain Dairy, Sheldon  
Island Acres Farm, South Hero  
Jasper Hill Dairy Farm, Greensboro  
Kane's Scenic River Farms, Enosburg Falls  
Knoxland Farm, Bradford  
Monument Farms Dairy, Weybridge  
Newmont Farm, LLC, Bradford  
Nordic Farms, Charlotte  
Rainville Farm, Highgate Center  
Shelburne Farms, Shelburne  
Terryland Farms, Inc., St. Eugene, Ontario



Debra Heleba, UVM Extension

UVM Agronomist Sid Bosworth studies cool-season grasses and forage crops at Borderview Farm in Alburgh in hopes of understanding the characteristics that could be altered to improve cattle health and lower feed costs.



### Chill Factor – How Will Plants Deal With What May Be Inevitable?



Cheryl Dorschner

Grasses include some of the grains that feed the world – wheat, oats, rice, corn and pasture crops, so how they withstand dramatic temperature change is important research that UVM's Jill Preston is undertaking.

In the lab, Jill Preston, left, supervises Ph.D. student Meghan McKeown as they extract DNA from 'poid' grasses in order to identify genes responsible for cold hardiness and compare them across several species to find indicators of a common ancestor.



Cheryl Dorschner



Plants such as wheat require a chilling period called "Vernalization" to initiate flowering. They also respond to day length.

Cheryl Dorschner

#### TOP 10 THINGS YOU NEED TO KNOW

- 1 70% of all food crops are grasses including rice, cereals and corn.
- 2 Other grasses are grown as fodder for livestock – indirectly are still human food.
- 3 Grasses developed from tropical plants to cold hardy – but how?
- 4 Maybe plants that landed in cold climates developed novel ways of surviving.
- 5 Or an ancestral gene may have expressed itself when life depended upon it.
- 6 That's what UVM plant biologist Jill Preston wants to find out.
- 7 This could be important to predict how plants will react to climate change.
- 8 If she identifies key gene(s), they could be modified for better crop yields.
- 9 In 2014 Preston received more than \$1.4 million to study the genetic origins of how cereal grasses adapted to cold temperatures.
- 10 Already she's finding evidence of a common ancestor.

#### CROP GRASSES (POOIDS), SUSTAINED LIFE THROUGH MILLENIA

| 55 MILLION YA                            | 40 MILLION YA           | 6700 BCE                         | 1200s                                 | 1500-1900s                | 1960s                             | 1965                                 | 2014                                   |
|--|-------------------------|----------------------------------|---------------------------------------|---------------------------|-----------------------------------|--------------------------------------|--|
| RICE GRASSES EVOLVED IN TROPICAL CLIMATE | POOIDS & BAMBOO EVOLVED | WILD GRASS TEOSINTE DOMESTICATED | FODDER & SOIL BUILDING GRASSES IN USE | "AGRICULTURAL REVOLUTION" | HIGH-YIELD HYBRID GRAIN CULTIVARS | "CHEMGRASS" ASTROTURF USED ON FIELDS | JILL PRESTON BEGINS UVM POOID RESEARCH |



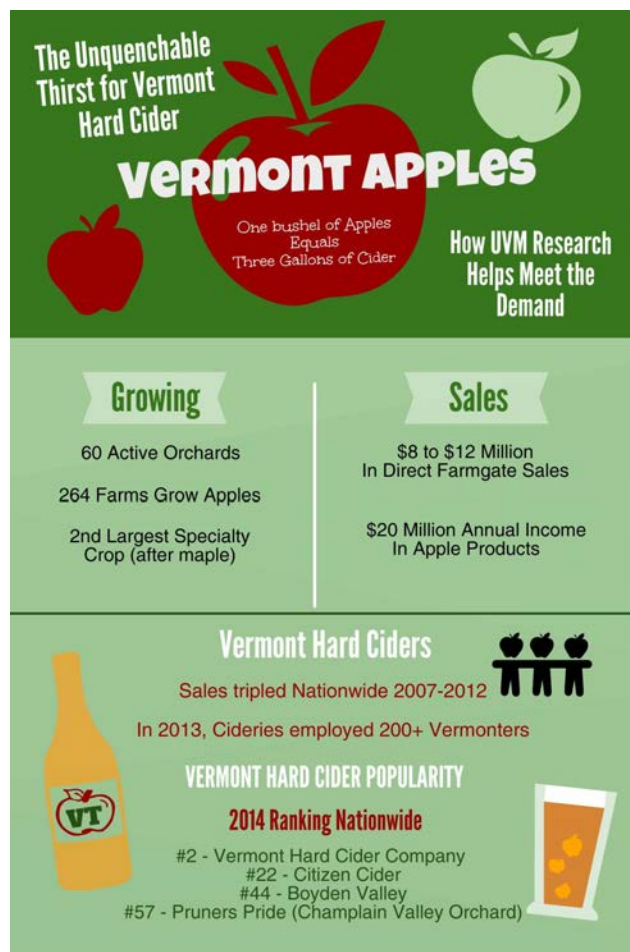
FOOD SYSTEMS THAT WORK: *TERENCE BRADSHAW*

## Cider House Rules: Huge Demand for Vermont's Latest Food Star



Cheryl Dorschner

How much does an apple tree produce? At UVM's Horticultural Research and Education Center, Terence Bradshaw picks a whole tree of 'Liberty' apples at peak and weighs the harvest. He also measures tree size and later the cider yield per tree to understand what he calls "yield efficiency."



## TOP 10 THINGS YOU NEED TO KNOW

- 1 Apples have long vied for second place among Vermont specialty crops (after maple).
- 2 2,800 acres of Vermont orchards produce mostly wholesale commodity apple crops.
- 3 But hard cider has become wildly popular – increasing annually 50 percent in sales.
- 4 Cideries' demand for apples is huge; growers scramble to plant or renovate orchards and adapt production to supply this new market.
- 5 If every Vermont apple were pressed into juice, it would barely fill a third of the fermentation tanks at Vermont Hard Cider Company in Middlebury – #2 producer in the U.S.
- 6 UVM's Terence Bradshaw is among the first in the nation to provide science-based research to help growers and cidermakers respond to overwhelming demand.
- 7 Bradshaw studies all angles: from fruit to bottle to understand costs, opportunities for efficiencies, management strategies and economic impact of cider production.
- 8 And he wants to know: what apple varieties grow best in Vermont, which produce highest yields, what the flavor profiles are of various ciders.
- 9 Research happens in UVM and Vermont orchards, in the UVM campus Jeffords Hall "juice lab" and in cider press rooms across the state.
- 10 Federal-state grants, cash and in-kind matching funds and donations from cider companies pave the way for Vermont to perhaps lead the nation in cidermaking and apple research.



Becky Gollin

At Middlebury's Happy Valley Orchard last November, Terence Bradshaw bottles fresh-pressed cider, from different apple cultivars. This spring, cidermakers will compare the likes of 'Jonagold,' 'Liberty' and 'Macoun' to help identify best flavored Vermont varieties for hard cider.



### Love It or Hate It: Sugary Drink Tax Provides Arena for Key Research



Cheryl Dorschner

Sarah Heiss, right, and Jane Kolodinsky are among the UVM researchers who collect data and study how Vermonters and the media frame their positions on the proposed excise tax on sugary drinks.

#### TOP 10 THINGS YOU NEED TO KNOW

- 1 Six states have proposed excise taxes on sugary drinks.
- 2 Berkeley, California and Mexico have instituted taxes.
- 3 After two previous tries, in January, a coalition proposed a Vermont sugary drinks tax of two cents per ounce.
- 4 UVM researchers Sarah Heiss and Richard Watts conducted a content analysis of media coverage of the proposed tax and how it influenced outcomes in 2011-2012.
- 5 Heiss previously studied how trade associations representing the sweetener industry reframed the risks and public debates associated with sweeteners.
- 6 UVM Center for Rural Studies director Jane Kolodinsky's data shows that opponents of the sugary drink tax switched the argument from one of public health to one of economics.
- 7 Surveys concluded: there's no evidence that a sugary drinks tax will hurt small retailers, cause job loss or an increase in border crossing to shop.
- 8 Findings also conclude, a tax would nudge consumers to choose lower-calorie beverages and lose weight.
- 9 Obesity expert Rachel Johnson's research links high intakes of sugary drinks with poor health outcomes. Now a spokesperson for the American Heart Association, she advocates for the tax. See chart.
- 10 USDA Hatch and UVM Food System Spire grants and the Robert Wood Johnson Foundation funded research.



Tina Zuk

Nutrition scientist Rachel Johnson's research reveals the links between consumption of sugary drinks and poor health outcomes.

### THE BUILDING BLOCKS FOR IMPROVING WATER QUALITY



*UVM Extension has worked with hundreds of farmers, industry professionals and other partners documenting almost 700 implemented best practices - the building blocks of environmental protection - and thousands more acres are under one or more best practices this year.*

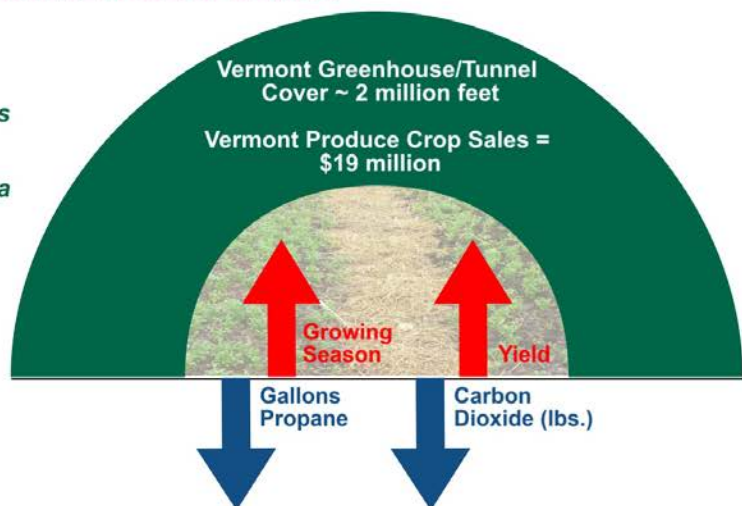
**Soil Health + Agronomic Management Practices = Less Runoff**

### STRENGTHENING VERMONT'S ECONOMY AND REDUCING POLLUTANTS

*UVM Extension assists growers with greenhouse growing and adoption of high tunnels and a biomass (wood pellet) heating option. A single system installation averages a savings of 600 gallons of propane which equals \$360,000 over 10 years - and a net reduction of 3.6 tons of carbon dioxide.*

*The high tunnel projects demonstrate options for growers who want to:*

- > Increase business viability
- > Provide local produce for consumers
- > Reduce carbon emissions





## PLANNING FOR CLIMATE CHANGE

## PREPARING THE SCIENTISTS AND ENGINEERS OF TOMORROW



Reached > 8,700  
Vermont youth

> 3,500 Vermont youth  
increased STEM  
knowledge/skills

4-H STEM education shows how science and engineering issues affect youths' lives and prepare a future generation of scientists and engineers. Last year:

**TEENS REACHING YOUTH (TRY)**, a STEM program, combines environmental education with service learning.

Almost 400 (grade K-3) youth solar and wind energy "engineers" learned energy concepts from Teen Renewable Energy Experts.



## COMMUNITIES ACT TO DEAL WITH CLIMATE AND ENERGY ISSUES

Town Energy Committees - about 100 in 2013 - formed to provide community leadership on complex issues and opportunities dealing with increasing energy costs.

Committee members desired more knowledge and skills to be successful, and Extension responded with an educational conference.

The (now) Annual Community Energy and Climate Action Conference encourages increased understanding of local opportunities for addressing energy and climate change while increasing capacity for community leadership. Last year:

 **6th Annual UVM Extension Energy Conference** had 259 attendees from 12 counties

 **45 communities, in 10 counties, started new projects** addressing local energy issues



## PROVIDING EDUCATION AND RESOURCES TO ADAPT TO A CHANGING CLIMATE

Climate change issues and challenges are addressed across Extension's programs and audiences in all 14 Vermont counties.

Last year, UVM Extension staff made ~47,000 direct educational connections with Vermonters addressing issues of importance to citizens, whether it be farmers dealing with extreme weather conditions, youth learning about sustainable energy, or other important topics.



## Water Management &amp; Protection

Agronomy workshops on field drainage  
Climate change adaptation & irrigation techniques  
Forest education  
Nutrient management planning



## Food &amp; Crop Production

High tunnel research  
Master Gardener Program  
Integrated Pest Management (IPM)  
Climate Hub & organic agriculture  
First Pest Detectors  
Maple production



## Energy Usage &amp; Efficiency

Sustainable Transportation Project  
Biomass heating options  
Energy Conference for municipalities  
4-H Teens Reaching Youth (TRY)



### CULTIVATING HEALTHY FOOD, ON THE FARM & AT THE TABLE



Helping farmers meet  
year-round market  
demand for  
**LOCAL, HEALTHY FOOD**

*through improved  
humidity and temperature  
monitoring and control  
to reduce spoilage*

9-farm pilot project  
**CULL RATES  
REDUCED 50%**  
for 423 tons of vegetables  
estimated value of \$910,000

**MINIMIZING RISK**  
of food contamination is  
important to consumers and  
producers

*Daylong workshops in 4  
Vermont locations held for  
small-scale direct market  
growers to develop a  
Produce Safety Plan*

Produce Safety Plans drafted  
by 87 farmers  
and agricultural  
service providers



EFNEP (Expanded Food  
and Nutrition Education  
Program) provides nutrition  
education to low-income,  
at-risk youth and families

*1,113 Vermont youth  
participated in EFNEP  
and 400 more children  
reached through  
adult participants*

87% of adult participants  
reported improved food  
access each month  
for their families



## BUILDING VERMONT COMMUNITIES

CULTIVATING HEALTHY COMMUNITIES IN VERMONT  
YOUTH, FAMILIES AND BUSINESSES

87% likely able to  
handle problems

42% answer **DEFINITELY**  
will do outdoor activities  
as a family

76% know one  
step to take  
towards goal



Pilot program  
has 10 teens  
purchase  
capital assets

Positive Youth Development  
Programs Making A Difference

**Becoming An Outdoor Family >**  
Creating resilience through fun  
in the outdoors

**PROSPER**  
(**P**RO**M**oting School Community  
University Partnerships to Enhance  
Resilience) >  
Fighting substance abuse in  
youth

**Youth Agriculture IDA Program**  
(**I**ndividual Development Account) >  
Removing barriers for young farmers  
to begin agricultural businesses

**4-H >**  
Hands-on learning activities in  
science, citizenship and healthy  
living

## Newport City Market Analysis &gt;

Building local economy through  
local input for designing  
downtowns

## Take Charge &gt;

Teaching leadership  
skills creates local  
leaders able to  
accomplish goals in their  
community

*Citizen committee  
raises \$300,000  
and restores town  
municipal building*

## AgriTourism Forum &gt;

Agribusiness and  
farm-based  
education options  
to keep farmland  
in production

*36 businesses and 706  
consumers surveyed  
for City Marketplace  
planning*

*143 farmers attend forum  
on farm-based education  
and agribusiness*



**Vermont Agricultural Experiment Station**  
**College of Agriculture and Life Sciences**  
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

