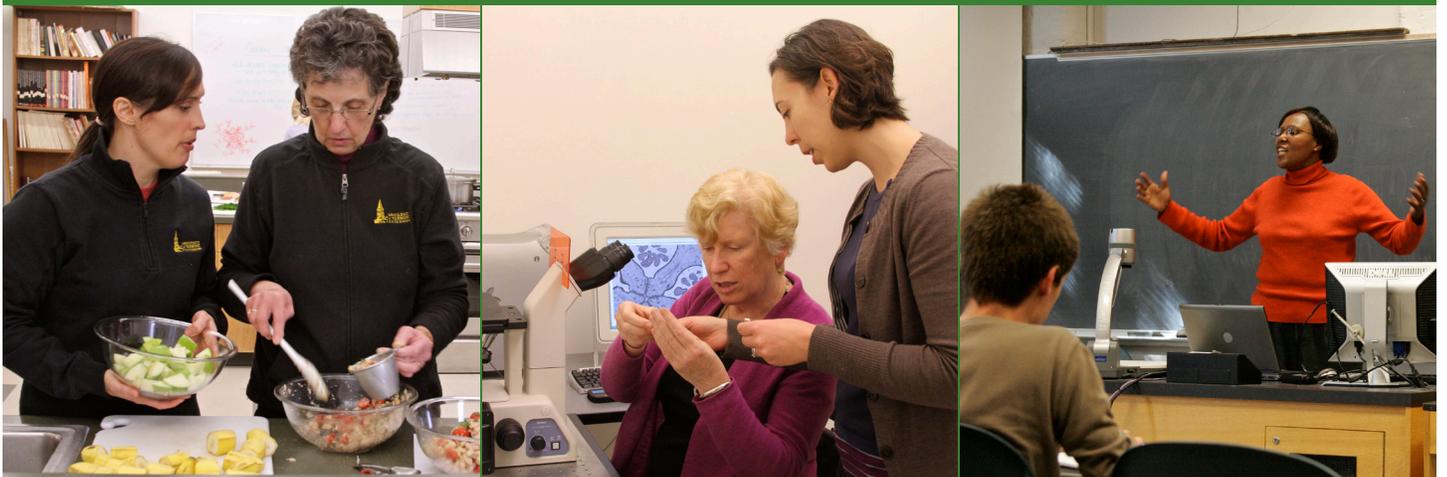


Annual Report 2013



Solutions for the Future



2013 Annual Report

The first crop of maple syrup isn't usually tapped and boiled yet, in mid-February when University of Vermont scientists, star students, program leaders and state officials gather in the Vermont State House cafeteria for sugar-on-snow and other delicious treats to celebrate the publication of the Annual Report of the Vermont Agricultural Experiment Station and UVM Extension.

We like to think we're way ahead of the times in the scientific research, outreach programs and maple syrup produced by the University of Vermont, the state's land-grant institution that serves Vermonters.

This booklet features eight examples of cutting-edge University of Vermont work that is linked to the issues and needs of Vermonters. Our mission includes bringing research-based knowledge to Vermonters so they can make their own informed choices.

That, like the Proctor Maple Research Center's sugar-on-snow, is both very cool and sweet.

Credits

CONTRIBUTORS & PHOTOGRAPHERS

John Barlow, David Barrington, Heather Carrington, Cindy Corkins, Caitlin Cusack, Gary Deziel, Cheryl Dorschner, Richard Fanus, Fletcher Allen Health Care, Kate Forrer, Lisa Halvorsen, Victor Izzo, Jeanne Keefe, Douglas Lantagne, Jerry Leonard, Daniel Lerner, Carolina Lukac, Sally McCay, Stephen Mease Photography, Tim Perkins, Jane Nevins, Robin Smith, Diane Trono, UVM Extension Master Gardener Program, Joan Vance, Tom Vogelmann, Tim Wilmot, Cathy Yandow

DESIGNER

Tom Baginski

PHOTOS: FRONT COVER & THIS PAGE

Cover Top: Bringing home the cows for milking, Olivia Thompson shares the chores of the student-run dairy herd in the Cooperative for Real Education in Agricultural Management nicknamed CREAM. Photo by Cheryl Dorschner

Cover From Left: Outreach – Research – Teaching are the three tenets of UVM's mission as a land-grant university serving Vermont. 1. Educators Susan Edwards and Louise Brunelle in UVM Extension's Expanded Food and Nutrition Education Program (EFNEP) reach out to low-income families. 2. Plant biologist Mary Tierney mentored Emily Larson who researched the changes in cell walls while earning her Ph.D. 3. Grace Matiru teaches macroeconomics for community development and applied economics. Photo by Cheryl Dorschner

This Page: Rachel Freund holds a day-old Holstein calf born into the UVM student-run CREAM herd. Freund is a senior majoring in community entrepreneurship. Undergraduate students typically have opportunities to do research with their professors and internships in their communities. Photo by Cheryl Dorschner



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Deans Say VT-AES, UVM Extension Embrace Vermont's Challenges and Changes

“Science is needed to clarify some of the unknowns of the future and focus research on key topics relevant to Vermont’s agricultural economy,”

says Tom Vogelmann, dean of the Vermont Agricultural Experiment Station (VT-AES).

Those “unknowns” include the challenges of feeding an increasing population, creating a resilient local food economy, addressing food safety, controlling invasive species and identifying adaptive responses to severe weather.

VT-AES tackles these tough issues with science-based research that informs Vermonters. This annual report highlights four examples: the opportunities and obstacles in Vermont’s food system of farm-to-institution contracts; how cattle epidemiology sheds light on raw-milk cheese safety; what fern DNA sequencing has to do with the burgeoning business of selling wild-picked fiddlehead ferns; and whether we can exploit pests’ natural interactions to manage them.

RESEARCH BENEFITS COMMUNITIES

UVM Extension builds on the University’s research by applying its results to benefit Vermont communities.

“Our robust program in outreach demonstrates the pieces of an intricate and coordinated research-engagement strategy that will constantly shift as we move into the future,” says Doug Lantagne, UVM

Extension’s Dean. His four examples in the following pages are how UVM Extension: educates people about tree health; provides small-scale maple producers a new cost-

effective option for sap collection; Master Gardeners play a role in Vermont’s food systems; and serves the needs of adults caring for grandchildren, nieces and nephews.

VT-AES and UVM Extension meet the challenges of our changing world and turn scientific research into new knowledge solutions and educational programs that reach Vermont communities. The projects described in these pages help Vermonters in agriculture, environment, nutrition, food safety, health, community and economic development.

Of course, it takes money to carry out this research and outreach to Vermonters.

Last year the combined budgets of the Vermont Agricultural Experiment Station and University of Vermont Extension totaled about \$21.9 million, down \$1.5 million from the previous fiscal year due largely to the federal budget sequester.

“We had the Sequester at the federal level and flat budgets at the state level for at least the past five years,” observes Lantagne. “Regardless of the funding environment, we will continue to focus on the issues at the forefront for improving Vermonters’ lives

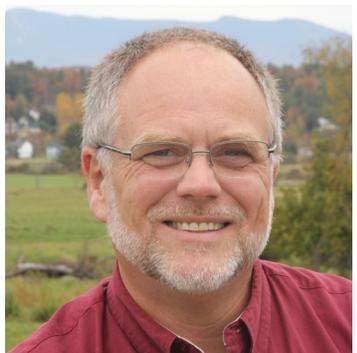
and their communities’ well-being.”

The charts at right demonstrate VT-AES and UVM Extension’s research and outreach obligation by categories specified by the USDA’s National Institute of Food and Agriculture (USDA-NIFA). Visit the websites listed throughout this publication for further details of our financial reporting for fiscal year 2013.



Tom Vogelmann, Dean
Vt Agricultural Experiment Station

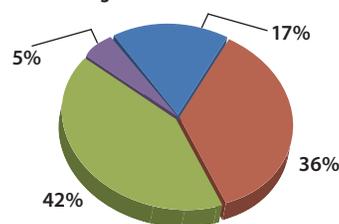
Sally McCay



Douglas Lantagne, Dean
UVM Extension

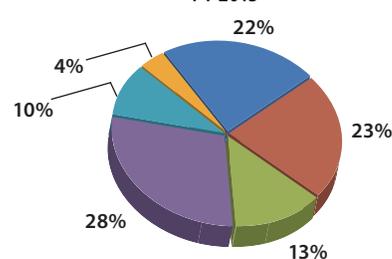
Cheryl Dorschner

VT Agricultural Experiment Station Budgeted Dollars FY 2013



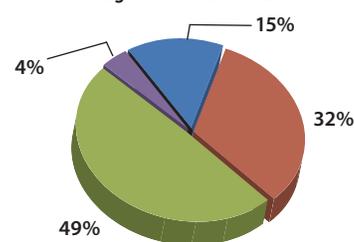
- Hatch Federal Funds \$1,286,040
- State/UVM \$2,777,868
- Grants & Contracts \$3,213,836
- Multi-State Research Federal Funds \$392,797

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



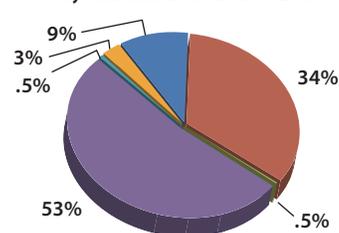
- Childhood Obesity \$1,726,877
- Climate Change \$1,732,680
- Food Safety \$1,018,518
- Global Food Security & Hunger \$2,156,277
- Sustainable Energy \$747,363
- Urban Non-Point Source Pollution \$288,826

UVM Extension Budgeted Dollars FY 2013



- USDA-NIFA Federal Funds \$2,047,881
- State/UVM \$4,601,000
- Grants & Contracts \$6,961,010
- Sales & Fees \$588,207

UVM Extension Budgeted Dollars by National Goal Area FY 2013



- Childhood Obesity \$1,440,287
- Community Development \$4,805,915
- Food Safety \$36,608
- Global Food Security & Hunger \$7,477,138
- Sustainable Energy \$65,208
- Urban Non-Point Source Pollution \$372,942

~ Cheryl Dorschner

AGRICULTURE

~ UVM Extension

Small-scale Sugarmakers Profit From Technology Outreach

Art Krueger likes to tinker. An engineer by profession, his ability to adapt or develop just about anything he needs allows him to live completely off the grid in Shrewsbury.

He and his wife, Trish Norton, own Krueger-Norton Sugarhouse, selling syrup, fudge and other maple products. Although most of their electricity comes from a combination of solar panels, wind generator and micro-hydro turbine, for the sugaring operation, Krueger rigged an old pickup truck to run the generator for his vacuum pump system.

So when he heard that Tim Wilmot, UVM Extension maple specialist, had designed a tubing system using natural gravity instead of mechanical pumps, he was intrigued. The fact that the maple expert was getting sap yields equivalent to that of a traditional vacuum pump system in his research trials at the UVM Proctor Maple Center in Underhill just sweetened his interest.

The system uses smaller diameter tubing – 3/16-inch instead of the traditional 5/16-inch – to create a higher vacuum with gravity flow. For maple producers who can't afford to invest in costly equipment, and have areas without access to electricity for fueling the pump or even prefer to live off the utility grid like Krueger, the new technology is a cost-effective option with the potential for high sap yield – and higher profits.

“It's the greatest thing since sliced bread,” Krueger exclaims. He tried the new technology with 200 taps in 2012 and was so pleased with the results that he applied for a Vermont Working Lands Enterprise Initiative grant to convert his entire 3,000-tap sugarbush.

SAVING ENERGY, INCREASING EFFICIENCY

“Not only is this an energy saver, but we are using less material and lighter tubing that is easier to carry when installing.” He developed his own tubing wheel for laying out pipeline in his woods as well as found ways to adapt standard industry fittings to the smaller-diameter tubing, information he's shared with Wilmot and other producers.

Andy Hutchison, a Leicester sugarmaker, first heard about Wilmot's research at the UVM Extension Maple School in Middlebury in 2012.



Tim Perkins

“I did not go hear Tim speak,” he admits, “but my wife went and thought it was interesting. I later read about his research in Maple Digest. What he wrote made sense, but it sounded too good to be true.”



Tim Wilmot

High sap yields, critical to a sugarmaker's success, are made possible by high vacuum levels. The gauge shows vacuum achieved by a new low-tech gravity collection system. Vacuum at this level was previously achieved only with a vacuum pump.

“I sell sugaring equipment and like to make sure what we sell works before I promote it,” says Hutchison, who owns Mount Pleasant Sugarworks with his wife, Donna. He decided to test the system on a small section of his 3,500-tap sugarbush where he did not use vacuum pumps, an area adjacent to his driveway where customers could easily check it out for themselves.

“My experience with 125 taps showed that production and vacuum levels were similar to Tim's. I ended up having to buy a larger tank for this bush. The one that was adequate for years was no longer large enough to hold a day's sap flow.”

Steven Roberge, University of New Hampshire Cooperative Extension forester, invited Wilmot to speak at the New Hampshire Maple School in Tilton, N.H. last October and has seen interest from sugarmakers in his state, especially small producers who may not have the cash flow to cover and recoup the costs of putting in a vacuum system.

“Lots of advancements like reverse osmosis are equipment-heavy,” he points out, “and are usually adopted by large producers with 10,000 taps or more. Smaller producers get left behind. Tim's research has the huge potential to increase a sugarmaker's production by 50 or even 100 percent.”

“For a small producer making 150 to 200 gallons of syrup per year, even if production increases by one third using this technology, that's a pretty large jump. It may allow folks with a marginal run of sap to stay in the game. Anytime we can increase sap production and maintain costs, that's great for the industry.”

~Lisa Halvorsen

AGRICULTURE

~ Vermont Agricultural Experiment Station

‘Super Pests’ Call for ‘Super Solutions’

The history of one of our food staples – potatoes – is fraught with famine, blight and beetles. And another important food family – the brassicas – broccoli, kale, cabbage and Brussels sprouts are magnets for so many pests that they are routinely grown under row covers.

These two vegetables, like all agricultural crops, live on borrowed time – that is, until they are discovered by insect pests that are able to exploit them.

For some insect pests, each insecticide is effective for a limited time, for others, no insecticides are effective. None.

University of Vermont insect ecologist Yolanda Chen makes it clear that pesticides are never sustainable as a long-term solution.

“Some insects, such as the Colorado potato beetle, have evolved resistance, more than 50 times. The cost of pesticide research and development alone can be prohibitive,” she says. “The problem is that we do not understand *how* insects are able to do this over and over again.”

Chen’s current research studies two insects that attack potatoes and brassicas – the Colorado potato beetle and the Swede midge respectively.

The Colorado potato beetle, *Leptinotarsa decemlineata*, devastates crops in the Eastern United States and is problematic throughout the northern hemisphere. The beetle has been an extraordinarily successful pest, rapidly evolving pesticide resistance and adapting to changes in climate and its host plants. Chen’s lab is precisely focused on trying to understand why this beetle is so successful, and how it has evolved.

The Swede midge, *Contarinia nasturtii*, is a small fly whose larvae distorts the growing tips of plants. One cannot see the damage until it’s too late, and the crop has been destroyed. As a new arrival to Vermont in 2006, it is particularly devastating in the Northwestern corner of the state. This spells trouble for Vermont agriculture, because brassicas are ideal for Vermont’s short, cool growing season.

Chen looks for solutions by asking questions about the very nature of the role of insects in their environment. She asks, “What have we done to plants? How do insects become pests?”

ORIGIN OF THE SPECIES

“Most crops we grow in the U.S. are not originally from here,” Chen points out. “Potatoes originated in Peru. Brassicas originated in the Mediterranean region. We have moved them outside their native habitat to one in which they didn’t evolve in balance with predator and beneficial insects, fungi, bacteria and the like. Domestication



Victor Izzo



Cheryl Dorschner

By understanding the ecological and evolutionary origins of pests, Yolanda Chen believes that we can exploit this knowledge to improve pest management.

reduces diversity and disrupts species interactions.” When relocated, their role in the system is completely changed.

That’s what we’ve done to plants. She also studies insects in terms of their origins. “If you think about it, 80 million years ago, all the major insect groups were already here on earth,” Chen says, “but agriculture has only been around for 10,000 years. So insects have a leg up, so to speak, on farm crops.”

Her research searches for the ecological and evolutionary origins of insect pests.

So for the Colorado potato beetle, “We looked at the characteristics of different populations around the world to understand how that beetle colonized potato crops,” she says. “We found one population in Mexico that shares many characteristics with those of northern U.S. populations – although genetically they’re different, they overwinter and they feed on the potato plants.”

Chen compares how beetle populations are genetically related, how they vary in response to the cultivated potato versus their native host plant *Solanum rostratum*, and whether different populations differ in their ability to become resistant to insecticides.

“What we learn about beetles in Mexico could provide insight about why this pest is so successful in escaping its natural enemies and adapting to temperate potato agroecosystems,” she says.

For the Swede midge, one study aims to increase the profitability of brassica farmers by developing low-input management strategies. Another looks at disrupting the host location using companion plants and non-host plant phytochemicals. But the larger question is still, how do we deal with invasive pests?

“If we understand more about insect ecology, we can exploit its ecological interactions for pest management,” Chen says. These new approaches to agriculture may lead to new methods ways to farm within a globalized world.

~Cheryl Dorschner

ENVIRONMENT

~ UVM Extension

Tree Stewards Branch Out to Help Communities

Tim Moran never envisioned that his interest in trees would one day find him trudging down 33 of Colchester's streets, GPS in hand, to inventory more than 600 public shade trees.

It was a project that would stretch over nine months, but one with significant long-range benefits for his town.

As a graduate of the Stewardship of the Urban Landscape (SOUL) course, Moran needed to complete 20 volunteer hours to become a certified SOUL Tree Steward. The idea of inventorying trees to gather information on location, size, species and condition appealed to him, as it did to the Colchester Conservation Commission, who he approached for feedback and assistance with the project.

"I have always had an interest in trees," he explains, "and once I saw the course description, I knew it would be a good way to learn more, including identification of species."

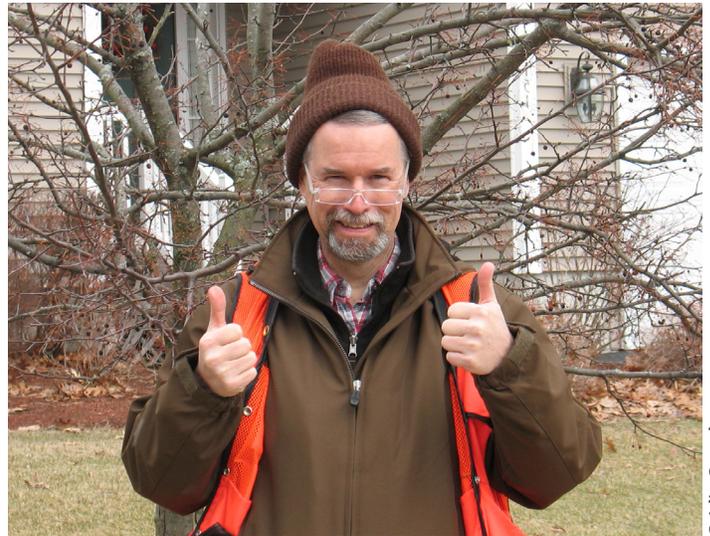
The course covers tree health, planting and maintenance; state tree laws and ways to be a community advocate for trees, among other topics. Since 1996 more than 400 people have taken the course, which is offered through the Vermont Urban and Community Forestry (UCF) Program, a partnership between UVM Extension and the Vermont Department of Forests, Parks and Recreation.

"In the urban and community forestry program we rely so much on volunteers to engage at the community level," says Steve Sinclair, Department of Forests, Parks and Recreation director and one of the course creators. "Municipalities do not have the wherewithal to manage trees in their communities. Most people go into the course with some tree knowledge. The course builds on that, providing the skills to be an effective leader and work with limited resources."

TAKING CHARGE OF TREES

Moran's tree inventory was a first for Colchester, which had developed a Street Tree Master Plan in 2001 to address specifics for tree plantings in new developments but did not consider the overall picture. He found that 46 percent of the 663 trees he surveyed, with the help of UCF Program's Caitlin Cusack and others, were either ash or maple, both highly susceptible to certain invasive pests.

"The town's urban forest is an invaluable natural resource to the community with widespread environmental, financial and quality of life benefits to its



Caitlin Cusack

Completion of a 663-street tree inventory receives a "thumbs-up" from Colchester SOUL Tree Steward Tim Moran. Gathering data on public trees is key to planning for a healthy (and resilient) urban and community forest.

residents," says Director of Public Works Bryan Osborne. "Tim's efforts today are a gift to future generations." In addition to developing a town tree ordinance, the community will use the data to increase its efforts towards diversification of tree species through the development review process.

The UCF Program also trains people to be Forest Pest First Detectors, Kate Forrer, UVM Extension urban and community forestry outreach specialist, notes. "This volunteer network is on the front line of defense to scout for three destructive pests, the Asian longhorned beetle, emerald ash borer and hemlock woolly adelgid."

Amalia Torres, a 2004 SOUL graduate and member of the Hartford Tree Board, is among the 113 Vermonters who have completed the First Detector training. This past summer she was part of a team that inventoried Hartford's trees to collect data on ash and other species for use in developing an emerald ash borer preparedness plan.

This proactive approach is in keeping with Hartford's vested interest in stewardship of its urban forests. In 2002 a group of SOUL graduates formed Trees Matter to help beautify the town through tree plantings in public spaces. That group later advocated for a town Tree Board, which was established in 2004.

"We educate people about trees, and the importance of planting trees along streets and parks in town," Torres says. The board's quarterly tree walks are popular with the public, as is its annual tree and shrub sale held in conjunction with Green Up Day.

"In FY13 SOUL Tree Stewards volunteered 1,352 hours, maintained 319 trees and provided outreach and education on the value of trees and proper tree care to an additional 295 people," Forrer says. "They also planted 407 shade trees that absorb 83,842 gallons of rainwater a year, thus reducing the amount of stormwater to be treated while providing \$24,440 of benefits to Vermont communities."

~Lisa Halvorsen



Kate Forrer

ENVIRONMENT

~ Vermont Agricultural Experiment Station

Fiddling with Fern Genetics

Wildly popular, fiddlehead ferns fetch \$8 for a small plate at tony urban restaurants, up to \$9

a pound at farmers' markets and are typically ordered weekly by supermarket chains in increments of 500 lbs. The lowly unfurled fronds picked along riversides, boiled and eaten as a spring tonic, have grown to "foodie" status wherever "localvore" is a mantra.

But when David Barrington looks at a plate of these steaming green spirals, he sees an evolutionary journey that dates back to the Pleistocene, and he wonders how their increasing popularity as a food crop will ultimately affect the genetic diversity of *Matteuccia struthiopteris*, commonly called ostrich ferns.

Supplying the burgeoning demand, foragers fan out across the state typically in April when the leaves spring forth from rich loam.

John Beaulieu of Ludlow says he used to take 4-5 weeks off from his day job to pick fiddleheads. In Beaulieu's foraging heyday 15 years ago, he'd pick a five-gallon bucketful in an hour. That's about 30 lbs. He sold them to a distributor in Hartford, Connecticut who typically expected a picker to deliver 500 lbs. a week for \$1-\$3 a pound. "I paid for my daughter's college and wedding by picking fiddleheads," Beaulieu says.

"It's not easy. Only about 20-25 people in Vermont can harvest that kind of volume. But the demand has grown; so have the number of suppliers," says Beaulieu, who now 65, scaled back his picking.

Dan Tricarico's numbers indicate just that. Director of purchasing at Black River Produce in North Springfield, he says about 10 serious foragers deliver fiddleheads each season and another 15-20 come once or twice. Black River sells 10-lb. bags wholesale for \$38-\$45 each. More revealing, Black River's bottom line on fiddleheads in 2013 – 4,000 lbs. – is only half what it was in 2008. Not for lack of fiddleheads. "This indicates there are many more foragers and distributors now," Tricarico concludes, "and that some foragers are selling direct retail in urban areas."

HOW LONG CAN THIS LAST?

"There's documentation of high harvests in big river bottoms in Vermont, Maine and Quebec," says David Barrington, who specializes in plant systematics and evolution at the University of Vermont. He set out to measure whether the genetic diversity of fiddlehead ferns was impacted by increasingly heavy picking.

Collecting data from plants in three Vermont watersheds and using molecular techniques revealed surprising results: neither of the common assumptions about its diversity is true. "I went into this study thinking the biggest populations would be most diverse," says Barrington. With two undergraduate students, "we tested the idea in seven locations along the Winooski and Passumpsic River watersheds."



David Barrington



Cheryl Dorschner

David Barrington's curiosity as a botanist who studies evolution and systematics led him to unravel the genetic diversity of the fiddlehead fern (*Matteuccia struthiopteris*) in Vermont. The results form a foundation for understanding what could happen to fiddlehead ferns in the event of overharvesting.

Back in the lab, they developed tools to reveal the DNA sequences of the plants by taking their genetic material, amplifying it, turning it out on a gel, staining and then photographing it with an ultraviolet light camera. With the DNA sequences they could compare plants to see whether the populations lower in the watersheds were more diverse. But population size did not relate to diversity, it turns out.

So they tried another possibility: that the outliers – the little populations on higher ground – are independent and genetically diverse. No. Elevation wasn't the factor either.

"The pattern was that the Winooski populations, large or small, low or high, were consistently more diverse than those on the Passumpsic," says Barrington.

"It was geographic history that was significant. My guess is that the Winooski watershed on the west side of the mountains is closer to a glacial-times refuge for the fiddlehead ferns in the Mississippi valley. It was farther for the ferns to get over the mountains to the Passumpsic once the ice melted."

Barrington and former students Dan Koenemann and Jacqueline Maisonpierre published the findings in the *American Fern Journal*.

Barrington calls the results a good demonstration of how science works, and it's applicable to the harvesting of fiddleheads.

The greatest diversity is in the Winooski where the most harvesting happens. "Whether that's a problem or not I don't know."

This study was a three-year, \$30,000 USDA-NIFA grant. With further funding they're searching for genetic variation that will allow a more detailed genetic portrait. "We have plants from Alaska, Vermont, New Brunswick to see if they vary genetically and by climate," says Brendan Lyons, a senior plant biology major working on this latest project.

~Cheryl Dorschner

NUTRITION, HEALTH & FOOD SAFETY

~ UVM Extension

Horticulture Training Cultivates Green-Thumb Experts

When Shari Johnson moved to Vermont six years ago, she was looking for a way to connect

with like-minded people, and although an experienced gardener, also she wanted to learn how to grow vegetables in the unfamiliar rocky clay soil at her Cornwall home. She found both through the UVM Extension Master Gardener course in 2009.

As a certified Extension Master Gardener, the retired high school teacher volunteers several days a month at the Addison County Parent Child Center in Middlebury, a support and alternative education facility for adolescent families. She works in the greenhouse and gardens as well as serves as a resource for an elective garden-to-plate course for students working on their high school diploma. This past fall eight students enrolled in the course, designed to teach them how to grow vegetables in the greenhouse and prepare nutritious, healthy meals at the center and at home.

Johnson helped launch the Parent Child Center greenhouse project with the help of fellow Master Gardener Jonathan Hescocock, owner of Vermont Victory Greenhouses in Cornwall.

“We used one of his custom-built greenhouses for the project,” she says, noting that the goal was to incorporate healthy foods into menus at the Parent Child Center. Johnson and other volunteers planted the first seeds in December 2012, growing several different salad greens for the cafeteria where the staff prepares 90 lunches daily.

“Greenhouse growing is essentially container gardening. We are teaching how to garden, but also stressing that you don’t need acres of ground to have a garden. You can grow vegetables in a bucket outside your door.” She hopes to encourage interest in horticulture as a career by taking the students to visit a local greenhouse to observe how a retail operation gets started with its spring seed planting.

GROWING NEW GENERATIONS OF GARDENERS

Like Johnson, Jerry Leonard is bringing his knowledge and love of gardening to students as a teacher at Lyndon Institute in Lyndonville. In summer 2009 with the students’ help, he broke ground on campus for a vegetable garden with 11 4- x 8-foot raised beds, doubling that number and beginning construction of a solar radiant-heated greenhouse the following year. Today the project has grown to include 42 raised beds for a total of 4,000 square feet of greenhouse and outdoor growing space.

“We are teaching kids to live better



Jerry Leonard, Lyndon Institute

Under the guidance of their teacher, Master Gardener Jerry Leonard, Lyndon Institute students are learning gardening skills and making healthy lifestyle choices.

lifestyles, eat better and make better choices,” he says. “When working in the garden, they will eat almost everything. It’s a great way to introduce them to different vegetables.”

The Newark resident’s interest in gardening took root as a teen in Sutton, Vermont, where his family tended a large garden. He helped his mother and grandmother preserve garden vegetables and wild berries, a practice he continues today with his own family. He completed the 13-week course, taught through Vermont Interactive Technologies, in 2009, and soon after proposed establishing a garden at school to teach horticulture and life skills.

Leonard also teaches free adult education gardening classes in late spring and worked with the Gilman Housing Trust to develop a community garden, among other projects that earned him a certificate of appreciation for contributing 250 hours as a Master Gardener.

Johnson and Leonard are among the 3,000 Master Gardener graduates of the program, first offered in Vermont in 1991. According to Director Heather Carrington, to become certified, gardeners must complete 45 hours of home horticulture training including six hours of online training through the National Plant Diagnostic Network on pest and disease identification, and a 40-hour internship.

In 2012, the latest year data is available, 766 active Master Gardeners provided 1,420 volunteer hours working on 100 projects focusing on local foods, sustainable landscapes, invasive species and water quality. They staffed information tables at 10 farmers’ markets and eight agricultural fairs to answer horticultural questions and responded to more than 1,100 calls and 430 e-mails through the UVM Extension Master Gardener Helpline. The Master Gardener Program also offers a Master Composter course in alternate years, which has graduated 708.

~Lisa Halvorsen



NUTRITION, HEALTH & FOOD SAFETY

~ Vermont Agricultural Experiment Station

Raw Milk Safety Underpins Cheesemaking, & Health

Stacked 15 high, 1,500 culture plates line the bench of John Barlow's University of Vermont lab.

This is the collection of just one day at one Vermont farmstead cheesemaker's farm.

Barlow's large-scale entire-farm sampling hopes to come up with some novel pathogen detection technology that may be particularly useful to small-scale, on-farm cheesemakers.

His research on various forms of *Staphylococcus* will fill in the gaps in understanding which are of concern to food safety, which are beneficial in the culturing of cheese and which may affect human health.

The UVM animal scientist's epidemiology research addresses on-farm practices and milk quality using molecular biology to identify pathogens that influence milk quality.

Building on UVM listeria expert Catherine Donnelly's research on how the safety of raw-milk cheeses informs national policy (reported in our 2011 Annual Report), Barlow's work is year two of a three-year \$300,000 transdisciplinary grant from the USDA National Institute of Food and Agriculture.

"Cathy Donnelly and I are combining efforts. Because of my interest in *Staph aureus* epidemiology in cows and humans, and their prior findings, I anticipate we will find great information that will help on-farm cheesemakers," says Barlow.

ON-FARM DETECTIVE WORK

On each of up to five Vermont farms that make artisan cheeses, Barlow and his team take milk samples from the mammary glands of all the cows in the herd, swabs of 15 different skin sites from six of the cows, and 15 different environmental samples – from, say, walls and stanchions.

"This results in running about 1,500 culture plates per farm," says Barlow. "From this we typically select about 300 *Staphylococcus* species bacterial isolates for identification and molecular typing."

Back in the Barlow lab in Terrill Hall on campus, Robert Mugabi, a second year Ph.D. student in animal science who also has a veterinary degree, examines these for potential virulence characteristics such as the ability to form biofilms and antibiotic resistance genes. Mugabi's thesis in progress is "*Staphylococcus* diversity and epidemiology on dairy farms that make farmstead cheese." In addition three undergraduate students are working on the project during the spring 2014 semester.

"We are doing a comprehensive survey to look for sources of *Staphylococcus aureus* and



Cheryl Dorschner

Research scientist John Barlow takes milk samples from a UVM cow to test for *Staphylococcus aureus*. Barlow is studying both pathogen and beneficial roles the bacteria may play in artisanal cheesemaking.

Staphylococcus species," Barlow explains. "*Staph aureus* is a food safety pathogen of concern, but other *Staphylococcus* species appear to be important for the cheesemaking process and may play a beneficial role as important normal bacterial flora on the cow skin."

To further complicate matters, some *Staphylococci* carry antibiotic resistant genes that could affect human health. "These may act as a reservoir for antibiotic resistance on dairy farms," says Barlow.

While it is too early to make conclusions, by using molecular typing techniques Barlow and colleagues are making progress in understanding the source of the sporadic new *Staph aureus* infections in these herds which generally have a low prevalence of udder infections caused by this pathogen.

Barlow continues to collaborate with Donnelly, and UVM researchers in community development and applied economics, David Conner and Sarah Heiss, are also making major contributions to the social science aspects of the project. "We are proud of the transdisciplinary approach to this project," says Barlow. He and Donnelly are particularly excited about the opportunity to collaborate with Conner and Heiss as they work to understand how the public views artisan cheese farms and raw milk, and how social networks may influence perceptions of food safety.

"In the big picture, we are excited to help artisan cheese producers improve animal health, milk quality and food safety," Barlow says, "and also to help these producers understand how consumers perceive these attributes for Vermont farms and how this affects their perception of food safety risk and ultimately their purchasing decisions."

~Cheryl Dorschner



John Barlow

ECONOMIC DEVELOPMENT & QUALITY OF LIFE

~ UVM Extension

When Kin Step In

Most grandparents never imagine that someday they will be asked to raise their grandchildren.

It's becoming an increasingly common scenario, however, when parents are no longer able to care for their children due to economic hardship, deployment, incarceration or other reasons.

In Vermont, 6,836 children – 5.4 percent of all children in the state – live with their grandparents or other relatives, according to the 2010 U.S. Census. Although having extended family step up lessens the emotional trauma for the children, for caregivers, taking on these new, and often unexpected, responsibilities can be quite daunting.

Just ask Lynn Granger, executive director of Vermont Kin as Parents (VKAP), a grassroots non-profit organization based in Williston that supports kinship caregivers' needs.

"Family dynamics are challenging when the grandmother becomes the mother," she explains. "There may be tension between the parent and grandparent or siblings may have resentment towards the grandmother who is now no longer available to babysit.

"Ninety-nine percent of grandparents are willing to take on this parental role though it is usually an unplanned event. At the beginning they may not realize the total impact that this will have on their lives."

UVM EXTENSION SUPPORTS THOSE WHO ASSIST KINSHIP CARE PROVIDERS

VKAP is one of several organizations in the state that offer assistance to kinship care providers, helping them adjust to their new situation and access necessary services including financial assistance, health insurance and mental health care. And when these stakeholder groups need help, they turn to UVM Extension foster parenting and kinship care specialist Joan Vance, whose work with needs assessment and curriculum development makes her an invaluable resource.

"Joan has been a real asset for us," Granger says. "She's a wealth of knowledge and is connected to people at the national level." VKAP has partnered with UVM Extension in a number of different ways ranging from staff trainings to co-sponsoring the annual Parenting Revisited Conference for caregivers, social workers, mental health providers and other professionals.

Vance also works closely with the Child Welfare Training Partnership (CWTP), a collaboration between the Vermont Department for Children and Families (DCF) – Family Services Division and UVM's Department of Social Work. She has provided training for staff who work with foster, kin and adoptive families, including helping to design and deliver a new kinship interactive training module for social workers.

"Prior to 2008, DCF social workers



UVM Extension

Kinship care – families caring for the children of relatives – is on the rise in Vermont. UVM Extension helps meet this growing need by providing expertise and support to non-profits and agencies that directly assist the caregivers.

were not required to seek kin placements for children in custody," Vance notes. "With new federal and state laws enacted in 2008, this became not only a priority but a legal necessity. Working with family members is a much different process requiring a different skill set than working with foster parents. DCF workers are constantly seeking to acquire new tools for working with families."

Vermont recently was selected as one of 16 states to pilot and demonstrate the Resource Parent Curriculum created by the National Child Traumatic Stress Network. The network was established by the U.S. Congress in 2000 to improve access to care, treatment and services for traumatized children and adolescents exposed to traumatic events. Vance has been asked to oversee the project in collaboration with CWTP staff.

"We are excited to have the curriculum in Vermont and to be part of the evaluation process," says Sarah Gallagher, CWTP coordinator. "Although we are spread out and rural, and our total number of resource parents is less than a city like Boston, we have the ability to have a big impact."

Vance also was instrumental in helping to establish the Northeast Kin Care Coalition and has presented talks throughout the state and country on kin family issues, including at the UVM Center on Aging Gerontology Symposium last spring. She is currently exploring ways that UVM Extension 4-H can better work with kin and foster children.

"Vermont has seen a dramatic increase in the use of kinship care," Gallagher says. "Joan's work has been helpful in guiding policy and legislative development of resources for kin caregivers. She is a regular part of our kin care, foster and adoptive parent training team and brings that perspective of kin caregivers to the table."

~Lisa Halvorsen

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ECONOMIC DEVELOPMENT & QUALITY OF LIFE

~ Vermont Agricultural Experiment Station

Helping Institutions Buy Farm-Fresh, Local Food

Fletcher Allen Health Care calls itself Vermont's largest restaurant, because it served more than

two million meals last year. The regional hospital located in Burlington aims to also be able to call itself the most sustainable hospital food service in the nation, believing that nutrition and food systems are linked to the health of patients and the health of the community. Fletcher Allen says it partners with more than 70 farmers and producers, and over half of the food it serves comes from local or sustainable resources.

"Given that we spend over \$1.5 million annually on local food, we assume that we play a part in farm viability in Vermont, but we are interested in exploring what economic impact we have on the Vermont farm community, so that we can share that information with other health-care institutions," says Fletcher Allen's Nutrition Services Director Diane Imrie.

That's where the research of David Conner and his former student Florence Becot comes in. Becot '13 earned a degree at the University of Vermont in community development and applied economics and is a research specialist at the UVM's Center for Rural Studies. "Florence and I are looking at the impact of Fletcher Allen's buying of locally grown food. That's a tremendous success story," he says.

Strong praise from a research scientist whose specialty is quantifying the benefits and obstacles farmers and large institutions – such as hospitals schools and senior residences – face when they deal directly with each other.

LIKE FARMERS MARKETS ON STEROIDS

When Conner, who earned his master's degree in the very department in which he now teaches, returned to UVM in 2010, he brought research with him from Michigan State University.

In his initial studies there, three key points emerged: trust is key, traditional linear supply-chain models neglect important components of local food systems, and local food relationships foster creative problem solving.

Direct Farm-to-Institution (FTI) food systems, it turns out, have many possible benefits: "the first is the food system and education opportunities," says Conner. Secondly, when local food is connected with real farmers "research shows that it makes it cool and something people are willing to try." Finally, "when we create markets for farmers, it keeps farm and farmland open. And the relationships formed among farms and institutions and supply chains enhances the social



Fletcher Allen Health Care



Cheryl Dorschner

David Conner and Florence Becot's interviews, surveys and number crunching research on Fletcher Allen Health Care's commitment to buy directly from Vermont farmers and food producers quantifies the benefits and challenges of farm-to-institution practices.

community," he says.

The complexity of providing fresh, local food on this scale is, well, akin to farmers markets on steroids.

Conner's findings in Michigan were a springboard for further grants and study here in Vermont.

"I brought some Hatch funds with me, and I feel like I really leveraged them well. The point of a Hatch grant is to get yourself going; I've done that," Conner says. "I've forged relationships and ongoing collaboration that is just getting stronger. I'm working with Farm-to-Institution New England (a regional umbrella group), Vermont Feed, NOFA and Fletcher Allen Health Care. And I've brought in graduate students."

In addition to Becot, Conner mentored Noelle Sevoian 'G13. Her research and degrees in community development and applied economics and civil and environmental engineering led to a plum job with Vermont's Agency of Agriculture Food and Markets' Working Lands Initiative as an agricultural development coordinator.

Sevoian's research described the supply chain of Vermont's mid-sized produce farmers. Her interviews of 19 farmers, distributors and buyers revealed that the difference between the prices that farmers need and the food budget of institutions remains a barrier. However, participants were highly motivated by values such as supporting local farms and economy and a desire to provide healthy foods and instill good eating habits. She found that institutions consider local food a strategic advantage due to its high quality, educational value and the community support it fosters.

That's exactly how Fletcher Allen's Diane Imrie said she feels. Now she hopes Conner and Becot's research results will help her quantify the economic impact Fletcher Allen's direct food purchasing practices have in Vermont, so that others can readily see it.

"Other hospitals in Vermont are committed to reaching the Farm-to-Plate goals and so will benefit from an example locally," she says. "We believe that there may be more than just the direct economic impact – some sort of multiplier." ~Cheryl Dorschner



Stephen Mease Photography

CONTACT US

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

Advisory Board

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UVM Extension

Douglas Lantagne, Dean
Doug.Lantagne@uvm.edu

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

Advisory Board

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