

The long view

10Green

That four-letter word

A watershed

# UMaine Today

CREATIVITY AND ACHIEVEMENT AT THE UNIVERSITY OF MAINE

SUMMER 2012



## Sea fare

Will ocean vegetables  
be the **next** gourmet food?



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Marine biologist Susan Brawley says the time is right to reintroduce Americans to their culinary roots — ocean vegetables — and give Maine-based aquaculture a boost in the process.

Volume 12 Issue 2  
**Summer 2012**



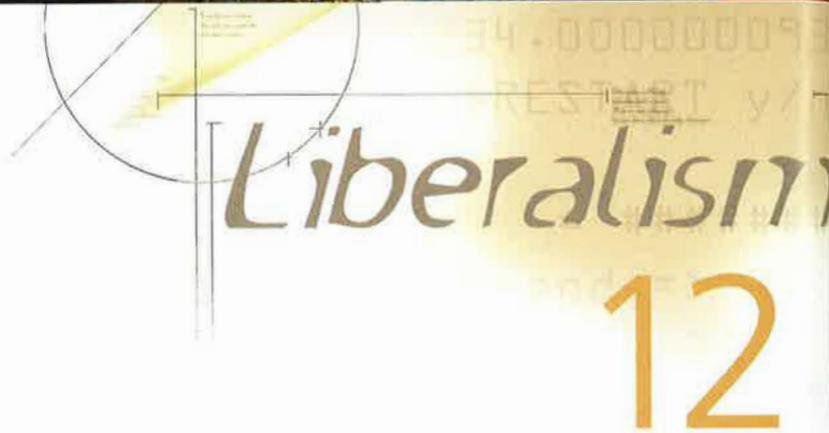
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ON THE COVER: Amid the growing interest in local foods and traditional cuisines, sea vegetables are seeking a place at the table. See related story on page 2.

# Sea fare

## Marine biologists help ocean vegetables go gourmet

By Meg Haskell

*What is a weed? A plant whose virtues have not yet been discovered.* Ralph Waldo Emerson

**A**GARDEN GROWS on the edge of the sea in Maine, in that rocky zone where the tides wash in and out. Winged kelp, nori, dulse and other succulent sea vegetables thrive in dense, undulating beds — an underwater Eden of tasty, nutritious foods.

To many Americans, these macroalgal plants are completely unfamiliar — except when, disguised as ordinary “seaweed,” they make for slippery footing at low tide or wash ashore following a storm. But that will change if University of Maine researcher Susan Brawley is successful in her campaign to cultivate appreciation for the flavors, textures and nutrients that sea vegetables add to new and familiar dishes — from piquant snacks and hearty main courses to rich desserts.

“

**There is no reason we can't build a food culture on sea vegetables, especially given the emerging interest in local foods and traditional cuisines.”**

Susan Brawley

For centuries, people of most coastal cultures have enjoyed the benefits of a diet rich in sea vegetables, Brawley notes. Although interest in Asian cuisines has showcased sea vegetables in this country — nori-wrapped sushi and “seaweed salad” are some familiar Japanese menu items — many European, South American and Scandinavian cultures also include sea vegetables in their food traditions. (Here

in coastal Maine, old-timers remember that paper sacks of crisp, home-dried dulse for snacking could be found on the counters of general stores.)

Brawley, a professor of plant biology in UMaine's School of Marine Sciences, says the time is right to reintroduce Americans to their culinary roots and give Maine-based aquaculture a boost in the process.

“There is no reason we can't build a food culture on sea vegetables, especially given the emerging interest in local foods and traditional cuisines,” she says. “There is already a strong international market, and it would behoove us here in Maine to develop a sustainable, integrated aquaculture industry to meet and drive that demand.”

Brawley's own research focuses on reproduction and stress tolerance in algae, which are among the oldest forms of life on Earth. Scientists have identified an algal fossil dating back about 1.2 billion years that is very similar to *Porphyra*, a type of red algae that is one of the world's most farmed sea vegetables.



**Dishes made with kelp — wraps with squid and salmon, and a slaw salad.**

Wrap photos courtesy of Ocean Approved, salad photo by Michael Mardosa

# Sea fare



Now, she is working with other researchers, private companies and high-end chefs to learn more about sea vegetables — their nutritional value, where and how they grow best, and, critically, how to market, prepare and serve them in ways that attract discerning mainstream consumers.

Last year, when Brawley was president of the Phycological Society of America, she brought Irish physician, chef and cookbook author Prannie Rhatigan to the group's annual meeting. The conference, held at the University of Washington, attracted hundreds of algal enthusiasts and scholars. Rhatigan's breakout session, a hands-on workshop on cooking with sea vegetables — from dulse and cheese scones to cannellini bean salad with marinated winged kelp — was a hit at the conference, as was a gourmet dinner that featured exquisite dishes containing sea vegetables.

Building on that success, Brawley is looking ahead to this year's association meeting in Charleston, S.C. She is working with conference organizers to

persuade chefs from Charleston's finest restaurants — and there are many — to develop and feature special dishes inspired by sea vegetables and the presence in Charleston of so many algal aficionados.

"If everyone worked with their own favorite restaurants and chefs," Brawley says, "we could start a revolution and support the development of sustainable wild harvest and aquaculture on the Maine coast."

AT UMAINE'S CENTER for Cooperative Aquaculture Research (CCAR) in Franklin, efforts are under way to develop techniques for growing native seaweed plants. Recently appointed Maine Sea Grant and University of Maine Cooperative Marine Extension Associate Sarah Redmond is working with Brawley to establish a sea vegetable nursery at CCAR, using edible species such as dulse (*Palmaria palmata*), nori and laver (*Porphyra* species) that grow wild in the cold waters of the Gulf of Maine and the Bay of Fundy. The two researchers are exploring techniques for integrating sea

vegetables into farming operations for urchins, clams and mussels to encourage diversification and sustainability in the aquaculture industry.

Brawley and Redmond are growing sea vegetable seed stock for the nursery, using native species that can be cultivated in the lab for spore production. Spores are seeded onto nets or lines, and then cultivated in the lab until juvenile plants are large enough for out-planting in the sea.

"The most critical stage of cultivation occurs during the microstage," Redmond says. "You have to provide the right environment — clean, cold, seawater, light and nutrients."

Once the plants are established, the seeded nets will be transferred to a tank of seawater that also circulates through fish and sea urchin tanks. The seawater carries nitrogen and phosphate excreted by the fish and urchins to fertilize the plants, and the plants produce oxygen needed by the fish and urchins. The same relationship will be true of sea vegetables and shellfish, such as clams, oysters and mussels, and finfish such as salmon.



Horsetail kelp

The practice of cultivating different sea vegetable and animal species in a single site is known as integrated multitrophic aquaculture. It promises to improve productivity and sustainability by mimicking the natural ecosystem.

In addition to her research at CCAR, Redmond will be educating local residents and visitors about sea vegetables. While most plants that grow in Maine waters are safe to eat, Redmond says, some are definitely tastier than others.

“Learning about sea vegetables is exciting because it enriches the experience of going to the shore,” she says.

ROBUST AQUACULTURE industries in Japan, China, South Korea and Chile grow and market many of the same wild sea vegetable varieties that thrive in the Gulf of Maine and Bay of Fundy. Maine-based sea vegetable companies are interested in transitioning from harvesting wild plants to sustainably farming sea vegetables along the state’s convoluted coastline.

Not far from the Franklin research facility where Redmond works, Shep



## Foraging for sea vegetables

COMMERCIALY MARKETED sea vegetables are clean, safe, sustainably harvested and conveniently packaged for home use. Maine sea vegetables are available at retail outlets such as Whole Foods (Portland, Maine), Natural Living Center (Bangor, Maine) and many similar retailers in the state and elsewhere. Although protected areas (e.g., state and national park shores) must be avoided, adventurous eaters and beachcombers may want to add occasional foraging to their day at the shore. Marine Extension Associate Sarah Redmond of UMaine’s Center for Cooperative Aquaculture Research in Franklin, Maine, offers these tips:

- Bring along a basic field guide to the edible plants you’re looking for. While there are no poisonous sea vegetables growing in Maine waters, some are definitely tastier than others. Look for kelp, dulse and nori. Sea lettuce and bladderwrack also are found in Maine waters.
- Rubber boots or water sandals with good traction, a pocket knife and a pail or basket will make foraging easier.

- Collect from a clean area of the shore, away from people, dogs or debris. Look for living plants freshly exposed by the falling tide that are still attached to rocks or other materials. Clip the top portion of the leafy blade, leaving the plant attached to generate new growth — the basis of a sustainable harvest.
- Keep harvested plants cool and moist until you get home. Place them in a cooler wrapped in clean, damp towels.
- Once home, rinse the plants well in fresh water to remove any sand. Use the sea vegetables in a recipe while they’re fresh or hang them in a protected sunny spot until they are dry enough to store for cooking later.
- Information about algae is available online ([algaebase.org](http://algaebase.org)).
- Recipes can be found online ([prannie.com](http://prannie.com)), ([seaveg.com](http://seaveg.com)) and ([oceanapproved.com](http://oceanapproved.com)).

Among the top sea vegetables found in Maine waters are sugar kelp (*Saccharina latissima*), laver or nori (*Porphyra* species), winged kelp (*Alaria esculenta*), dulse (*Palmaria palmata*), Irish moss (*Chondrus crispus*) and horsetail kelp (*Laminaria digitata*).

## Sea fare

Erhart is gearing up for his busy summer season. His company, Maine Coast Sea Vegetables, was founded in 1971 as a home-based business with a handful of local customers. Now the thriving company employs 18 year-round workers. During the summer harvest, Erhart buys fresh, wild sea vegetables from about 50 local harvesters. The crop is dried and packaged for sale to customers worldwide — restaurants, retailers and wholesale distributors.

Erhart says cultivating sea vegetables in Maine is an important way to ensure sustainable harvests in the face of growing demand. In conjunction with UMaine's Sea Grant Program, Maine Coast Sea Vegetables is experimenting with growing kelp alongside farmed mussels and other shellfish in Penobscot Bay.

In Portland, the sea vegetable company Ocean Approved has received more than \$400,000 in state and federal grants and is working in partnership with researchers at UMaine and the University of Connecticut to develop sustainable kelp farming on the Maine coast, primarily in Casco Bay.

"We expect this year we will harvest our second crop from our farms and we expect to break even or maybe make a profit," says company president Paul Dobbins. The business, which is entering its fourth year of operation, markets several varieties of kelp, most of it frozen, all up and down the Atlantic coast. Customers are primarily health-food retailers — including the Whole Foods supermarket chain — and restaurants.

"There is a significant opportunity right now to develop a cultivated sea



### Reasons to eat your vegetables

IN ADDITION TO their salty tang (which comes mostly from potassium, not sodium) and fresh texture, sea vegetables pack a punch of nutrition. Low in fat and calories, sea vegetables deliver significant amounts of protein, vitamins, minerals and dietary fiber. Most are an important source of vitamins, iodine, calcium, iron and magnesium. They are rich in antioxidants such as beta-carotene. Sea vegetables also contain polysaccharides, such as alginate and carrageenan, in their cell walls that are used to thicken soups and stews, that contribute to a food's texture and sensation in the mouth, and that help create a sense of gustatory satisfaction that curbs appetite.

vegetable industry in the United States," Dobbins says. "This is a \$7 billion global industry generating 17.2 million metric tons of farmed sea vegetables annually."

Ocean Approved is expanding its presence on the West Coast, where the market for sea vegetables is strong and currently being filled largely by Asian growers. And while the world may see a trend toward growing sea vegetables for gourmet markets, Dobbins predicts demand for the highly nutritious vegetables will grow as world populations expand and available farmland decreases.

PLENTY OF FOODS have become staples of the American diet over the course of a couple of generations, Susan Brawley points out. Pizza and bagels, for example, were considered "foreign foods" not too long ago and now are available in corner stores and fast food restaurants everywhere.

Chinese and Mexican foods have established a strong mainstream presence in the U.S. Traditional Japanese dishes have become popular in many areas, as have Korean and Vietnamese specialties.

At the same time the American palate is evolving to appreciate these ethnic flavors, locally grown produce and foraged foods, such as wild mushrooms and seasonal berries, are finding new favor with chefs and consumers.

All these trends support the expansion of sea vegetable aquaculture, Brawley says. But most coastal cultures of the world have long included sea vegetables in their diets, incorporating their distinctive flavors and textures — and their powerful nutritional benefits, including protein, calcium, magnesium, iron, vitamin B<sub>12</sub> and other essential nutrients — into everyday dishes now familiar to many Americans — from meatloaf and chowders to casseroles and cakes.

"The goal is not to persuade Americans to accept sea vegetables as a novelty or as part of an Asian food experience," she says, "it is to restore the historic role of sea vegetables in the foods they are already eating."

With their deep roots in many food cultures, sea vegetables have an important role to play now and in the future, feeding the people of the world, says Brawley. ■

## Woods woman



*Three wild birds - 1892 -  
taken by M. Hardy at the last dinner  
on the Passadumkeag.*

A photo of Fannie Hardy Eckstorm captioned "Three wild birds — 1892 — taken by M. Hardy at the last dinner on the Passadumkeag" is included in Fogler Library's Fannie Hardy Eckstorm Papers, a collection dating from 1833 to 1962. The collection includes documentation on North Woods ballads and legends, woodsmen and river drives, and the Penobscots and other Maine tribes.

**N**ATURALIST, historian and author Fannie Hardy Eckstorm was an authority on Native Americans, folklore, nature and ballads. She was born in Brewer, Maine, in 1865 and graduated from Smith College. Her career achievements include being the first woman in Maine to be a superintendent of schools and one of the first women to be admitted as an associate member of the American Ornithologists Union. She also worked in the book department of the Massachusetts-based D.C. Heath Publishing Co. But it was the years spent as a child and young woman, traveling the Maine woods with her father, Manly Hardy, a fur trader, that inspired her lifelong passion for natural history. Both father and daughter kept journals of their long forays and drew upon them in their extensive writing for popular magazines and newspapers. Fanny Hardy Eckstorm published several books, beginning with *The Woodpeckers* in 1900 and ending with *Old John Neptune and Other Maine Indian Shamans* in 1945. She died in 1946 at the age of 81. ■

# W

## Climate Change Institute develops tool to gauge the health of our environment

By Jessica Bloch

WE LIVE BY the numbers. We gauge our physical health by such measures as cholesterol and blood levels, and our fiscal health by credit scores. College aptitude? There's a score for that.

And now there's a new number to help fathom our personal well-being — this one calibrating the health of the environment in which we live.

Researchers at the University of Maine have assembled an interactive website called 10Green.org that rates the air quality of locations in the U.S. on a 1-to-10 scale. Enter a zip code or name of a city or town and up pops the environmental health score for that location, based on 10 categories of pollutants in the air. The higher the score, the healthier the air.

The goal of the website is to make people aware of the quality of the air they breathe, according to UMaine Climate Change Institute Director Paul Mayewski.

"We feel it's as critical for people to understand the air quality where they live as it is for them to know their credit rating or their blood pressure," says Mayewski, who oversaw 10Green along with Sudarshan Chawathe, a UMaine associate

professor of computer science and a cooperating associate professor in the Climate Change Institute; and Andrei Kurbatov, assistant research professor in the Climate Change Institute and the Department of Earth Sciences.

"We want people to realize that while we have done a lot in this country and we are a leader in terms of air quality legislation, there are places where things may not be better, may have gotten worse, or for which there is no way to assess whether it is better or worse. It's a very important health issue for the public and we want to draw attention to this."

The Climate Change Institute's interest in providing information about air quality stems from its world-renowned work on ice cores. The cores have allowed UMaine researchers to demonstrate dramatic long-term changes in the effects of pollutants on the atmosphere. In particular through their research, UMaine climate change scientists have developed an understanding of how air quality has changed over time, back thousands of years.

"We all understand that there are strong associations between air, water and

food quality, and our health,” says Mayewski, who spearheaded 10Green with the support of the Portland, Maine-based communications agency Garrand. “You can drink clean water if you choose to and you pay for it. You can select the types of foods that you eat. But you cannot escape the air, which is why we are focusing on air quality.”

10GREEN'S CREATORS believe the site is a unique, user-friendly portal to a large database of information that most people do not necessarily track or access, despite its importance to their quality of life. The data used to assign scores are from the U.S. Environmental Protection Agency, European Commission, California Environmental Protection Agency, Health Canada, and World Health Organization. All data are available to the public.



# 10GREEN

Making 10Green accessible to everyone was essential — and a challenge, says Sudarshan Chawathe, a UMaine associate professor of computer science and a cooperating associate professor in the Climate Change Institute. The key was in creating an engaging presentation of the material and presenting the data in a way that is easy to understand and attractive to people. Chawathe developed the 10Green website in collaboration with computer science graduate student Erik Albert. Aspects of the method Chawathe and Albert developed, which is known as RESTful Framework for Dynamic Client Environments, or RFDE, was included as a chapter in a new book on REST — representational state transfer, a type of Web architecture.

To use 10Green, a locale name or zip code is entered on the website. The ranking number is based on measurements for 10 categories of human-source pollutants, including large and small particulates, carbon monoxide, ozone, carbon dioxide, other greenhouse gases, heavy metals, sulfur dioxide, nitrogen dioxide and other pollutants, such as benzene and polycyclic aromatic hydrocarbons. Each of the 10 categories is measured as healthy or unhealthy, depending on the percentage of measured values above and below health standards. The 10Green ranking is based on the number of measurements in the healthy range.

For example, Seattle earns a 7 because it has healthy levels of seven categories of

pollutants. On the other end of the scale, Los Angeles earns a 3 because it has unhealthy levels in seven categories.

Scores at the top-end of the scale — 9 or 10 — are virtually unattainable because there is no locale that escapes the impact of greenhouse gases.

One caveat of the website is that there are many locales for which there is little air quality monitoring and therefore insufficient data. For example, Juneau, Alaska, receives a score of 1, in large part because there is no data for six of 10Green's categories. Of the four available measures, Juneau has three unhealthy categories and one healthy category.

Sean Birkel, a postdoctoral researcher in the Climate Change Institute who earned his Ph.D. from UMaine, assimilated the data sets with help from Bjorn Grigholm, a graduate student in the Climate Change Institute and Department of Earth Sciences who studies ice cores. The use of health standards from different sources is crucial for 10Green's integrity.

"Health standards can differ, and what one standard may tell you is healthy, another may tell you something else."



Mayewski says. “The 10Green health standard is always the strictest, meaning we always go to the health standard that takes the lowest level for a pollutant and says you should be below that.”

The interactive elements of 10Green also allow users to look at scores over time and compare scores between locales. There also are explanations of how each pollutant can affect human health. Elevated concentrations of ground-level ozone, for example, can cause lung damage and respiratory illness, while the heavy metal cadmium can reduce kidney function and affect the skeletal and respiratory systems.

“All 10 pollutants, including greenhouse gases, have a potentially deleterious effect on humans and the ecosystem, greenhouse gases largely so because they create warming and the warming leads to drought, flood, heat stress, storms, increase in insect-borne diseases,” Mayewski says. “Other pollutants such as particulates, ground-level ozone and heavy metals can contribute to respiratory and nerve disorders and cancers.”

While Garrand designed the look of

the 10Green project and website, and also came up with the concept of assigning numerical values to air quality, faculty and students at UMaine oversaw the creation of the databases and website.



Chawathe says the work included scaling the website for concurrent users, organizing data and ensuring accessibility for users on all kinds of computing platforms.

Accessibility was a particularly important challenge for Chawathe and computer science graduate student Erik Albert. Working with Chawathe, Albert played a key role in the architecture and implementation of the 10Green website, as well as its deployment in a cloud-based infrastructure.

Mayewski hopes 10Green will be a go-to source of information, especially if locales improve their air quality monitoring and generate numbers that can be used on the website. The Heinz Endowments of Pittsburgh has provided funding for future applications for 10Green.

The project has already compelled the climate scholars — whose research focuses on predicting future climate trends — to look closer at the present.

“Climate change discussions have thus far been about greenhouse gases and warming, which are critically important and have big implications for everybody,” Mayewski says. “10Green is not just about the very important problem that the future is going to get warmer. It’s about what is happening now. It’s about understanding what your health means to you.” ■

**“10Green is not just about the very important problem that the future is going to get warmer. It’s about what is happening now. It’s about understanding what your health means to you.”** Paul Mayewski

# That four-le

A UMaine political scientist studies

By Jessica Bloch

**P**OLITICS NEVER TAKE a holiday. But in the months leading up to a presidential election, the rhetoric is particularly poignant, with political pundits hanging on every word.

This is Mark Brewer's favorite time of year.

In the coming presidential campaign, the University of Maine political scientist will be parsing and analyzing the endless stream of speeches, looking for key words and phrases that have to do with the role of individual responsibility in society. In

particular, he is focused on the one age-old word that has morphed into an almost four-letter word of innuendo: liberalism.

"Liberalism meant a very different thing (years ago)," says Brewer, who has presented papers on the topic and is working with Syracuse University political scientist Jeffrey Stonecash on a book about the roots of contemporary partisan conflict. "Classical liberals, in many ways, would almost be considered conservatives in contemporary American politics. A classic liberal had a strong respect for the free market and a wariness of government

getting involved in that market. The classical liberal placed a heavy emphasis on individual rights and civil liberty protections, but was very wary of the state and wanted a very limited state, at least outside of national defense."

Liberalism, as a concept and word, has undergone a transformation from the start of the 20th century, when the word was party-neutral and meant something akin to a belief in freedom of the individual from government involvement. In contemporary times, liberalism more frequently describes a belief system associated with the Democratic Party, that



*Liberalism*

Liberalism

# tter word

## the devolution of liberalism

some amount of government involvement is good for the individual.

The historical, social and political twists and turns of the 20th century, particularly the Great Depression, the Great Society and the social and political movements of the 1960s and 1970s, produced changes in the concepts of liberalism and individual responsibility. Even though contemporary politicians might not make direct references to those concepts, Brewer hears many clues to how the candidates perceive individual responsibility and liberalism.

Brewer is most interested in how

Democrat and Republican positions on individual responsibility have changed over the years — indeed, over the decades — and how the meaning of the word has shifted to reflect changing attitudes about individual responsibility.

“Obama mentioned responsibility several times,” Brewer says of the last State of the Union. “You could hear it in his message of a fair shake and building a new 21st century that’s built to last. Those are the themes he’s going to hit all the way through November, that not everybody has a fair chance to succeed and some people are significantly privi-

leged while some have serious disadvantages, and it’s not only just but required that the state steps in to address this.”

THE EVOLUTION OF the meaning of liberalism and disassociation to the responsibility of the individual started in the 1930s. Before that era — as far back as the Federalist and Whig parties of the 18th and 19th centuries, respectively — there was a common belief in the meaning of liberalism and the primacy of the individual and personal responsibility. The word “liberalism” was not yet associated with one political party or another.

liberalism

*Liberalism*

# That four-letter word

“Other than maybe the obscure socialist parties, the (mainstream) parties were relatively consistent on the concept of the necessity of individual responsibility,” Brewer says. “The idea was that it was not only a desirable thing, but a necessary element in a well-functioning society, and that individuals have to work hard and be responsible for themselves and their families. The belief was that everybody is capable of achieving.”

**“FDR and his supporters changed what liberalism means in American politics. If you were a classical liberal, you couldn’t use the term anymore and have it mean what you wanted it to mean.”** Mark Brewer

After the Civil War, veterans’ pensions were the first to be associated with social welfare and therefore government involvement. At the turn of the century, with the growth of the progressive movement and fields such as sociology, political science and social work, there were more social welfare programs. One example was Protestant clergy members who advocated assistance for widows with children. The argument for such assistance, Brewer says, was widows were in their particular situations through no fault of their own, at a time when it was not viewed as appropriate for women to work.

The first major shift in thinking about individual responsibility came in the 1930s with then-President Franklin D. Roosevelt and the New Deal programs he instituted to bring the country out of the Great Depression. Roosevelt was a Democrat, and those in his party embraced

programs such as Works Progress Administration, in which the government provided millions of unemployed workers with jobs in construction and other fields such as art and theater projects. It’s then that the Democrats began to appropriate the word liberalism.

“Liberals, of which FDR was one, embraced this view of changing responsibility,” says Brewer. “They believed individual success was not solely determined

by the individual, that there were some situations beyond the control of the individual that dramatically either increase or impede their chances of success, and it was the state’s responsibility to step in and try to address those situations that the individual couldn’t control. This was a view that believed government could be a positive force in the lives of individuals and also for society as a whole.”

Roosevelt pushed through most of his major social initiatives by 1937 and, out of necessity, turned to international issues, primarily World War II. By then, Roosevelt found that a coalition of conservative Republicans and Democrats — mostly Democrats from Southern states — made it difficult for him to continue his major domestic policy programs. Among the loudest voices speaking out against the newly active federal government was former President Herbert Hoover, who lost the 1932 elec-

tion to Roosevelt and became an outspoken critic of the New Deal. He labeled Roosevelt’s programs as socialism and believed they would kill liberty and freedom in the U.S., Brewer says.

Hoover even wrote a book about his opposition to the New Deal, but his disastrous presidency meant few took him seriously at the time.

“FDR and his supporters changed what liberalism means in American politics,” Brewer says. “If you were a classical liberal, you couldn’t use the term anymore and have it mean what you wanted it to mean.”

REPUBLICAN OUTCRY AGAINST shifting views of individual responsibility and liberalism began to coalesce in the 1950s, when Republicans started to use the term conservative to describe themselves. This coincided with the introduction of conservative publications such as William F. Buckley’s journal *National Review*, which provided an outlet for those who were troubled by the increased government involvement of the 1930s.

But without a strong Republican president, the party couldn’t move forward. President Dwight Eisenhower was elected as a Republican, but Brewer says even the much liked “Ike” didn’t do anything to dramatically reverse the New Deal.

It took another decade, but the 1964 Republican nomination of Barry Goldwater marked a sea change within the party as it found a candidate with a strong conservative backbone to support.

“The Republican coalescence is firmly in place by the 1960s,” says Brewer. “Goldwater’s nomination signified that.

He was the first candidate to stand up and say, the New Deal is terrible and ruining the country, and we have to get rid of it. Even though they lose the election, the conservatives maintain control of the party. Not every Republican since Goldwater has run on that theme — Ford didn't, and neither did George H.W. Bush — but most have.”

Conservatives in the Republican Party grew even stronger in the 1960s and 1970s as social issues came to the fore in the American consciousness. President Lyndon Johnson and fellow Democrats in Congress enacted the programs known as the Great Society, which focused on ending poverty and what the party believed was racial injustice. College students protested the Vietnam War. Later in the 1970s, gay rights and abortion became flashpoints.

Although Republicans Richard Nixon and Gerald Ford each served as president in this era, the outrage among conservatives about the Great Society and other social issues — issues seen by conservative Republicans as assaults on individual responsibility — came to fruition in the election of the conservative Ronald Reagan in 1980.

There are vast differences between the issues liberals chose to tackle in the 1930s, and the issues of the 1960s and 1970s, Brewer says. During the Great Depression, liberals believed they were lifting up those who faced disadvantages due to external economic circumstances — the kind of government intervention that made the pre-conservative Republicans uncomfortable. The liberals of later eras, with their focus on social issues,

supported the kind of government intervention that Brewer says provoked outrage among conservatives. That outrage continues today.

“If you take Goldwater’s book, *The Conscience of a Conservative*, substitute militant Islam or Al-Qaeda for all of his rants about the Soviet Union, and you put in a chapter on social issues because they didn’t really exist when the book came out in 1960, it would fit today’s Republi-

**The liberals of later eras, with their focus on social issues, supported the kind of government intervention that provoked outrage among conservatives. That outrage continues today.**

can Party,” Brewer says. “I think we’re still in the heart of this division based on the responsibility issue and I don’t see it going away any time soon.”

OBAMA ISN’T THE only candidate whose views on individual responsibility can be easily read between the lines of his speeches. Brewer says the four Republicans who lasted deep into the primary season — Mitt Romney, who is on track to be the Republican nominee, along with Rick Santorum, Newt Gingrich and Ron Paul — also speak and write about individual responsibility, from the conservative point of view.

It is a point of view closely connected to the classic definition of liberalism.

“(The Republican candidates’) rhetoric is heavily cloaked in this discussion of individual responsibility, and the need to have less government interference with people and fewer rewards for those

people who refuse to work,” Brewer says. “They want a return to a previous era when individuals had to work hard and those who worked hard succeeded, and those who were unwilling to work as hard will have to ask themselves some hard questions about whether they are going to work hard or accept a lower quality of life.”

It’s a completely different view of individual responsibility that, at least in the

current election, Brewer says, could be traced to childhood experience. Obama, for one, speaks about times in his youth when his mother was on government assistance, and about his grandfather who attended college on the G.I. Bill. Romney, the son of a businessman who was a former governor of Michigan, has likely never had the experience of being on some form of assistance, says Brewer.

As in any presidential election, the outcome of this November’s election could come down to one or a number of issues. But at its root will be the issues of personal responsibility and government involvement — what in the past century has become a debate about liberalism.

“I think we’ll hear that all the way through the campaign and the distinctions will be sharper,” Brewer says. “I think we’re still in the heart of this division based on the responsibility issue and I don’t see it going away.” ■



# The long view

## Art of medieval masters and the Dutch Golden Age resonates in Grillo's contemporary photography

By Kristen Andresen

**T**HERE ARE THE street scenes, shot in black and white in Italy. A couple locked in an embrace. A busker playing an accordion. A pair of businessmen on a train, smiling at the camera.

There are the domestic scenes, shot in color in Maine. Wife in robe, early morning, standing in the backyard. Young sons, one at the computer, the other surrounded by toys, a blur of motion in the living room. A family camping trip, dinner at sunset, ocean in the background.

And then there are the scenes that got away. The moments when the camera isn't immediately handy. The moments when everything is almost — but not quite — perfect. For Michael Grillo, a photographer and University of Maine associate professor of art history, those are the scenes that haunt him.

"The images are at first resident in your head and you go out and make them happen," says Grillo, whose photography informs and is informed by his research. "You're trailing something specific. I have images in my mind that I'm still waiting to make happen. I know they're out there."

Often, the images in his mind are inspired by significant works from art history — a landscape by Vermeer, a portrait by de Hooch, a fresco by Giotto. He thinks deeply about the composition of his photographs and the interactive power of imagery. To Grillo, photography is a means of conversation, a narrative shaped by artist and viewer, a social pursuit.

"How do images help us negotiate the world and, in turn, shape how we envision it?" Grillo asks. "Photography has given



For Michael Grillo, photography has become a way to more fully understand the choices painters made. For instance, it's one thing to read about Vermeer's use of a camera obscura — a filmless camera that provides perspectives beyond what the eye can see. It's another to get behind the camera and imagine what lenses the painter used — and, more important, why.

Michael Grillo  
*79 Maple Street, 2005*

Emmanuel de Witte  
*Interior with a woman at the virginal, 1665–1670*  
Courtesy Museum Boijmans Van Beuningen, Rotterdam,  
The Netherlands

# The long view

me insights into the structure of images. How do images communicate? What's the role of images in creating meaning? That's what I write about."

GRILLO IS AN expert in medieval art history, specifically Italian paintings of the 14th century, as well as Renaissance and 17th-century Dutch painting. His book *Symbolic Structures: The Role of Composition in Signaling Meaning in Italian Medieval Art* explores how composition allows artists to better express their ideas.

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"I wouldn't have known until I made those choices," Grillo says. "It's exactly those wide-angle shots that give you portraits where the person is nestled within an environment, where the environment is as important as the individual. It wasn't until I started taking these photographs that I fully understood it."

Beyond optics, photography has given

**"The images are at first resident in your head and you go out and make them happen. You're trailing something specific. I have images in my mind that I'm still waiting to make happen. I know they're out there."**

Michael Grillo

Grillo a better understanding of the more mundane aspects of historical paintings. Take, for example, his photographs of a family camping trip. Though the scenes are different — a picnic, children swimming, a hiking boot and knapsack sitting on a rock — the ideas that drive Grillo are similar to those that drove Jan Steen or Pieter de Hooch.

"Steen asks, 'Where's the world we live in?'" Grillo says. "De Hooch paints people conversing in their spaces. These are rehearsed domestic scenes."

Grillo's street photography — urban portraits shot after chatting up his subjects — aims to capture Hendrick ter Brugghen's theatricality. The whole process of negotiating the photograph was a performance. His domestic scenes, which feature his family, friends and neighbors going about their daily lives, reflect the "social warmth" he sees in Italian

Michael Grillo's street photography — urban portraits shot after chatting up his subjects — aims to capture Hendrick ter Brugghen's theatricality. The whole process of negotiating the photograph was a performance.

*Piazza San Giovanni*





Michael Grillo's images are inspired by significant works from art history — a landscape by Vermeer, a portrait by de Hooch, a fresco by Giotto. He thinks deeply about the composition of his photographs and the interactive power of imagery.

Michael Grillo  
*Stations 2006*

Giotto di Bondone  
*Christ on the Way to Calvary*, c.1305  
Courtesy Scrovegni (Arena) Chapel, Padua, Italy



medieval works by Giotto and the Lorenzetti brothers.

"It's staging people in their normal life," Grillo says. "That's the principal realm driving my photographs."

GRILLO CAME TO photography early and he approached it seriously and studiously. As a boy, he wanted to learn all he could about the art and craft of taking pictures. He consulted the *Book of Knowledge* encyclopedia. He asked his parents for a camera. His high school had an extensive darkroom, and he mastered the technical elements of photography.

In college, he began dabbling with masks and layered negatives, which allowed him to play with textures — a sky

with the texture of a brick wall or skin like tree bark. Today, people do that in PhotoShop all the time, but back then, it was cutting-edge.

It was also the reason why Grillo decided to abandon photography, albeit temporarily.

"People would pick up my work and say, 'Wow, how did you do this?'" he says. "At that point, I realized the photos were meaningless. I had gotten so skilled in the technical aspects that I didn't have a whole lot to say. So I went on with my life merrily as an art historian and dropped it all."

Fifteen years later, after he had earned his Ph.D. from Cornell University, Grillo realized that his study of art history had given him a lot to say.

"I found that photography allowed me to work through a lot of ideas that were very core to me in the 14th- and 15th-century history of art or 17th-century Dutch painting, in a way that would complement the way I write about these things," Grillo says.

It also has informed how Grillo teaches students who have lived their entire lives with access to inexpensive point-and-shoot cameras and cell phone images. By examining the choices made by painters in the 14th, 15th or 17th centuries, students gain the analytical skills they need to understand contemporary imagery — whether it's a photograph by Grillo or a spread in a fashion magazine. ■

# Gigabit access

## Ultra-fast Internet comes to UMaine

**I**NSTALLATION OF MAINE'S first gigabit Internet network commercially available to business and residential customers has begun in the Old Town and Orono communities surrounding the University of Maine.

The new ultra-high-speed Gigabit Main Street Internet Network, built by GWI Inc., based in Biddeford, Maine, is expected to drive innovation and create economic opportunity by providing an Internet network as fast as any in the world. It also will make UMaine one of the fastest-moving and leading innovators of the nationwide Gig.U initiative.

Gig.U — the University Community Next Generation Innovation Project — is a group of 37 leading research universities across the United States seeking to accelerate the deployment of ultra-high-speed networks to leading U.S. universities and their surrounding communities. The goal is to improve high-speed Internet networks to drive economic growth and stimulate a new generation of innovations addressing critical needs, such as healthcare and education.

"The University of Maine is committed to serving as a catalyst for technological, economic and job development in the state of Maine," says UMaine President Paul Ferguson. "This new Gigabit Main Street network is a perfect example of how we intend to bring people from the public and private sectors and the university community together to drive innovation and create economic opportunity."

Blair Levin, executive director of Gig.U, says UMaine was one of the first institutions to sign up to participate in Gig.U and is now one of the first to move forward, in partnership with GWI, to make the idea of Gig.U a reality in Old Town and Orono.

"This GWI Gigabit Main Street deployment will not just benefit the University of Maine community; it will provide

Orono, Old Town, and the state of Maine with the strategic bandwidth advantage necessary to lead in the next generation of broadband innovation," Levin said.

GWI's Orono-Old Town Gigabit Main Street Network will be built in two phases, based on customer demand and network use. Phase I will quickly build out and reach downtown districts and business-heavy parts of Old Town and Orono. Phase II will build out further, based on demand and population density.

The Gigabit Main Street network will provide 125 times faster download speeds and 1,000 times faster upload speed than current offerings.

The network will be built on an open-access model, meaning that GWI will install optical fiber to the business and home, and make that network infrastructure available to any service provider that wants to offer service to customers within the network. The network will also be mixed-use, meaning that it will serve both business and residential customers.

"We were proud to partner with the university to bring the Three Ring Binder network to Maine, which runs from Kittery to Fort Kent and is now owned and run by Maine Fiber Company. We hope our success here in Old Town and Orono will lead to the development of other networks and increased economic opportunity in university and rural communities across our state," says GWI Inc. CEO Fletcher Kittredge.

The difference in performance to both residential and business customers on the Gigabit Main Street network powered by GWI will be dramatic, comparable to the move from dial-up to current broadband speeds — at roughly the same price as their current service. Dial-up modems delivered speeds of 30k to 56k. Current broadband speeds are approximately 8,000k. ■

## History of Maine's cyber infrastructure

**D**UE TO its location, Maine has always been challenged in its cyber communication capabilities. As a result, the state has been aggressive in bringing communications services to constituents. Leading the state's cyber infrastructure initiatives have been the University of Maine and University of Maine System. Highlights include:

### **BITNET**

In 1982, Maine joined a developing network of universities called BITNET. At the time, the closest connection point for Maine was Yale University. The connection speed was 9600 bps (bits per second), which is substantially slower than modern dial-up modems. BITNET's first electronic magazine, *VM/COM*, began as a UMaine newsletter, but was broadly circulated across BITNET by early 1984.

### **The Internet and NEARNET**

In 1986, the National Science Foundation (NSF) funded the first "Internet," connecting six supercomputing sites across the U.S. In July 1988, this was expanded to 13 connection points at communication speeds of 1.5 Mbps (1.5 million bits per second). In 1989, UMaine received an NSF grant to connect the University of Maine System's statewide network to the fast-developing Internet. The university joined the New England Education and Research Network (NEARNET) to provide the first Internet connection in Maine.

### **Maine Schools and Library Network**

From 1989 to 1994, UMaine provided network access to other educational institutions, many high schools, Maine government and many

nonprofit organizations. Combining the resources from these various entities enabled UMaine to increase its connection speed using multiple 1.5 Mbps circuits. In 1996, the University of Maine System managed the deployment of a network connecting more than 1,100 sites in the Maine Schools and Library Network, which continues today. Maine became the first state in the nation to connect all its elementary and secondary schools, as well as all its public libraries, to the Internet. This brought Internet access to the most rural areas of Maine, including islands off the coast.

### **Internet2**

In 1998, the University of Maine was awarded a \$350,000 NSF grant to establish an Internet2 connection. Since the creation of Internet2 in 1996, a New England connection point was developed called the Northern Crossroads. The initial connection speed was 45Mbps and was upgraded to 155 Mbps in 2000.

### **Supercomputing**

In 2001, construction began on UMaine's first large cluster supercomputer at the Target Technology Center in Orono. In 2003, this machine was one of the 500 fastest machines in the world. In 2005, a more powerful machine was installed and used by researchers and educators until 2012. This year, with support from the Maine Technology Asset Fund, a new supercomputer was installed on campus and networked to be accessible from anywhere in the world to serve high-performance and cloud computing needs.

### **MaineREN**

In 2007, the University of Maine System and

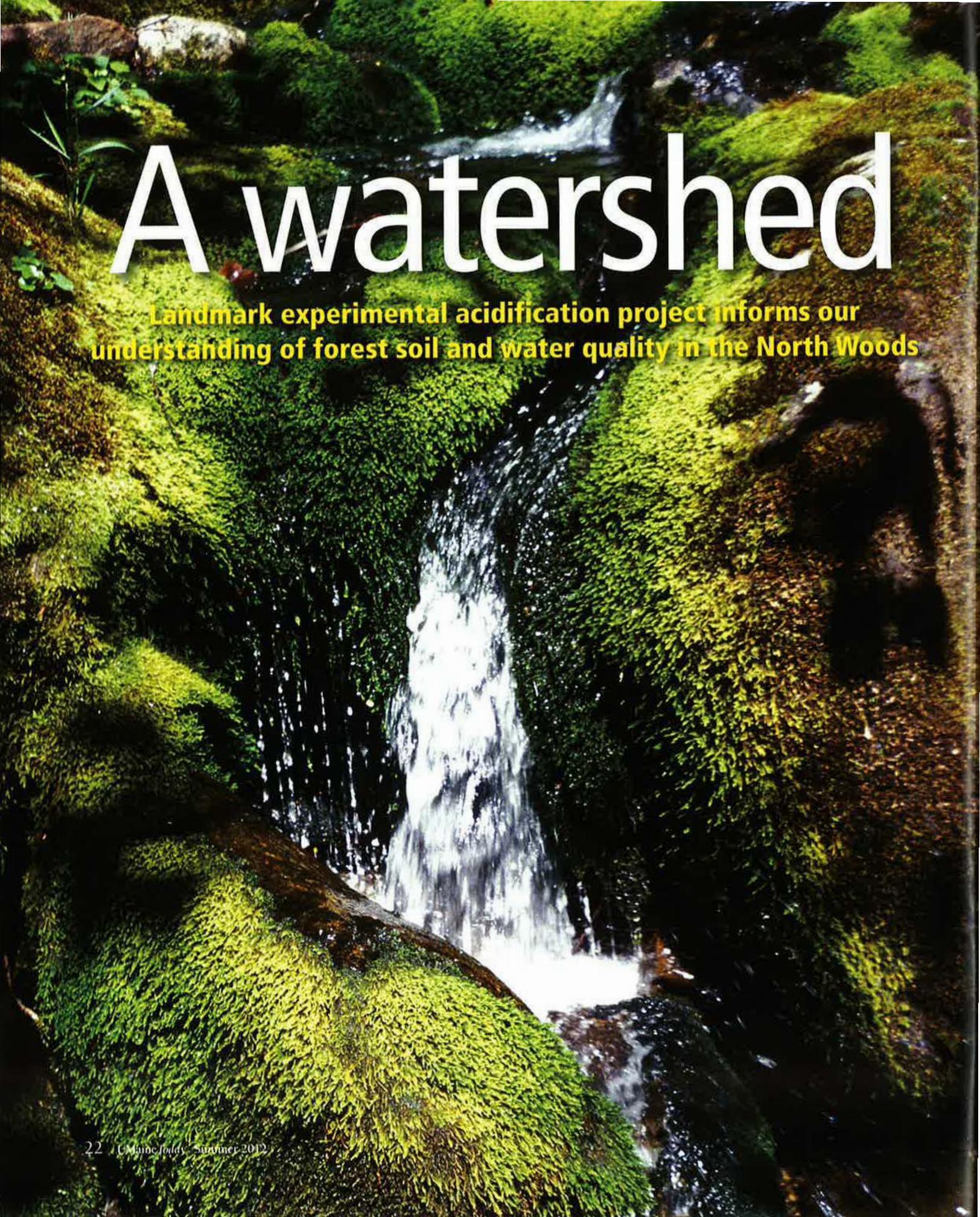
Jackson Laboratory partnered to deliver the cyber infrastructure necessary to participate in, and be considered for, high-technology research by creating MaineREN. MaineREN is a facilities-based fiber-optic network that extends from Bar Harbor, Maine, to Cambridge, Mass., connecting Maine's research and education (R&E) community with advanced network capabilities. Since its inception, MaineREN has grown to include 12 higher education and research participants, along with more than 900 K-12 schools and public libraries.

### **Three Ring Binder**

In 2009, with significant effort by the Biddeford-based company GWI Inc., the University of Maine System and UMaine, the Maine Fiber Company was formed. The basis of the company was \$25 million from the U.S. Department of Commerce and \$7 million in private investment to fund the Three Ring Binder, comprised of three interconnecting rings of 1,100 miles of middle-mile dark fiber, available on a nondiscriminatory, open-access model. This model provides the capacity for multiple networks having tens of gigabits of bandwidth. In addition to the middle-mile connectivity, the Three Ring Binder directly connected a large number of Community Anchor Institutions to the Internet at gigabit speeds.

### **UMaine in Gig.U**

In 2011, UMaine joined the nationwide Gig.U initiative to accelerate the deployment of ultra-high-speed networks to leading U.S. universities and their surrounding communities.

A vibrant photograph of a forest stream. The water flows over a series of large, dark rocks that are heavily covered in bright green moss. The stream is surrounded by dense, lush green foliage, creating a sense of a deep, healthy forest. The lighting is bright, highlighting the textures of the moss and the clarity of the water.

# A watershed

**Landmark experimental acidification project informs our understanding of forest soil and water quality in the North Woods**

By Jessica Bloch

**M**ORE THAN A quarter-century ago, University of Maine geochemist Stephen Norton, forest soils scientist Ivan Fernandez and colleagues wrote a U.S. Environmental Protection Agency grant proposal that launched a landmark whole-watershed manipulation project to study effects of acid precipitation. Norton, a national expert on acid rain, and his research team identified the perfect spot in the North Woods — a paired-stream watershed on the southeast slope of Lead Mountain in northern Hancock County, known as Bear Brook.

Literally and figuratively, it was a watershed moment in the study of long-term experimental acidification. Today, the Bear Brook Watershed in Maine (BBWM) research program is internationally recognized for its contributions to our understanding of the effects of elevated atmospheric nitrogen and sulfur deposition in forests.

Research began on the privately owned land in 1987 and has continued since, making Bear Brook one of the longest experiments of its kind in the world and the oldest in the U.S., along with a partner site in West Virginia. And while the initial research was part of the national agenda to determine the effects of acid rain, the scope of BBWM has evolved to address some of the most pressing issues of our day related to forest soil and water quality, including climate change, carbon sequestration, nitrogen saturation, acidification, and depletion of calcium and other nutrients from forest soils.

Through the years, grants from the EPA, the National Science Foundation and other sources have brought more than \$11 million in funding to UMaine for work at Bear Brook, and

provided support for dozens of undergraduates to experience lab and fieldwork, and graduate students to pursue high-level research. The experiment includes bimonthly applications via helicopter of an ammonium sulfate fertilizer to the West Bear watershed, simulating elevated levels of nitrogen and sulfur on forested watersheds. The adjacent East Bear watershed remains untreated to serve as a reference, and to study the recovery of watershed systems in response to improvements in air quality as a result of the Clean Air Act. Through the years, continuous

high-frequency stream monitoring has been done collaboratively with the U.S. Geological Survey.

Because of its long-term nature, the Bear Brook study has allowed UMaine researchers to see ecological responses that would likely not have been identified in a typical three- to five-year study.

**“You can define short-term responses, but that’s not what happens 10 to 20 years later. That’s what this kind of research allows us to understand.”**

Ivan Fernandez

AT THE BEGINNING of the project, research focused on testing three computer models used to guide Congress in deliberations on the Clean Air Act reauthorization in the late 1980s, with an emphasis on effects of sulfur on surface waters. Since then, research has shown where the models were right and wrong. And scientists have broadened their research scope to include many aspects of biological and geochemical function in forested watersheds.

Today, they are studying poorly understood processes regarding carbon sequestration and dissolved carbon release to surface waters; the effects of unanticipated events such as ice storms; how recovery from higher levels of sulfur deposition happens in ecosystems and why recovery is not as advanced as predicted; the role of phosphorus in acidification; and insights on forest nutrient cycling critical to understand forest sustainability in an era of increasing population and expanding bioenergy markets.

# A watershed

The critical questions that are the focus of research today were not recognized at the beginning of the experiment. The last two decades have been a period of warming climate, changes in storm patterns and decreases in sulfur deposition, which are all examples of changes in the environment that can only be fully understood by including long-term ecological observatories like Bear Brook in the mix of science.

“It has taken a different path than we thought,” says Norton, now professor emeritus, who retains his interest in Bear Brook and still collaborates on research while Fernandez oversees the project. “None of these processes would have been unraveled by a three-year study.”

RESEARCH AT BEAR Brook and similar locations in the U.S. was sparked by an EPA effort in the mid- to late-1980s to determine the ecological effects of acid precipitation. For Norton and Fernandez, the focus at the time was on determining how nitrogen, base cations and, especially, sulfur would affect their watersheds at Bear Brook. But UMaine researchers had unexpected results over the long term, including some that deviated substantially from model projections.

For example, nitrogen levels did not behave as expected. For two or three years after Bear Brook had been identified, nitrogen was increasing in the watershed runoff. Researchers assumed levels would continue that way, but in the fourth year, nitrogen in untreated East Bear Brook decreased to virtually zero and has remained that way ever since.

“It was a climate signal that was alter-

ing the watershed we haven’t been tinkering with, and it’s been seen now all over the Northeast,” says Fernandez, who earned his Ph.D. at UMaine and returned to the faculty after working in industry, and has been involved in Bear Brook from the beginning. “At the same time, the nitrogen in the watershed we treated has gone up, but not as much as we thought it would.”

**The water chemistry of the reference watershed in East Bear has seen some recovery, especially in sulfate concentration related to the decrease in sulfur emissions to the atmosphere. That recovery, however, is not as great as projected, and current UMaine research is contributing to understanding the complexity of ecological recovery.**

Most of the nitrogen being added is still accumulating in the soils.

The combination of acidification and nitrogen in the treated watershed has changed the way phosphorus cycles through the watershed. Fernandez says the prediction was that, as more nitrogen was added to West Bear, phosphorus would become a limiting nutrient. However, after 10 years, researchers found some evidence that the treated watershed

cycled phosphorus faster than expected. But while phosphorus was more available, this effect varied in the different forest types in the watershed.

Those changes also resulted in an increased loss of phosphorus from the ecosystem through time. An increase in the rate of phosphorus cycling means trees — which need a certain amount of phosphorus in order to store energy from photosynthesis and other functions — are taking in more phosphorus, which ends up in the leaves.

When the leaves fall, they enrich the upper levels of the soil with phosphorus. But it also leaches into streams at a rate that can sometimes be 10 times as fast as normal, compared to other watersheds in the region.

Research is now focused on understanding if this is a temporary shift in phosphorus cycling and if the ecosystem ends up in a new nutrient status because evidence suggests some of these processes are transient. If so, then only through this type of long-term project would researchers see these changes — an argument for continued research to determine how these processes cycle through time on a decadal scale.

FERNANDEZ AND NORTON say the original models predicted a particular equilibrium concentration for sulfate would be reached in stream runoff, but that plateau was never attained.

“For the first 10 years, the model predicted well, so had we only done a three- to five-year study, we would have been really happy with the model’s performance,” Fernandez says. “But after

about a decade, we found sulfate concentration in the stream started to plateau earlier than it should have and we still don't really know why. It does indicate the model was wrong as comprised if applied to this ecosystem."

However, Bear Brook has turned out to be a near-perfect demonstration of model predictions for the effects of acidification on calcium loss in watersheds to date. Researchers found calcium concentrations increased in the West Bear stream because calcium was being stripped out of the soil for the first 10 years. At that point, the ecosystem switched from a calcium-buffering system to an aluminum-buffering system, and calcium concentrations in the treated watershed decreased.

"In fact, we joke that we should stop the study soon because we'll find out that it doesn't behave as perfectly over the long term," Fernandez says. "Yet, if that is true, it is exactly that type of discovery that can only be achieved through long-term research programs like Bear Brook, where we can learn about ecosystem sustainability on time scales of the 21st century."

IN 1990, AN amendment to the Clean Air Act sought to address the effects of acid rain on the general public. Norton says while the impacts on public health were measurably positive, it has been much harder to determine the ecological impacts without long-term studies.

The water chemistry of the reference watershed in East Bear has seen some recovery, especially in sulfate concentration related to the decrease in sulfur emissions to the atmosphere. That recovery, however, is not as great as projected, and

current UMaine research is contributing to understanding the complexity of ecological recovery.

A short study also wouldn't allow researchers to see the implications of a recovery from random, unpredictable events for which there is no adequate model based on ecosystem processes, such as the recent, relatively warm winter or the ice storm of January 1998.

The ice storm, it turns out, had a dramatic effect on the biogeochemistry of Bear Brook. At the time, the impacts appeared minor, but researchers found that the loss of foliage allowed increased sunlight to reach the forest floor, even for a short period of time, causing a blip in the rates of nutrient cycling and changes to the streams that lasted three or four years.

"Had we come along the day before the ice storm and decided to do a year-long study to tell us how the ecosystem functions, we would have gotten it wrong," Fernandez says. "At that point, we were really watching the variability in ecosystem behavior that was laid over the long-term trend, and without the long-term trend, we wouldn't have known how to interpret what we were seeing.

"Without the long-term record, you can't understand events. We can also see that the response to treatments and the effects of changes in the environment on sulfur, calcium, nitrogen and phosphorus would not be discernible with a three- to five-year study.

"You can define short-term responses, but that's not what happens 10 to 20 years later. That's what this kind of research allows us to understand." ■

## Global perspective

THE BEAR BROOK Watershed research program is one reason UMaine is considered a national leader in long-term biogeochemical research and monitoring taking place on glaciers and in lakes, streams, wetlands and forests.

More than 200 scientists from around the world will see some of these research projects firsthand when UMaine hosts the BIOGEMON Conference, a gathering of international scientists, students and researchers who study how biogeochemical research, including monitoring, modeling and experiments, support our understanding of how chemical and physical climate change influences the environment on our planet. The conference, July 15–20, will be held in Northport, Maine.

BIOGEMON's emphasis is on biogeochemistry as an evolving and integrated discipline, including research at the watershed, ecosystem, landscape and global scales. A major emphasis of research throughout the history of BIOGEMON has been on the effects of atmospheric deposition on ecosystem function and water quality. In the U.S., concerns for these effects were an important consideration in the reauthorization of the Clean Air Act in 1990. It is these long-term research and monitoring programs that we rely on to determine the benefits of policy actions on environmental quality.

The conference will focus on biogeochemical change through time — from ice cores to gauged watersheds. It will provide a forum for the dissemination and discussion of recent research findings, explore future directions for biogeochemical research and foster interdisciplinary collaboration.

The 2012 conference is organized by UMaine in concert with Villanova University and the Czech Geological Survey. UMaine Professor of Soil Science Ivan Fernandez and Professor Emeritus of Earth Sciences Stephen Norton are leading the conference planning effort and are part of the international planning committee. They and other UMaine faculty members and graduate students will present scientific papers in various sessions and lead fieldtrips to critical research locales and natural sites, such as Bear Brook Watershed.

# Big picture

## A recent grad has her sights set on the intersection of animal and public health

**F**OR AS LONG as she can remember, Darryl Ann Girardin of Presque Isle, Maine, has been passionate about animals, especially big ones. And since the eighth grade, when she researched the best pre-vet schools in the country, she's known she was going to study at the University of Maine. Ironically, she also grew up without any household pets and, before she came to UMaine, had no experience with large animals.

"The first thing I did was volunteer at Witter (UMaine's teaching and research farm) and work in the calf pens," she says. "The farm is a mile down the road with a 40-cow dairy herd and 12 standardbreds. I enjoyed getting the hands-on experience. There aren't that many (universities) where you can do that."

As a freshman and sophomore, Girardin continued to volunteer doing livestock chores. She describes the three months between her sophomore and junior years as "one of the best summers of my life" because she started daily milking chores, beginning at 3:30 a.m. Her animal and veterinary sciences coursework involved the care and handling of both cows and horses.

In her junior year, Girardin was deciding on possible topics for her senior capstone and honors theses, including the biosecurity implications of infectious disease outbreaks on farms, with the help of her academic adviser, Dr. Anne Lichtenwalner. Lichtenwalner is an assistant professor of animal science and a University of Maine Cooperative Extension veterinarian who directs UMaine's Animal Health Laboratory, a campus-based service for Maine veterinarians, livestock producers and animal owners.

In addition to providing a variety of diagnostic services, including necropsies and research, Lichtenwalner works with veterinarians, farms and industries to help control problems related to animal health in the state.

"I realized I really liked learning about the mechanisms of disease," says Girardin, who graduated from UMaine in May. "I had already started applying to vet schools, but realized I wanted to do more than I originally thought. I wanted to do something with food animal health and infectious disease, possibly become a state vet, monitoring diseases while helping to keep production high and implications to the environment and animals low."

By the end of her junior year, Girardin had decided to pursue a master's degree in public health, focused on infectious disease and public policy as they relate to domestic food animals. After that, she'll pursue her degree in veterinary medicine. ■





### **'I like being elbows-deep in the gross stuff'**

DARRYL ANN GIRARDIN'S hands-on experience in the University of Maine's Animal Health Lab included necropsies on young moose. The animals were found dead in the Maine woods in 2010, and brought to the lab by Maine Department of Inland Fisheries and Wildlife officers to determine the cause of the higher-than-normal mortalities. Lab Director Dr. Anne Lichtenwalner and her team, including senior capstone student Jana Drury, found high counts of lungworm in the moose, which led to the question — and Girardin's honors thesis — about the species of the parasite.

The speciation process involved Girardin learning to perform DNA extraction, polymerase chain reaction, gel electrophoresis, cloning and DNA sequencing. The research team isolated a gene from lungworms whose DNA sequence will be compared to those published in a genome database.

"This procedure allows us to be open to possibly discovering a novel lungworm species — or at least one not previously known to be infecting Maine moose," says Girardin, whose research was selected for this year's Undergraduate Research and Academic Showcase on campus. "The lungworms discovered in other studies are not host-specific, which means one species of lungworm could infect moose, deer, even cattle. This could have serious implications for the control of the parasite."

Last September through November during the Maine moose hunt, Girardin joined Inland Fisheries and Wildlife officers at the tagging stations to collect lungs from the gut piles. Moose lungs were analyzed for lungworms. If lungworms were found, they were collected for lab work to determine the infectious species.

Girardin also assisted Inland Fisheries and Wildlife officers in the collection of moose ovaries for a reproductive health study.

"When I tell people what I do, a lot of them say, 'Eeeww, why do you want to do that?'" she says. "I like being elbows-deep in the gross stuff. We need to know what diseases are affecting our populations of animals — wildlife especially. We need to know if we're going to have a problem on our hands."

# Science is kid stuff

## 4-H steps up its STEM education efforts

**S**CIENCE HAS BEEN a focus in 4-H for more than a century. But today, in addition to the traditional forms of science, including animal husbandry and other aspects of agriculture, 4-H also is about such fields as robotics, alternative energy and GPS technology. According to the National Assessment of Educational Progress, 21 percent of high school seniors are proficient in science, but only 1 percent perform at an advanced level.

Through a variety of 4-H Science initiatives, University of Maine Cooperative Extension hopes to help reverse that trend by preparing the next generation of scientists and engineers.

“We want to get kids excited about science,” says John Rebar, executive director of UMaine Extension. “We want kids to understand its relevance in their lives and the opportunities for science in their careers. Maine has a growing high-tech sector and a huge healthcare sector. How do we get people excited about those careers?”

The 4-H answer? Start early.

In 2011, 4-H Science outreach efforts served 29,000 Maine youths ages 5 to 18. Among the most successful new endeavors is the 4-H Afterschool Academy, a professional development program that trained some 380 after-school providers in its first year. Those providers then shared their knowledge with 18,000 Maine children.

“We know there’s a huge issue with a shortage of scientists in the United States — that’s no big secret,” says Lisa Phelps, 4-H program administrator for UMaine Extension. “With 4-H Science, we have the ability to provide hands-on learning for kids. Anything we can do to supplement learning in the classroom is important.”

That learning extends into the community. On Maine lakes, teams of youths and adults have used GIS technology to map invasive species. In fact, on Bryant Pond, 4-H campers have used engineering technologies to deploy submersible robots in an effort to identify and eradicate milfoil.

In 2012, Cooperative Extension plans to more fully align UMaine’s teaching and research expertise in science and engineering with the needs of Maine children. A new coordinator, based at UMaine, will identify projects and professors who may be a good fit for 4-H programs.

Phelps and her colleagues hope that the effort will bring more youths to campus and inspire them to consider science careers. ■



Photos by Edwin Remsburg and UMaine Bryant Pond 4-H Camp

**“We want to get kids excited about science.”**

John Rebar

# NEW leadership

## Empowering young women to influence tomorrow



Mary Callaway

Mary Callaway hopes to work in some area of social services. She is particularly interested in women's health advocacy. She plans to go on to graduate school and get a Ph.D. in sociology.

SINCE 2009, MAINE NEW Leadership's summer institutes at the University of Maine have attracted 78 students from 24 colleges and universities. The program provides leadership education for college-age women, including training in public speaking, coalition building, networking, advocacy and running for office. Throughout the six-day residential experience, participants rub elbows with some of the state's — and the nation's — most influential women. Because of this program, UMaine is at the forefront of women's leadership education in the state.

Mary Callaway, a UMaine senior from Old Town, Maine, majoring in women's studies and sociology, shares her experience in NEW Leadership:

**Why were you interested in NEW Leadership for women?**

I wanted to learn more about political leadership, and learn new techniques and skills for influencing policy.

**What did you gain through the program and how has that shaped who you are today?**

I learned a lot about working with people who have a variety of perspectives. Once I graduate from college, I'm pretty sure I'll encounter many people who do not share my political opinions. It's great to have learned skills for negotiating and crafting arguments that can really work.

**Tell us about the leadership skills you developed as a NEW Leadership participant and how they manifest themselves in your day-to-day life.**

The program made me more aware of the variety of our experiences and how we have come to hold the beliefs that we have. I've tried to remember this throughout my political discussions and try my best to see where people are coming from, even if I don't agree with them. ■



## Going deep

Science Foundation and more than \$30,000 from the National Geographic Society to establish three long-term monitoring sites in Chile where she will take samples of deep-sea corals for reproductive ecology studies. Waller also will explore Maine's coastal areas for deepwater emergent coral habitat sites, and use \$48,000 from the National Oceanic and Atmospheric Administration to continue a long time series of red tree corals in Alaska. She intends to register the new locations and depth ranges in the U.S. Geological Survey Cold-Water Coral Geographic Database and hopes to discover a scuba-accessible site from which to launch future studies of deep-sea, cold-water coral ecology and physiology.

"The discovery of deepwater emergent corals in areas such as Chile, Alaska and even here in the Gulf of Maine makes ecological research possible on species previously unobtainable in enough numbers and from enough times of year to say anything useful about their population processes," Waller says.

**B**ECAUSE OF THE DEPTHS at which they grow, deep-sea corals are not as well studied as their tropical cousins in shallower waters. Yet both are vulnerable to environmental pressures and human impacts. Rhian Waller, a University of Maine assistant research professor, has received grants to explore corals usually found in the deep sea, but now living in shallower waters in the Gulf of Maine, Alaskan fjords and the Patagonian fjords in Chile.

Her funding includes a more than \$78,000 RAPID Grant from the National



**It is possible that colonization of new or depleted areas occurs by influx of larger cod rather than cod larvae when adjacent populations reach high densities, which has not happened in New England for decades at least, according to UMaine marine scientist Robert Steneck.**

## Cod clues

NEW EVIDENCE SUGGESTS that Atlantic cod may have the ability to affect entire food webs in both benthic and pelagic marine ecosystems, according to a University of Maine marine scientist, writing in the Proceedings of the National Academy of Sciences (PNAS).

"Not only are (cod) strong interactors capable of limiting the abundance of their prey and their prey's prey, but also the prey themselves may limit the recovery of this predator," says Robert Steneck of the large carnivore that, prior to overfishing, was "widespread, abundant and possibly the most important predator throughout the coastal regions of the North Atlantic."

"In most countries where fisheries management exists, the focus is on the dynamics of single species," says Steneck, "and often there is no consideration of how two or more managed species interact or how such interactions can affect the entire ecosystem."

In his PNAS commentary published May 14, Steneck points to an event in which an overabundance of Atlantic cod in the Baltic Sea spilled over into the Gulf of Riga, as reported by a research team led by Michele Casini of the Swedish Board of Fisheries. The "predator pulse" — in-migration of juvenile and adult cod — into the gulf lasted a decade, causing a trophic cascade in the marine food web. Cod ate the herring, causing the herbivorous zooplankton population normally eaten by herring to increase. Because zooplankton consumed phytoplankton, water in the Gulf of Riga cleared, but only for the decade when cod spilled into the region.

This example of successful, albeit serendipitous, cod colonization provides clues as to how the species' repopulation occurs and why it isn't as simple as closing large areas to fishing when Atlantic cod stocks collapse, Steneck contends. In the case of Canada and the United States, fishing managers expected a full recovery of cod stocks within a decade after the closures in the early 1990s; nearly two decades later, cod stocks remain historically low.



UMaine professor Marie Hayes is leading a series of ongoing longitudinal studies of neonatal abstinence syndrome babies, tracking their physiological and cognitive development into their toddler years, as well as genetic factors affecting outcomes.

## Crisis of care

AS THE NATIONAL epidemic of opiate abuse and addiction continues to swell, the social and financial burden of treating infants born to drug-addicted mothers also grows.

In poor, rural states like Maine, where opiate abuse rates are among the highest in the nation, clinicians and researchers have developed an expertise born of necessity in managing opiate addiction in pregnant women and neonatal abstinence syndrome in their infants. But rural states also are the most likely to feel the pinch in their cash-strapped Medicaid budgets of the increased demand for treatment.

A recent issue of the *Journal of the American Medical Association* features an editorial written by University of Maine psychology professor Marie Hayes and Dr. Mark Brown, chief of pediatrics and director of nurseries at Eastern Maine Medical Center in Bangor, Maine. The article, "The Epidemic of Prescription Opiate Abuse and Neonatal Abstinence," details the challenges of caring for this vulnerable population, cautions against defunding maternal treatment programs, and calls for new research efforts to establish effective medications and standardized protocols for prenatal management of maternal and fetal health and postnatal withdrawal.

## Golf green

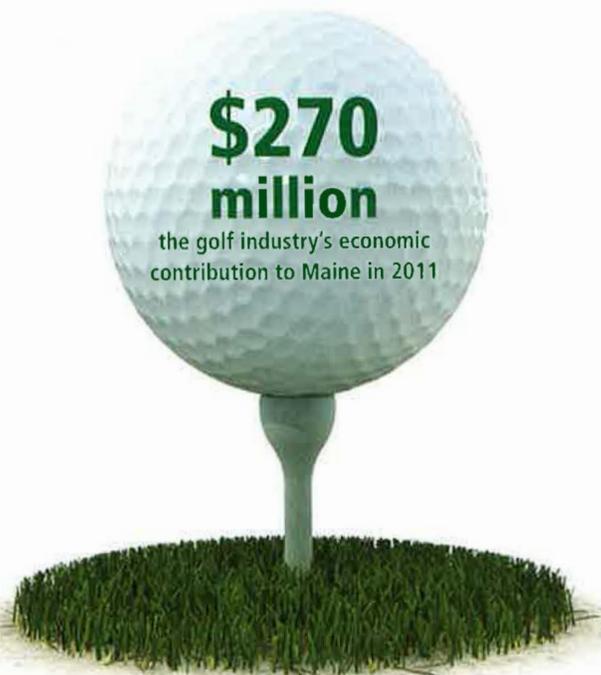
ACTIVITY AT MAINE'S 144 golf courses, along with the tourism-related spending by out-of-state golfers, generated a \$270 million statewide economic contribution in 2011, according to research by University of Maine economists Todd Gabe and James McConnon.

Gabe and McConnon, who conducted a similar study 11 years ago, recently calculated that the golf industry's \$270 million economic contribution, which includes the expenditures by golfers and related multiplier effects, support 4,935 full- and part-time jobs in Maine, which provided \$90 million in labor income.

Study results are based on surveys of Maine golf courses conducted at the end of the 2011 golf season, as well as visitor spending figures from the Maine Office of Tourism. The study was funded by the Maine State Golf Association and Golf Maine.

"Golf ranks right up there with activities such as hunting, fishing, skiing and snowmobiling in terms of participation by visitors to Maine," says Gabe, a professor of economics. "The golf courses told us that 31 percent of their players are from outside of Maine, which is almost identical to the out-of-state golfer estimate from our 2001 study."

Maine's golf courses indicated that poor weather, the low number of people playing golf, and competition from other courses and activities are some of the biggest challenges facing the golf industry.



## Genetic testing

COLLEGE STUDENTS enrolled in basic genetics courses often bring with them deep-rooted conceptual difficulties about fundamental genetic principles. Even among students majoring in the biological sciences, these erroneous concepts can be surprisingly difficult to dislodge, according to two biologists involved in science education research.

Michelle Smith of the University of Maine and Jennifer Knight of the University of Colorado administered a Genetics Concepts Assessment as a pretest and post-test to 750 undergraduate students enrolled in basic genetics courses. The researchers found that nine of the 25 questions generated the most incorrect post-test responses, reflecting fundamental misunderstanding in three broad concept areas: genetic content and genetic code; the nature of mutations and their effects; and the process and results of meiosis, including probability calculations. They also found a surprising number of students persisted in answering these nine questions incorrectly and each question had a most common incorrect answer.

The incorrect answers may represent misconceptions that are resistant to change and that can prevent students from learning a concept that is consistent with what scientific data suggest to be true, Knight and Smith wrote in the journal *Genetics*.

The authors encourage educators to systematically identify fundamental student misconceptions and correct them with a variety of techniques throughout the academic semester.

**A** HORMONE that plays a role in regulating body weight may be a key to understanding how hibernating bears can remain

inactive for so long and not experience bone loss, according to a research team led by a University of Maine alumna and researcher. Dr. Rita Seger, a researcher in the University of Maine Department of Animal and Veterinary Sciences, and a team of researchers conducted the bone metabolism study. They compared active and hibernating bears using a suite of 12 serum markers of bone metabolism and X-rays of the bears' paws. The researchers found greater amounts of leptin in hibernating than in active bears. In addition, leptin levels in hibernating bears correlated with serum markers of bone turnover, leading them to hypothesize that the hormone's effect on the sympathetic nervous system may help to prevent bone loss. In essence, the skeleton appeared to perceive that it was "loaded" or supporting an active body, when it was actually "unloaded" during hibernation, the researchers wrote in the journal *Bone*. Hibernating bears are the only animals that do not experience unloading-induced bone loss. Researchers hope that greater understanding of the role of leptin in bone biology can

contribute to our understanding — and better treatments — of skeleton-related diseases, such as osteoporosis.

## Bear bones



## Good catch

CONTRARY TO PREVIOUS findings, there are no differences between boys and girls in two key sports skills — catching and kicking, according to researchers from the University of Maine and Jefferson Village School in Maine. The researchers tested 186 children ages 5 to 14 and found that there were rapid gains in object control skills at ages 9 and 10. After that, skill development slowed in catching, throwing and kicking. The study did find that boys were more adept at striking and throwing, leading the researchers to call for an examination of instructional approaches "given evidence that object control performance during childhood is predictive of sport-related performance in adolescence." The results were published in the journal *Perceptual and Motor Skills*.

At ages  
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*UMaine Today* is produced four times a year by the Department of University Relations, University of Maine, 5761 Howard A. Keyo Public Affairs Building, Orono, Maine 04469-5761, 207-581-3745.

Printing and distribution of *UMaine Today* are underwritten by the Office of the Vice President for University Development and Alumni Relations, and the University of Maine Foundation.

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IT IS WITH great pride in and admiration for our University of Maine community that I share with you some of the interesting and exciting people and programs in this new issue of *UMaine Today*.

After seven months of rigorous planning by the Strategic Planning Leadership Team, the President's Cabinet, focus group participants and community members, we have published our consensus-based vision and plan, the Blue Sky Project. I want to thank those of you who participated in "setting forth the University of Maine's guiding principles and key areas of distinction, shaping a bold yet pragmatic framework for innovative and entrepreneurial growth, and charting a responsible course for fiscal sustainability through 2017."

During this time, we have also awarded our first PRE-VUE Program grants to UMaine faculty and staff. We received 45 highly competitive proposals and funded six. Those selected for funding were rated most highly for the potential to enhance excellence and campus transformation through broad-based, campuswide partnerships, employ a cost-effective approach to addressing pressing issues for UMaine, achieve a sustainable impact, and align with UMaine's emerging and strategic priorities. These projects will provide initial momentum on campus for a number of key initiatives in student recruitment and retention, renewed focus on the humanities, faculty development, university marketing and branding, and undergraduate research opportunities as we begin to fully implement the Blue Sky Project.

The UMaine community also reflected on the institution's tremendous legacy of leadership in Maine during Leadership Week. Attendees enjoyed a number of events celebrating leadership and culminating in the April 19, 2012 Presidential Inauguration. The events included the Distinguished Presidential Lecture with Adm. Gregory G. Johnson, Leadership Week keynote speaker Doris Kearns Goodwin, the GradExpo, the Undergraduate Research Showcase, Student Leadership Awards and the UMaine Symphonic Band Concert in Portland. I am encouraged that we all ended the week reflecting on the need to reaffirm the public good in the public research university for which UMaine is a shining example — and national leader.

As I come to the end of my first year as the 19th President of UMaine, I especially want to thank you for your wonderful encouragement and support for the Fergusons, as well as your deep love for the University of Maine. Based on our collective affection and commitment to UMaine and its success, I have an even greater sense of hope and confidence during our second year together that we will achieve our Blue Sky Vision and advance the "College of Our Hearts Always" to further academic excellence.

A handwritten signature in black ink, appearing to read "Paul W. Ferguson". The signature is fluid and cursive, with a long horizontal stroke extending to the right.

Paul W. Ferguson  
President

These young pitchers, photographed in June from the Orono Bog Boardwalk, arose about a month earlier from a perennial rootstock that produces new pitchers annually. Pitcher plants are abundant where the walkway first emerges into the open bog and are among four kinds of "carnivorous plants" found in the bog. Also growing nearby are cranberry plants with trailing stems and pink flowers.

Photo by Ronald B. Davis



**T**he Orono Bog Boardwalk Endowment Fund was established in the University of Maine Foundation in 2002 to maintain, operate and develop the Orono Bog Boardwalk and associated educational programs. The mile-long boardwalk begins in Bangor's Rolland F. Perry City Forest and runs through the University of Maine's property in the Orono Bog. Annually, the boardwalk is a destination for some 35,000 visitors, including more than 800 schoolchildren who receive guided educational tours. Orono Bog Boardwalk is open May through November, affording visitors opportunities to observe the seasonal changes in the colorful, natural beauty of the site's diverse flora and fauna. The Orono Bog Boardwalk Project was initiated in 1999 by University of Maine professor Ronald B. Davis of Orono and the University of Maine.

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