Lake Effect | Turbulent Lives | Agents of Change

UMaine Today

CREATIVITY AND ACHIEVEMENT AT THE UNIVERSITY OF MAINE

MAY/JUNE 2009

Waste? Not!

Turning organic discard into green

President's Message

THE LAND-GRANT UNIVERSITY concept that dates to the Civil War has brilliantly withstood the test of time. Universities such as UMaine have educated generations of leaders, provided the new knowledge that has helped our society prosper, and extended resources that improve lives in meaningful ways. By design and through practice, land-grant universities have become indispensable to their home states.

This issue of *UMaine Today* provides several good examples of how the contemporary University of Maine works to make lives better all across the state.

When Gov. John Baldacci saw the need for a comprehensive look at the impact of climate change on Maine and its likely long-term effects, he turned to UMaine. Our faculty delivered by providing a report that will frame policy discussions related to energy, land use and countless other issues for years to come. UMaine's Compost School has significant environmental ripple effects on businesses and communities. Our EPA-funded work will protect Maine's precious lakes, and research aiming to make biofuels from seaweed may provide an important use for an abundant natural resource. On an individual level, we also are proud of the results of our efforts to find ways to deliver a UMaine education to students through distance education.

As we see the effect of the economic difficulties on our friends and neighbors, the time is right to reflect on UMaine's impact close to home, and to resolve to continue to find ways to optimally serve the people of Maine.

Robert A. Kennedy
President

ON THE COVER: For 12 years, communities and businesses in Maine and beyond have come to the University of Maine to learn how to turn organic waste — from food scraps and grass clippings to animal manure and carcasses — into a valuable commodity. The Maine Compost School teaches participants to mine the economic and environmental benefits of the soil-enriching "black gold." As a result, communities save money by reducing landfill waste, companies offer a marketable product and businesses incorporate green strategies into their production. See related story on page 2.

UMaine Today

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University of Maine profile

Located in Orono, Maine, the University of Maine is the state's land-grant and sea-grant institution. UMaine serves its home state through its explicit statewide teaching, research, and public service outreach mission. Offering 89 bachelor's, 92 master's and 30 doctoral degree programs, UMaine provides the most varied and advanced selection of programs available in Maine. The Carnegie Foundation for the Advancement of Teaching classifies UMaine as a Doctoral Research Extensive University, the highest classification.

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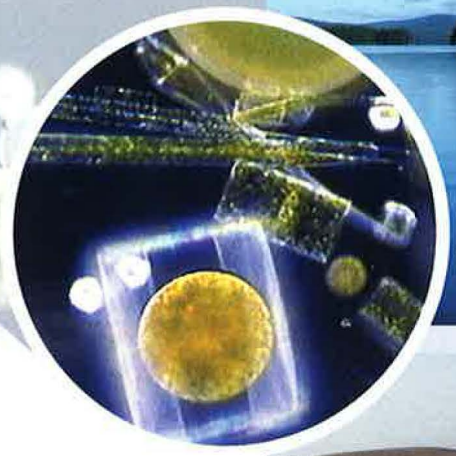

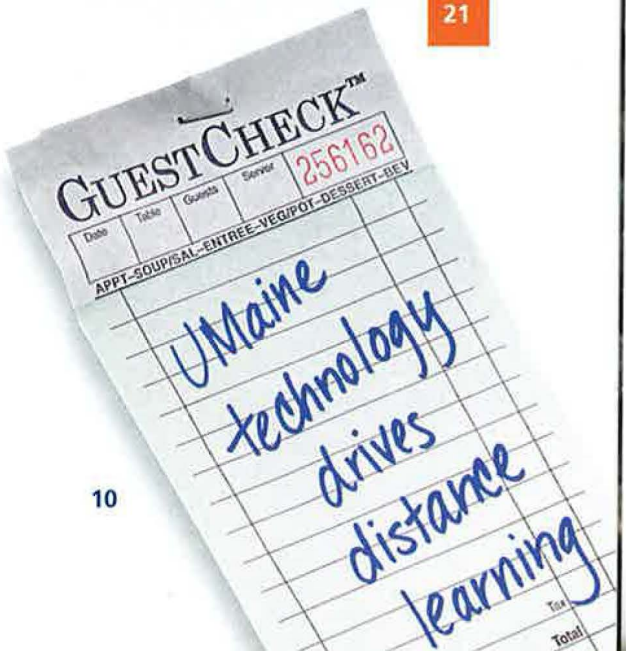

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+Online

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In *UMaine Today* magazine, +Online indicates the availability of additional content — Web-exclusive stories, video and audio clips, photo galleries, full-length versions of articles and a comprehensive editorial archive.

PAY DIRT

CASHING IN ON BLACK GOLD

At the Maine Compost School, businesses and communities learn the value of waste

By Kristen Andresen

COMPOST HAPPENS.

Sure, it makes a clever slogan on a bumper sticker. But *how* does it happen? And who really wants to know?

As it turns out, more people than one would think.

Since its founding 12 years ago, the Maine Compost School at Highmoor Farm in Monmouth has served more than 600 students from throughout the United States and around the world. The school is an outreach effort of the University of Maine Cooperative Extension; Maine Department of Agriculture, Food and Rural Resources; Maine Department of Environmental Protection; and Maine State Planning Office.

Some who enroll in the certificate program want to learn how to manage organic waste more efficiently. Others come from municipalities in search of a cost-effective way to reduce what they send to the landfill. And increasingly, students come in the hope of starting a business.

"When we first started out, people didn't understand what compost was; I don't think the market was there," says Mark Hutchinson, an associate Extension professor who is on the school's faculty. "The demand has increased tremendously, which consequently creates business opportunities. Today, we've got people who can't produce enough compost for the demand."

For the uninitiated, compost is fully decomposed organic matter that is added to soil to improve its structure and nutrient profile. When managed correctly, a compost heap won't attract vermin or other pests, and it reaches a high enough temperature to eliminate most pathogens and kill any weed seeds.

The end product plays a key role in soil fertility. Healthy soil is a "living biological system," according to Hutchinson, and compost provides food for the organisms that drive that system. It makes nutrients in the soil more readily available to plants, and it improves drainage and air circulation, as well.

John Beyer of Commercial Landscape Management in South Portland knows compost is good for plants, but that's not why he got into the business. He and his crew were producing 10 to 15 cubic yards of grass clippings a day, six days a week, 30 weeks a year — and paying $8 per cubic yard to get rid of it.

"I kind of started experimenting with composting on my own,

University of Maine Cooperative Extension Educator Mark Hutchinson checks the temperature of a compost pile at UMaine's Highmoor Farm in Monmouth, the home of the Maine Compost School. Temperatures up to 160 degrees F facilitate decomposition. It's time to turn a compost pile when the internal temperature dips below 110 degrees F. Photo by Edwin Remsberg, USDA

and I was doing a horrible job of it," Beyer recalls. "I really thought all I had to do was lump up my products, but it became a big, slimy, nasty mess."

When he attended the Maine Compost School four years ago, he learned how to combine ingredients such as leaves, sawdust, grass clippings and the like to create a balanced — not slimy — product. His company now offers a high-quality compost-loam mixture and straight compost to clients. And today, other landscapers pay him to dispose of their grass clippings.

CASHING IN ON BLACK GOLD

"We'll take it, turn it over and sell it the next year," Beyer says. "It's double-source revenue. From a business perspective, it has saved us on disposal fees, and it made us a greener company in the eyes of our customers."

THE PROCESS ESSENTIALLY turns trash — organic waste that ranges from leaves to sewage sludge to animal carcasses — into treasure. And it has large-scale composters seeing green, both environmentally and financially.

"Our landfills are starting to fill up, and transportation to other states is expensive, so many municipalities and farmers have decided to compost and market it to home gardeners as a soil amendment," Hutchinson says.

That need is what drew Michael Conway of the Bethlehem, Pa., Recycling Bureau to the compost school last summer. Annually the city collects 20,000 tons of leaf and yard waste from residents. When Conway and his colleagues decided to expand their composting capacity, they knew just where to turn for help: The Maine Compost School.

"It's known across the country," Conway says. "This is *the* primary compost school. It's that well-known and the reputation is that high."

The school is an outgrowth of the Maine Compost Team, which includes representatives from the Maine Department of Agriculture, Food and Rural Resources; the Maine Department of Environmental Protection; the State Planning Office; and UMaine Cooperative Extension. When the team came together in 1991, there was no such thing as a compost industry in Maine.

The team was providing assistance to communities, businesses and farms trying to reduce, reuse and recycle their organic waste. Over time, more and more compost operations started with the team's help. Training of the operators was done on an individual, as-needed basis. As the industry grew, the need for training also grew, to the point where individual instruction at each compost site no longer made sense. In 1996, the team decided it was time to look into offering classes on a regular basis.

After several months of preparing the agenda, planning program details and development of hands-on activities, they were ready to offer the program to Maine composters. But the team was shocked to discover the demand was not just in Maine. Students started showing up from all over the country and the world.

Over time, the school's curriculum grew to include marketing and networking techniques, in addition to recipe building, safety and vector management.

At the Harraseeket Inn in Freeport, Maine, food waste is collected and trucked to a local farm for composting.

"We've had a shift in the type of people — from those who wanted to know what composting is to municipalities interested in waste management and people who are interested in starting their own business. They see this as a viable business," Hutchinson says.

To that end, the team started bringing in industry leaders to serve on the faculty, such as Wes Kinney of Kinney Compost in Knox, Maine, and Carlos Quijano of Coast of Maine Organic Products in Portland, whom Hutchinson calls "one of the premier marketers of compost in New England, if not the United States."

Today, the school is internationally known. The 2008 summer session brought in students from Puerto Rico, Pennsylvania, Illinois, New York, Rhode Island and Maine. Since its founding, it has attracted people from 48 states and 28 countries.

The lectures are held in Highmoor's barn, while the hands-on classes take place in a clearing down a dirt road that winds through the farm's acreage. A recent $56,000 Maine Economic Improvement

The compost is used in growing produce for the inn. The closed-loop system is economically and environmentally beneficial.

Fund grant provided an asphalt pad and buffer areas to catch any leachate that may run off from the long compost piles, called windrows, or the piles of raw materials, such as chicken manure, apple pomace, leaves and wood chips.

This is the learning laboratory, where students can experiment with different recipes and "ingredients." Here, the team has successfully turned everything from horse carcasses to a dolphin — yes, a dolphin from the University of New England that had washed ashore — into "black gold." And because the folks at the Maine Compost School really know what they're doing, the only off-putting odor in the air comes from the pile of chicken manure. Everything else smells like moist soil.

THE ABILITY TO COMPOST almost anything organic is essential, because everyone who comes to the school has what Hutchinson calls a "problem ingredient" — too much of one thing. For a student from a Jamaican canning plant, the ingredient was ackee pods; the fruit's flesh is a hot commodity, but the leathery pods aren't. For a farmer, the problem ingredient might be horse bedding or cow manure. For a municipal worker, the ingredient might be sewage sludge.

The process has large-scale composters seeing green, both environmentally and financially.

"It's not so much the materials you have, but how those materials are put together," Hutchinson says. "We try to teach methods and technology. That allows you to go back and apply it. People want to know: How do you build that recipe? What do you look for in a good pile? What does it look like? Feel like? Smell like? What do the temperatures tell you? We really want them to have the ability to transfer knowledge from one situation to another."

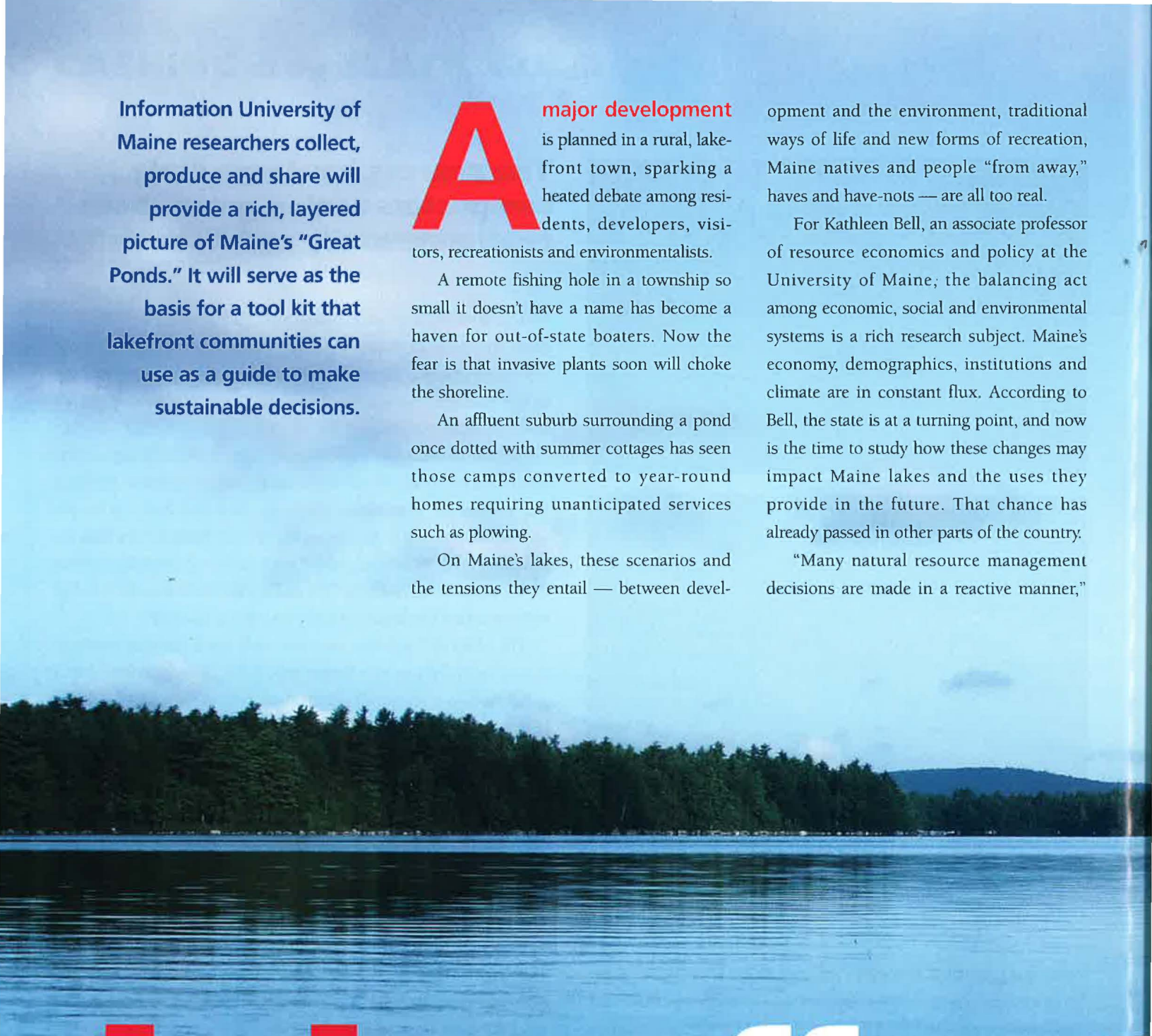
The setup at Highmoor may not work for a city that wants to reduce landfill waste or a farmer who'd like to turn an old potato conveyor into a compost bagger. That's why the schedule includes field trips to a variety of compost operations that show students what is possible from industry and waste-management perspectives.

For the Maine-based businesses and towns that have sent representatives to the school, the possibilities are endless — and inspiring. Take, for example, the Harraseeket Inn in Freeport. When Andy Ono came on board seven years ago as a purchaser, the inn was producing 40 cubic yards of waste a week — and paying someone hundreds of dollars each month to haul it away.

Ono grew up on farms, so he knew that the food waste could be turned into compost. And for a facility whose mission statement includes sustainability, environmentally sound practices and supporting local agriculture, it seemed like a logical fit. So Ono turned to the Maine Compost School to learn the finer points — the science behind the process and all the variables to consider when running such an operation.

What started as a cost-cutting measure for the inn has blossomed into a closed-loop system: Food scraps are collected on-site and trucked to a local farm. There, they are turned into compost, which the farmer then applies to the fields where produce for the tavern is grown. Today, the inn produces less than 8 cubic yards of waste a week, saving hundreds of dollars — and, in some ways, the environment.

"Done right, it can touch a lot of things. It can help a lot of things. Economically it has helped, and obviously, environmentally it has helped too," Ono says. "It's full circle." ▮



Lake effect

Fathoming the ecological, economic and social

By Kristen Andresen
Photo illustrations by Carol Nichols

Information University of Maine researchers collect, produce and share will provide a rich, layered picture of Maine's "Great Ponds." It will serve as the basis for a tool kit that lakefront communities can use as a guide to make sustainable decisions.

A major development is planned in a rural, lakefront town, sparking a heated debate among residents, developers, visitors, recreationists and environmentalists.

A remote fishing hole in a township so small it doesn't have a name has become a haven for out-of-state boaters. Now the fear is that invasive plants soon will choke the shoreline.

An affluent suburb surrounding a pond once dotted with summer cottages has seen those camps converted to year-round homes requiring unanticipated services such as plowing.

On Maine's lakes, these scenarios and the tensions they entail — between development and the environment, traditional ways of life and new forms of recreation, Maine natives and people "from away," haves and have-nots — are all too real.

For Kathleen Bell, an associate professor of resource economics and policy at the University of Maine, the balancing act among economic, social and environmental systems is a rich research subject. Maine's economy, demographics, institutions and climate are in constant flux. According to Bell, the state is at a turning point, and now is the time to study how these changes may impact Maine lakes and the uses they provide in the future. That chance has already passed in other parts of the country.

"Many natural resource management decisions are made in a reactive manner,"

says Bell, the principal investigator on a three-year, interdisciplinary study of lake management, funded by a $300,000 grant from the U.S. Environmental Protection Agency. "It would be great to break that pattern, identify win-win opportunities and strengthen the adaptive capacity of our landscape.

"Great things will come from moving beyond the polarized perspective of development versus the environment, and redirecting energies," she says.

Bell and her UMaine colleagues — Jessica Leahy, Stephen Sader and Jeremy Wilson of the School of Forest Resources; and Peter Vaux of the Sen. George J. Mitchell Center for Environmental and Watershed Research — intend to help various stakeholders, such as state agencies, communities and nongovernmental organizations, adopt more proactive approaches to lake management.

An interdisciplinary approach will allow Bell and her colleagues to explore the cumulative effects of system change.

Bell employs GIS data and modeling tools extensively to understand the spatial aspects of economic behavior. She has studied the economics of land use issues for years and helped develop spatial models of land use change.

Her experience suggests that certain patterns of development, policy impacts and landowner responses aren't really surprising, yet they seem to continually take communities throughout the United States by surprise. Hard lessons seem to be learned again and again.

By considering the social, economic and environmental aspects of lake resources, Bell and her colleagues hope to improve lake management and to help Maine communities avoid those hard lessons.

Their research considers changes in the built environment around lakes, recreational use of lakes, lake water quality, and the likelihood of invasive plant and fish introductions. It is being conducted at two scales: statewide assessments and community-based case studies, which offer distinct perspectives of management opportunities and challenges. The research includes interviews and physical surveys, the building of

interactions for better planning

spatial databases that chart recent changes, and the use of those databases to model future changes.

By 2010, researchers hope to provide stakeholders with practical planning tools to support lake management, land-use planning and economic development decisions.

The researchers take an objective view of sustainability as it applies to the economy, social concerns, the environment, recreation and tradition. The goal is to achieve joint resiliency of economic, social and environmental systems.

"Changes in housing around lakes are one focus of this research," Bell says. "We are not antidevelopment. Rather, we are learning about why different housing patterns emerge on different lakes and exploring the extent to which these patterns interact with lake attributes, such as recreation opportunities and water quality."

The community-based studies focus on 11 lakes in 20 towns and townships, from Aroostook to York counties. Whether small or large, all are "Great Ponds."

The research team is collaborating with state agency staff, town managers and lake association members to determine what research, scientific data and planning tools will help them better manage their lakes.

"Maine lakes are unique ecological, economic and social assets," Bell says. "These assets produce services that enhance Maine's quality of place. We're conducting research to better understand these services, and developing information and planning tools to help others think about the sustainability of these services in a changing landscape."

The researchers are assembling data from numerous sources, including their community partners, to better understand the economic, social and environmental characteristics of lakes. Particularly challenging are data gaps, such as recreation and land use histories. The team is exploring innovative ways to begin to fill these

gaps, including a collaboration with the Maine Volunteer Lake Monitoring Program, a citizen-based initiative.

Margaret Snell, a master's student studying resource utilization in the School of Economics, and Christine Paluga of Mount Desert Island, Maine, an undergraduate in UMaine's Parks, Recreation and Tourism Program, spent last summer interviewing community leaders to gather information. They asked about the role lakes play in the community; management challenges and uses over time; changes in residential development and water quality; and challenges of invasive plants and fish.

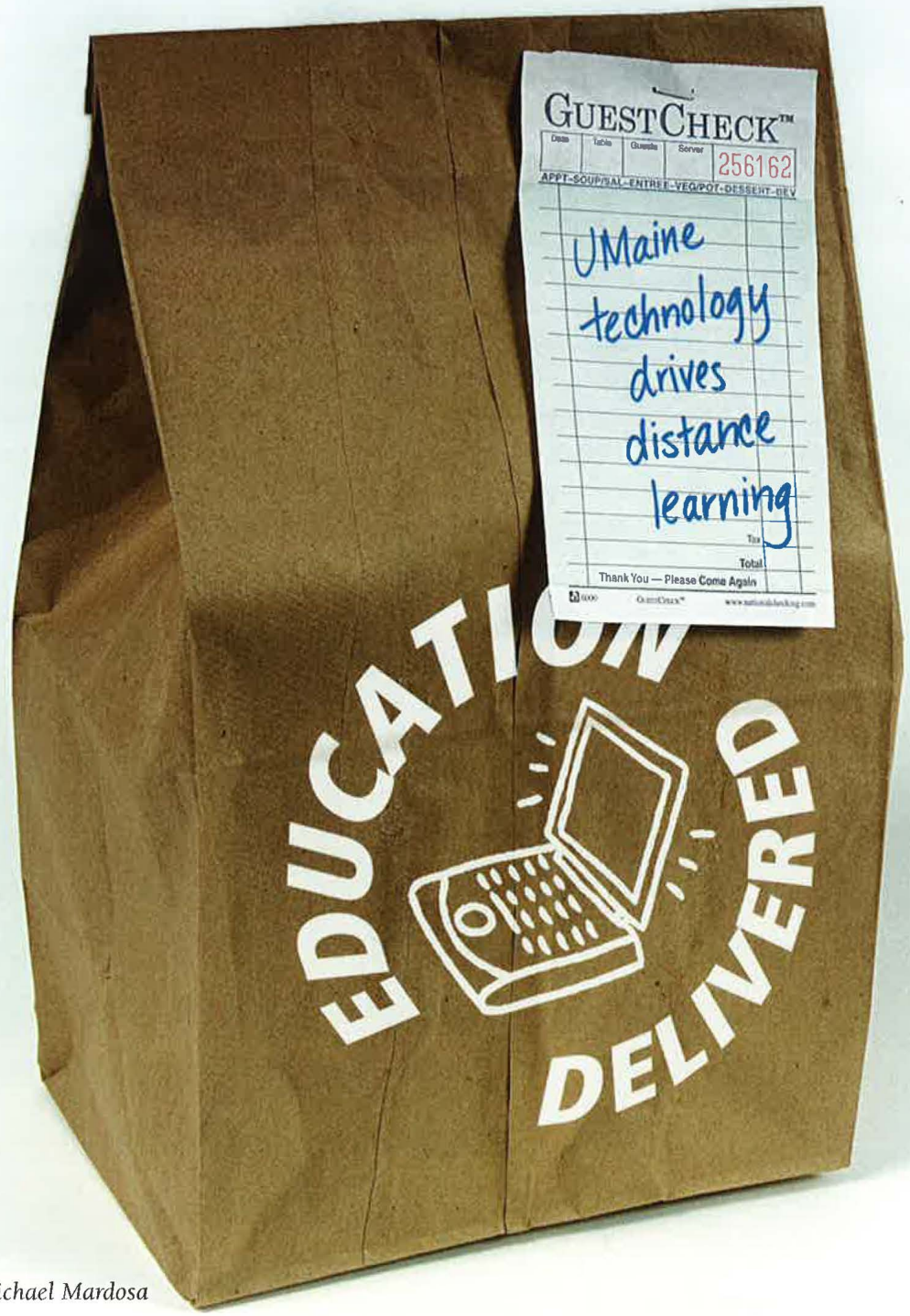
Concurrently, Paluga and Snell did their own survey of kayaks and motorboats, docks or moorings, shoreline landscaping and the type of buildings around each lake. Different lakes have distinct personalities. Their survey initiated a mapping of attributes related to this variation in character.

"We were trying to get a feel for what is going on at the lake, the relationship between development and recreational use," Snell says. "Were there recreational conflicts? Do patterns of housing affect recreational use?"

Two other graduate student researchers involved in the project — Megan Tylka in the School of Economics and David Ellis in the Department of Wildlife Ecology — are studying water quality and invasive plants and fish, respectively.

Information the UMaine researchers collect, produce and share will provide a rich, layered picture of Maine's Great Ponds. It will serve as the basis for a tool kit that lakefront communities can use as a guide to make sustainable decisions.

"By thinking more creatively about the interactions among economic, social and environmental systems, we can better support the resiliency of these systems," Bell says. "Sustainable lake management is one of many opportunities to improve our economy and our environment." ▮



By Kristen Andresen
Photo illustrations by Michael Mardosa

Amy Cross couldn't have done it any other way.

The University of Maine student had two children at home when she enrolled in online courses. She had left a career in commercial insurance and risk management, and wanted to return to school to earn a degree in education. Though she lives in Brewer, Maine, just a few miles south of Orono, a daily commute to campus wasn't an option.

"If it weren't for distance learning, I don't think I'd be in school. Distance learning was the only way I could afford to do it without having to pay exorbitant daycare fees," says Cross, who has been taking an average of four classes each semester since 2005. "I fell in love with it."

Cross is far from alone. This semester, 3,255 students accounted for 4,315 separate course registrations for distance-delivered UMaine classes — up 1,000 from spring 2008.

The reasons for the increase are myriad. The slumping economy has made travel to campus cost-prohibitive for some. In a state as large and rural as Maine, distance is always an issue. For those who

have a day job, a traditional course schedule may not work. And many prefer the convenience of taking a course when — and where — they want.

"As a land-grant university and the flagship campus of the state, the University of Maine's mission is one that is statewide," says Robert White, UMaine associate provost and dean of the Division of Lifelong Learning. "The resources of our faculty have been extended, allowing more people access to UMaine's offerings."

When it comes to technology, the University of Maine is well ahead of the curve — but not so far ahead that it leaves people out.

Since 1989, when Maine invested heavily to create off-campus centers for an instructional television network, access has been at the heart of distance learning. Though instructional television (ITV) sites are still a vital component, course slots were and continue to be a limited resource. Advances in technology and a focus on Internet classes have made UMaine's offerings more appealing, accessible and plentiful than ever.

"We are serving students regardless of where they are, who they are or what age they are," White says.

What started with two ITV classes has grown to 250 distance-education courses annually, delivered through ITV, video conferencing, the Internet or any combination of the three. Videoconferencing allows students in Maine to connect with other campuses in the United States and abroad. Asynchronous online courses combine video, audio, online content and text to provide a rich experience for students and faculty, and are a growth area at UMaine. Because Internet access varies throughout the state, courses are offered in a variety of formats to accommodate different computers, connection speeds and platforms.

Today, about 11 percent of the university's total credit hours come from such courses, delivered from the Orono campus as well as the Frederick Hutchinson Center in Belfast, Maine. The offerings are varied and, at times, unexpected — from music appreciation, physics and nursing to electrical and computer engineering. Maine high school students can get an early jump on college through UMaine's Academ-e program. Students of all ages can enroll in certificate programs, such as Maine Studies, or one of dozens of classes in the arts, humanities and sciences. Though many courses of study require on-campus classes, there are options for those who want to pursue a bachelor's or master's degree through distance learning. One undergraduate and five graduate degrees are offered online.

UMaine has twice been recognized by the University Continuing Education Association for its programs in liberal arts distance education, and the Hutchinson Center received a New England Board of Higher Education program achievement award.

"UMaine has been a regional and national leader and innovator in the use of technology in distance teaching and learning from 1989 to present," says James Toner, director of distance education at UMaine.

When it comes to technology, the University of Maine is well ahead of the curve — but not so far ahead that it leaves people out. Justin Hafford, the assistant director for distance education, is always

One of eight certificate programs offered by UMaine distance education is Maine Studies, in which students learn about the state through courses in history, literature, women's studies, economics, political science, geology and geography.

looking for new, more effective ways to deliver content to students. That could mean downloading a lecture on iTunes U and watching it on an iPhone. It could mean broadcasting a live course over the Internet. It may mean teaching a class in Second Life, a virtual world. Or it could involve a podcast.

"They're all good for different reasons," says Hafford. "We really need to have all these options so we can accommodate people with different learning styles and lifestyles."

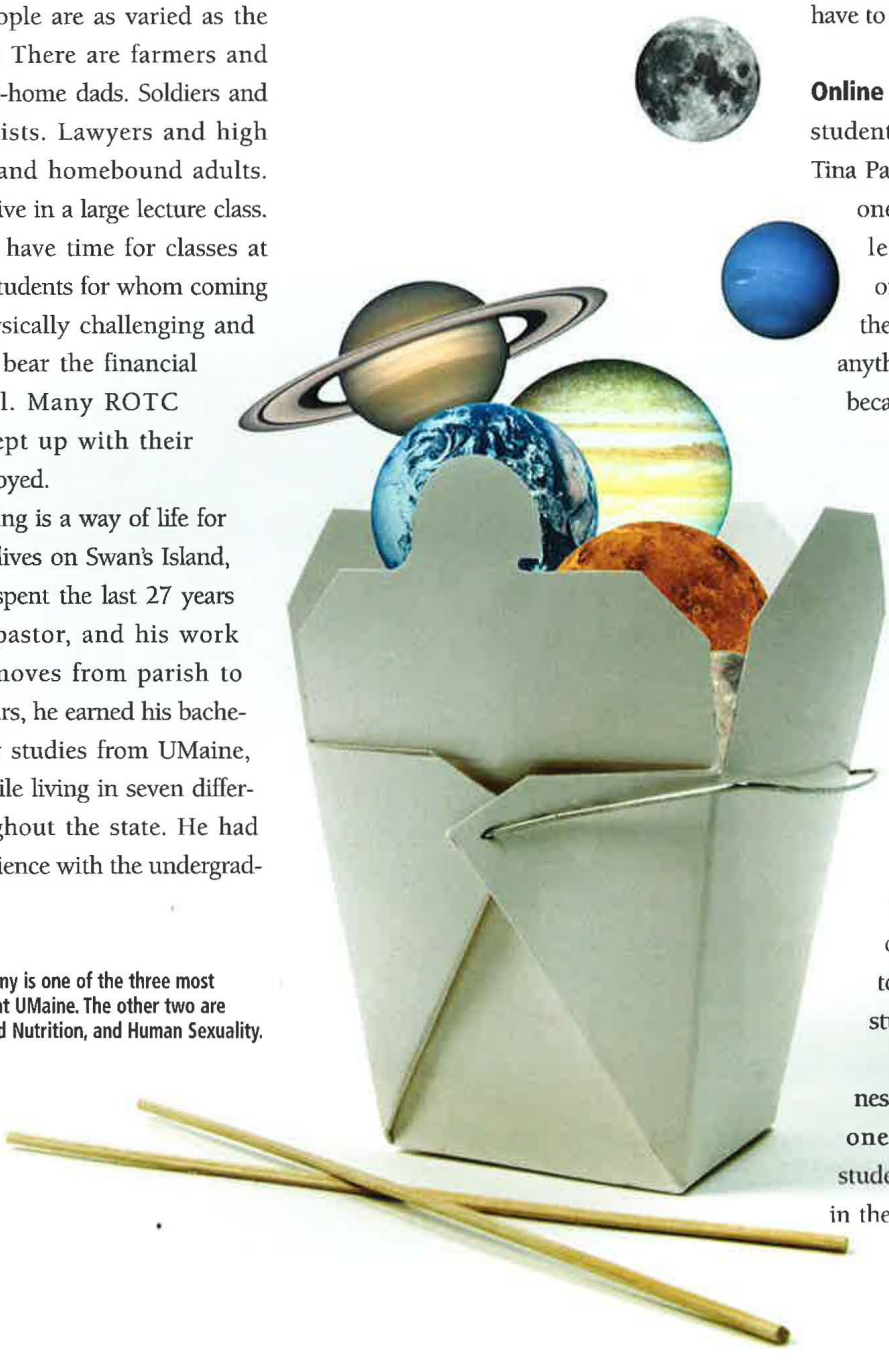
And those people are as varied as the course offerings: There are farmers and nurses and stay-at-home dads. Soldiers and veterans and artists. Lawyers and high school students and homebound adults. Some may not thrive in a large lecture class. Others may only have time for classes at 2 a.m. There are students for whom coming to campus is physically challenging and others who can't bear the financial burden of travel. Many ROTC students have kept up with their studies while deployed.

Distance learning is a way of life for David Uber, who lives on Swan's Island, Maine. Uber has spent the last 27 years as a Methodist pastor, and his work entails regular moves from parish to parish. In nine years, he earned his bachelor's in university studies from UMaine, mostly online, while living in seven different towns throughout the state. He had such a good experience with the undergraduate work he completed in 2007 that he recently enrolled in the master's-level Peace Studies Program.

"I've lived in other states, and this, to me, is the best setup," Uber says.

Though island life makes online courses a necessity for Uber, they aren't just for students who live far away from campus. Increasingly, "traditional" students choose to take one or more courses a semester online. Giang Vo, a sophomore accounting major from Hanoi, Vietnam, is one of them. Vo only takes electives online, as she'd rather interact with her business professors and classmates in person. But she loves asynchronous courses because she's a night owl, so she can sit through lectures when she's most alert.

"You remember the material more," says Vo, who generally takes one or two online classes a semester. "Plus, it saves a lot of time. But it takes a lot of self-discipline. You have to schedule yourself."



Introduction to Astronomy is one of the three most popular online courses at UMaine. The other two are Introduction to Food and Nutrition, and Human Sexuality.

Online courses work particularly well for students of Vo's generation, according to Tina Passman, a classics professor who was one of UMaine's pioneers in distance learning. She introduced her first online Latin class in 2000. Because the language isn't spoken, it doesn't lose anything in an all-text presentation. And because the flagship is the only campus in the University of Maine System that offers Latin, Passman saw an opportunity to make the course available to students statewide. She has since developed 15 online courses, including several in peace and reconciliation studies, and one in universal design.

Passman is the first to admit that certain subjects, such as Latin, lend themselves more to an online format. But she is convinced that online courses are a perfect fit for today's multitasking, computer-savvy students.

"There's a different kind of richness," says Passman. "I have a one-on-one relationship with every single student, because they e-mail, they hand in their work, they do all kinds of things,

Modern Languages and Classics distance education course offerings are Spanish, French, Latin and multiculturalism, as well as topics classes. Latin is one of UMaine's two longest-running online courses. The other is Surveying Enginering.

like upload photos of their dogs. It's a different kind of relationship. It's the kind of relationship that the student of the 21st century is really comfortable with and actually likes."

For those who teach UMaine's distance education courses, the experience is equally rewarding, once they get used to the idea. Music professor Anatole Wieck wasn't wild about offering his music appreciation course online. For the live class, he plays violin, brings in musicians, and often plays recorded music and movies.

"My class is a multimedia event," he says, laughing.

The course, which launched in 2002 and is one of UMaine's most popular online classes, required a huge investment of time up front. But now, because everything is organized digitally, Wieck says it has improved the quality of his live class.

"The online version of my class works very well, particularly for students who live very far away. I've had students in my class who were studying abroad in Vietnam and Germany," he says. "I do believe if a course is online you don't have the vibes from the teacher or the performer, but it does have its own advantages."

Though distance education is growing in popularity, don't expect online courses to replace traditional classroom learning anytime soon.

"The resources of our faculty have been extended, allowing more people access to UMaine's offerings."

Robert White

Even Cross, who has taken the majority of her courses online, needs to come to campus once or twice a week. She is switching to an interdisciplinary bachelor's degree program, and has found her calling. Her own experience showed her what is possible worldwide through distance education.

Cross, who plans to graduate in 2010, recently founded the International Collaborative Educational Alliance, a virtual education initiative centered on sustainable community building and nonviolent conflict resolution. The school will reach out to individuals at risk to offer technical and academic courses.

"It's literally all because of distance learning. With distance learning, there's so much more you can do," she says. ▮ Online

By the numbers

Spring '09 UMaine distance learning

3,255 students enrolled, most in online courses

415 Maine communities that **2,811** of the students call home

113 courses offered this semester, most online

73 international students enrolled

63 Maine communities that **113** Academ-e high school students call home

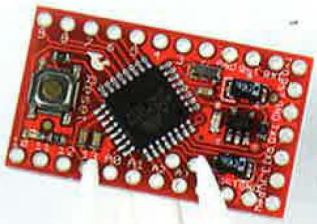
3 online courses most popular: Introduction to Food and Nutrition, Introduction to Astronomy, and Human Sexuality

2 UMaine academic areas — peace studies and education — offer the largest number of distance learning courses

2 UMaine's longest-running online courses — Latin and Surveying Engineering

1 UMaine's longest-running distance education course — Senior Seminar in Nursing

One undergraduate and five graduate degrees are offered through distance education, including a master's in electrical or computer engineering.



Turbulent lives

UMaine researchers study **the role of diverse cell shapes** in phytoplankton ecology

By Margaret Nagle
Photos by David Townsend

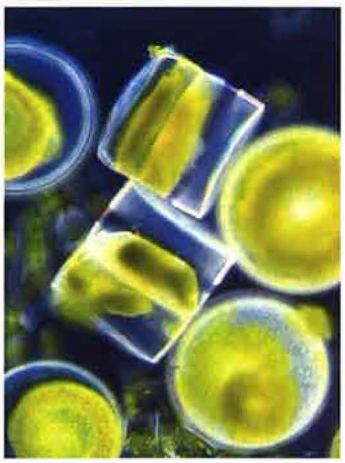
THEIR SHAPES ARE AS BEAUTIFUL as they are mysterious. Spheres covered in round, intricate calcium carbonate plates or appendages like tiny trumpets and flower blossoms. Spiny chains like primitive centipedes. Species that resemble ornate glass pillboxes, toy tops, mesh containers. Geometric shapes and patterned stars.

The marine environment's version of snowflakes.

A cup of water scooped from the ocean, river or lake can contain millions of the microscopic, single-celled organisms called phytoplankton. Most drift passively in the water. Some have flagella for mobility. Thousands of species exist, with more being discovered every year.

Phytoplankton are some of the most important Protista on Earth. They anchor the bottom of the aqueous food web, providing nutrition for fishes and mammals ranging from zooplankton (one click above phytoplankton) to whales. In their short (days to weeks) life cycles, they remove carbon dioxide from the air and produce oxygen through photosynthesis. As a result, about half of all the photosynthesis on the planet occurs in the oceans.

And because their growth depends on such essential factors as sunlight and nutrients found in colder, deeper depths, phytoplankton are the quintessential harbingers of climate change.



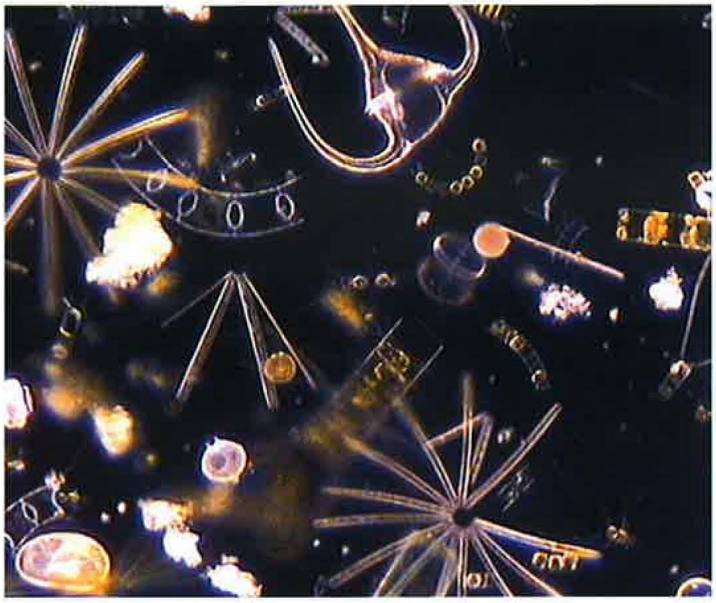
Ceratium (photo left)
A dinoflagellate with long spines, pictured with a larval bivalve.

Coscinodiscus
A large, centric diatom.

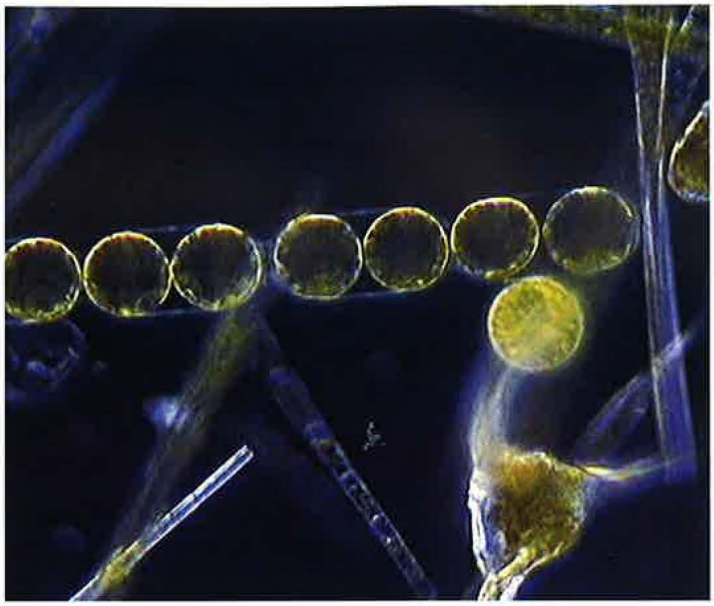
The photographs by University of Maine Professor of Oceanography David Townsend are part of his current research projects focusing on phytoplankton, nutrients and red tides in the Gulf of Maine.

"We know that their shapes have consequences, but we don't know how and what. They are nature's art and design, but we don't understand their function. In design, shape has a function, and that's our working hypothesis here, too." Pete Jumars

Turbulent lives



Mixed phytoplankton
A sample from the Gulf of Maine containing a mixture of species, mostly diatoms.



Diatom chains
Two different diameter chains, along with a *Ceratium*.

Until recently, most marine research in this area has focused on the size of the single-celled organisms, investigating the difference that dimensions make in the lives of the many different phytoplankton species. But marine scientists at the University of Maine are exploring the role of cell shape in phytoplankton ecology, hoping to better understand how the diversity affects function.

With a more than $520,000, four-year National Science Foundation grant, UMaine biological oceanographers Pete Jumars and Lee Karp-Boss are studying the effects of turbulence on the base of the marine food web. Ultimately, their findings could help address growing concern about how global warming affects phytoplankton.

Climatic warming is expected to decrease turbulent stirring of waters globally, on average, through increased ocean stratification, yet increase turbulence locally and temporarily through more severe weather events, thereby impacting production in the food chain.

The NSF award also has a mathematical geosciences component, with a $471,000 grant to Tulane University computational mathematician Lisa Fauci, who will develop numerical models to complement the UMaine research.

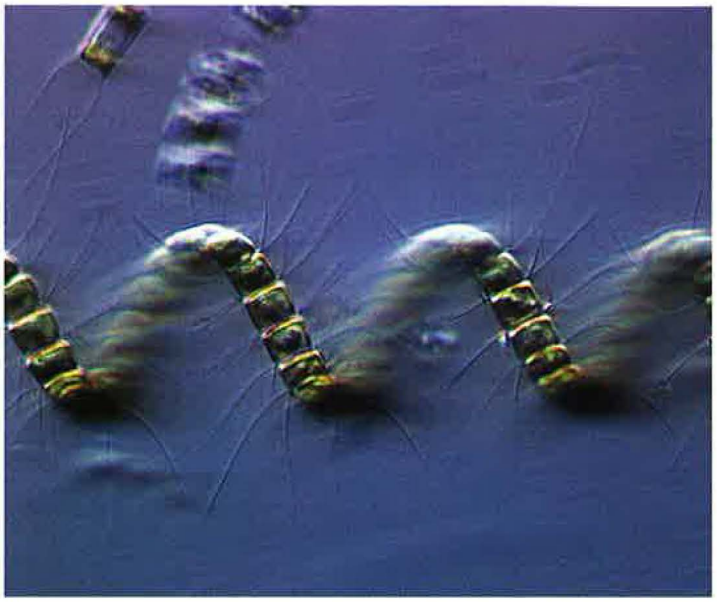
"It is not enough to know how much phytoplankton is there in terms of biomass," says Karp-Boss, a phytoplankton ecologist who studies the organisms in functional groups characterized by cell size and morphology — the important physical traits that affect many of their functions. In her research, she looks at the effects of turbulent flows on the many species' forms, such as small versus large cells; single cells versus chains; rigid versus flexible chains; species with spines versus those without.

"It's important to know — and be able to predict — who is there," Karp-Boss says, "because the structure and function of aquatic food webs and fluxes of organic carbon from the ocean surface to the deep ocean depend on the taxonomic composition of phytoplankton."

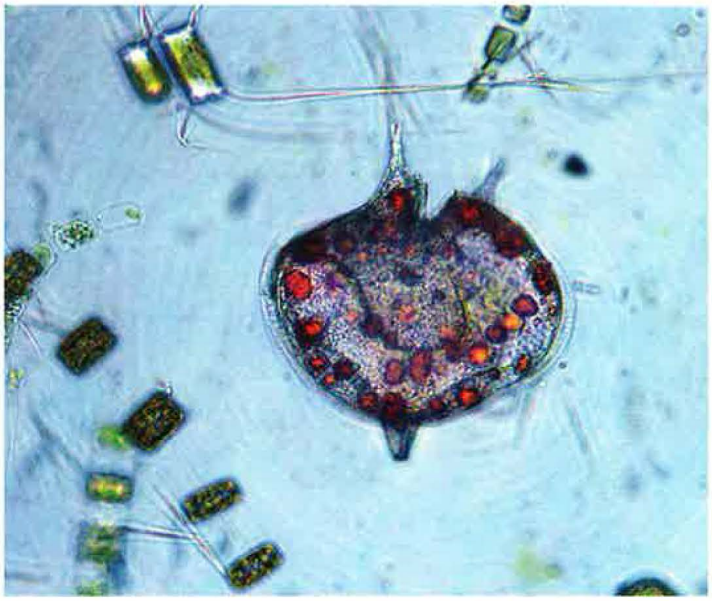
THE UMAINE RESEARCHERS are trying to close the gap between textbook understanding of turbulent flows and the consequences for suspended organisms and particles. That includes better understanding of how turbulent stirring affects phytoplankton processes.

Phytoplankton are often modeled as spheres, but that is not the prevailing form across the spectrum of cell sizes. Their varied shapes are thought to affect many aspects of phytoplankton ecology and physiology. That's why a synthesis of the relative effect of shape on all of these functions is essential for realizing the selective pressures on phytoplankton.

The understanding of such a small world that has big implications for life on this planet begins with an investigation of the physical constraints that dictate how the organisms interact with their environment and each other. The question is how the sizes and shapes of phytoplankton affect their performance, and what are the consequences of their structure on the community and next trophic levels.



Chaetoceros
A chain-forming diatom.



Dinoflagellate
With diatom chains on the periphery.

"The big question is: What processes affect distribution and species composition of phytoplankton? We don't have a good mechanistic understanding of the processes that select for certain species. Hence, our ability to predict who (what species) will be there and when is limited." Lee Karp-Boss

In their search for answers, Karp-Boss and Jumars are incorporating experimental flow models, the physics of molecular diffusion, fluid dynamics, oceanography, particle mechanics, computer science and mathematical biology. Their goal is to develop new numerical and analog models, incorporating current understanding of small-scale structure and its evolution in natural turbulence, and the little-understood role of vorticity (swirling, as in a vortex). The models will be used to predict and test mechanisms of flow effects on phytoplankton cell motions and their consequences.

Such models may one day help scientists understand how the diverse shapes of one phytoplankton species provide an advantage over another in the varied mixing environments of the seas.

"Different phytoplankton, including diatoms of different sizes, take in nutrients at different rates. The function is determined by size and shape — morphology," says Jumars, director of the UMaine School of Marine Sciences. "When interacting with turbulence, some are not as beneficial. A fundamental question has to do with the limitations and what we can infer about species that have an advantage under certain conditions."

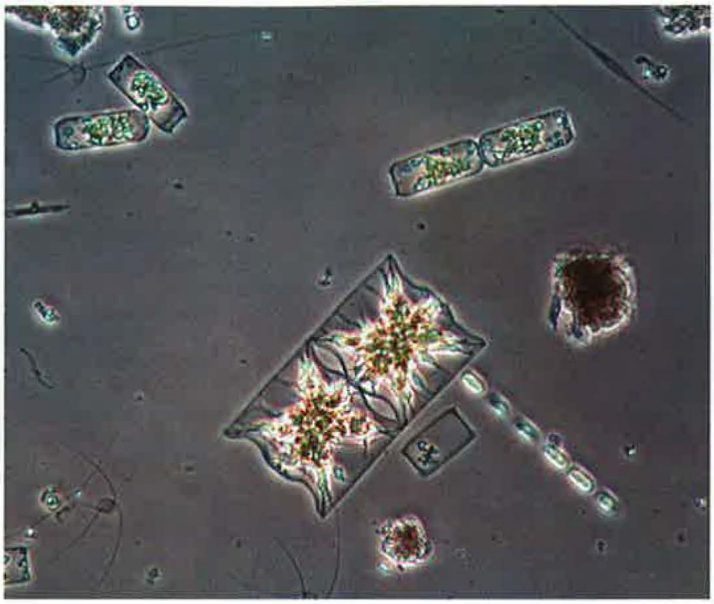
Jumars has been studying effects of fluid and particle dynamics on organisms for 40 years; Karp-Boss has been collaborating with him for more than a decade. In 1998, Jumars and Karp-Boss published research on the behaviors of two chain-forming phytoplankton species in a simple shear flow — the first step, they said, toward understanding the behavior of real phytoplankton in natural flows.

The observed diverse behaviors implied that fluxes of nutrients and collision frequencies vary greatly with detailed shapes and mechanical properties of chains and their unit cells. However, their research raised more questions than it answered, they said.

"We know diatoms (one of the three large groups of phytoplankton, along with dinoflagellates and coccolithophorids) need light and nutrients to grow and divide, they

Turbulent lives

Coscinodiscus
In the process of division.



Mixed phytoplankton
A sample from the Gulf of Maine containing different species of diatoms, including *Eucampia*.

need to avoid being preyed upon and, as part of their sexual phase, they have to find a mate," says Karp-Boss. "We need to understand how they perform these functions in a world that is not intuitive to the one that we live in. What are the constraints of environment in performing these functions?"

THE WATERY WORLD in which phytoplankton live has been described as being the consistency of honey or molasses for organisms that are so small and slow. It is a world in which the organisms' movement, ability to flex (in the case of chains), reproduce, eat, escape predation and, ultimately, sink to the sea floor are dependent on the turbulence of their environment.

Most phytoplankton live in a world of low Reynolds numbers, where motion stops as soon as propulsion stops, and the dominant force is friction from the stickiness of water molecules to each other.

Low Reynolds number worlds defy our intuition. For instance, if a semi passes a car in an adjacent lane of the highway, passengers in the smaller vehicle will feel the pull of the wind. But if that truck passes two lanes away, the rush of the wind is indistinguishable. For life at low Reynolds numbers, a diatom or particle experiences substantial fluid motion 100 lanes away, and even more car lengths ahead and behind.

"If you drop a particle and it falls through stagnant water, the object drags substantial volumes of water with it. That's not what happens at high Reynolds number," says Jumars. "That's why it's important to learn how forces are transmitted through such a continuous medium."

Jumars and Karp-Boss are testing the hypothesis that diffusing momentum and vorticity on the dissipation scales of turbulence are major contributors to relative motion between water and phytoplankton.

"We know that global warming is going to stabilize the ocean by decreasing the turbulence intensity," Jumars says. "Understanding what that means to the base of the food web is critical. A signature of climate change is more intense storms at certain places and times. We also have to understand the other extreme."

Better understanding of biological fluid dynamics will provide insight into the fundamental physics — including motion and behavior of nonspherical shapes — of phytoplankton and other complex particles in turbulent environments.

"The big question is: What processes affect distribution and species composition of phytoplankton?" says Karp-Boss. "We don't have a good mechanistic understanding of the processes that select for certain species. Hence, our ability to predict who will be there and when is limited."

The morphological diversity of diatoms in the world is screaming to tell us something, but we don't yet know what it is, Jumars says.

"We know that their shapes have consequences, but we don't know how and what," says Jumars. "They are nature's art and design, but we don't understand their function. In design, shape has a function, and that's our working hypothesis here, too." ▮

Photos that Make Cents

THE BLACK AND WHITE PHOTOGRAPHS that University of Maine civil engineering undergraduate Sara Fortin takes may be grainy and the subjects — campus buildings — sometimes barely recognizable, but the information she's gathering is keeping money from slipping through the cracks.

Using a thermal imaging camera, Fortin is able to see where heat is leaking from the 200 buildings on campus. White radiating from a building means heat loss; black represents cold.

"I'm really interested in green technology, energy efficiency and the environmental aspects of civil engineering," says Fortin, who took the suggestion of her brother, a recent UMaine physics graduate, and asked physics professor Tom Hess if he had any projects for her work-study job.

Fortin, who is from Madawaska, Maine, hopes to use this energy auditing experience to get a job in a similar field when she graduates.

"The university has a lot of places where we can save energy, and we were thinking of some ways to measure where the worst heat leaks are on campus," Hess says.

Sara Fortin uses a laptop and a thermal imaging camera on a pistol-grip tripod to collect images that show where heat is being lost from campus buildings.

The thermal imaging camera records video of the buildings, which Fortin then uses to capture still snapshots that show where heat loss occurs. Fortin's data will be made available to UMaine Facilities Management for planning purposes.

"We pretty much are just looking at the windows and foundation where heat's coming through," she says. "I focus mainly on the windows, because that's something that's easily fixed by installing newer windows, adding storm windows, putting up plastic or caulking."

Fortin has found that newer campus buildings are reasonably efficient, but some older facilities could use more roof insulation and window upgrades.

Saving SPUDS

THE RESULTS ARE IN. Maine potato farmers saved an estimated $17 million of their 2008 crop from potential threats such as late blight with help from the University of Maine Cooperative Extension Potato Integrated Pest Management (IPM) Program.

"We identified weather conditions that were extremely conducive for the development of potato late blight," UMaine Cooperative Extension Executive Director John Rebar says. "This information, coupled with the field surveys conducted by our IPM scouts, resulted in the potato industry being much better informed about how high the potential was for a serious outbreak of potato late blight."

Potato late blight is a fungal disease that can be devastating to potatoes and also can affect tomatoes. It can damage stored tubers when secondary infection by soft rot bacteria spreads. Until stocks stored farther down in the pile are reached and inspected, months after harvest, it's difficult to tell if late blight successfully was conquered.

"Wet, cool conditions such as those experienced during summer 2008 created an ideal environment for the spread of the disease," says James Dwyer, a UMaine Extension crops specialist.

Potatoes are the top agricultural commodity in Maine, where nearly 60,000 acres are devoted to the crop that has a total economic value of more than $500 million and employs about 6,000 people.

Since 1977, UMaine Cooperative Extension's Potato Integrated Pest Management Program has worked closely with growers and processors to maximize the value of the crop and protect the industry from damage due to disease and predation from insects and other pests.

"We coordinate a statewide network of electronic weather stations, and survey 100 potato fields on a weekly basis for weeds, insects and diseases," says Jim Dill, a UMaine Extension professor and pest management specialist. "The resulting data helps our IPM scientists track potential pest outbreaks and provide growers with current information on specific and timely treatments in order to minimize pesticide applications and maximize potato yield."

The information from the field scouting and electronic weather stations is entered into a Pest Management Hotline, a voice mail system operating on a toll-free telephone line. Clients have access to the information 24 hours a day, seven days a week.

During the growing season, information on the Pest Management Hotline is updated twice weekly; more frequently if conditions warrant. From June 15 to Sept. 15 last year, the hotline received 2,088 calls. Potato growers also access weekly pest alerts on the Web during the cropping season. The site containing information about insects and diseases, fact sheets and field guides received almost 250,000 hits last year.

Comments from growers, as well as surveys conducted in previous years, indicated two to four applications of fungicide were saved per grower per year, says Steve Johnson, a UMaine Extension crops specialist. "This was directly as a result of the information and recommendations provided by the hotline," he says.

Of the respondents, 95 percent reported saving money by reducing pesticide applications.

This year, UMaine Cooperative Extension and its Canadian counterparts will work closely, hoping to further minimize potato late blight.

Agents of change

Peru's southern coast features steep, barren terrain, often shrouded in dense fog. Up until 600 years ago, the coastal hills and nearby canyon, Quebrada Chololo, were agricultural sites. It would be easy to blame local smelter plants for the subsequent desertification, says University of Maine anthropologist Gregory Zaro. But the reality is such a process usually has human and nonhuman causes. Photos courtesy of Gregory Zaro

UMaine anthropologist studies the roles humans and climate play in transforming Peru's coast

By Kristen Andresen

DURING THE AUSTRAL winter months, a veil of gray mist shrouds the coast between the Tambo and Ilo rivers in southern Peru, but the soil is a crumbly, faded brown year-round. The few plants that can survive in such harsh conditions are scraggly and wind-whipped. Though the trees are long gone, stumps jut out of the hillsides like half-exhumed skeletons.

It looks like the scene of a post-apocalyptic Hollywood drama, and it is, in many ways, a dead landscape. But it hasn't always been this way. The remains of stone-faced terraces and ditchlike irrigation canals are evidence of the area's agricultural past. Today, however, a few lonely farms remain.

Nearby, one of the world's largest industrial copper smelters has sent plumes of sulfur dioxide into the air since the 1960s, before significantly cutting back its emissions just a few years ago. At first glance, it would be easy to blame the region's rapid desertification on the smelter. But Gregory Zaro, an assistant professor of anthropology and climate change at the University of Maine, sees things a little differently.

"If you were to make a quick judgment, you could say, 'Look at that smelter. That's the reason.' But the smelter is coming in very late, at the tail end of a process that took five or six centuries," says Zaro, who is one of a handful of researchers in the world studying this region of Peru. "Desertification as a process often includes both human and nonhuman drivers. Human agents most often stem from agricultural mismanagement, overgrazing, deforestation and industrial activity. Each of these has been present at some point in this study region over the past 600–800

years, and often overlapping. What I can do is use desertification as a measuring stick to gauge how the landscape has changed and what role we have in that change."

Did centuries-old agricultural practices deplete or enhance the soil? Did deforestation and overgrazing catalyze desertification of southern Peru's inland hills? Was past or recent desertification a slow or rapid process, either in the ancient past or more recently?

While not the only way humans impact the environment, agriculture is of particular interest to Zaro because it involves deliberate manipulation of the landscape, with intentional and unintentional consequences. Looking at climate change from an archaeological perspective allows Zaro and his colleagues to better understand the way human activities have shaped the environment — and, equally important, how they have not.

"We're beginning to understand how humans have had an impact on the environment deep into the past," Zaro says. "It really questions what benchmarks we set over 'natural' environments. What we're inheriting today are environments people have manipulated for thousands of years."

ZARO BECAME HOOKED ON anthropology, archaeology and Spanish as a teenager, when his father took him to Peru. While working on his master's degree at the University of Chicago, he spent time on the northern coast of Peru, a hotbed of archeological research.

"We can't only think about life within our political borders. We need to start thinking about humanity as very interconnected, both spatially and historically. Climate change doesn't know these boundaries."

Gregory Zaro

His Ph.D. work at the University of New Mexico led him south. Because the southern Peruvian coast is less extensively studied, thus less crowded, it allowed him to work more closely with his advisers, who had spent time researching in the area earlier in their careers.

"As a student down there, I saw a real opportunity to understand a very unknown area," Zaro says.

As a professor, he continues to see that opportunity. The Cola de Zorro site has been marginalized on both a community and, he argues, a scholarly level. He researches from the perspective of historical ecology, which views the evolution of landscapes as the result of the interplay between human and nonhuman processes. And this abandoned farming area was ripe for exploration.

"This whole coastline was very different 500 years ago than it is today," Zaro says. "I would love to be transported back in time just to see what this place looked like in its heyday."

Though not the same as a time machine, anthropology, geology, soil chemistry, paleoethnobotany, and zooarchaeology combine to provide a historical view of land use on the site. Individually, these research areas are pieces of the overall climate change puzzle. Together, they may not entirely solve the puzzle, but they offer a much more detailed record of what happened.

By teasing apart different events — light and intensive farming; the building of homes, cemeteries and terraces; industrialization; and the desiccation of the landscape — and when they occurred, Zaro and his colleagues can begin to understand what role humans have played in long-term environmental change.

"Geologically speaking, humans are late arrivals on the planet," Zaro says. "To put humans in the context of continuous change, there were billions of years of change without us. When we talk about sustainability, what we really need to think about is how we can successfully manage change."

THE WAYS IN WHICH people managed change in a specific region — Cola de Zorro and its neighboring coastline — can have important implications when viewed as part of a larger phenomenon. Nearly a third of the world's land is arid or semi-arid. Will this percentage increase? Has it always been this way? What factors cause

Agricultural terraces at the archaeological site of Cola de Zorro, constructed around A.D. 1200, abandoned sometime before A.D. 1600.

deserts to expand or shrink? And what does this mean for the world?

"The big question of climate change, and part of what I see missing still, is that articulation between the local, regional and global," says Zaro. "Synergistically, the local and regional impact humans have on landscapes ultimately affects climate as well. These things add up, but we can't understand how these things add up until we start looking at the local and the regional level."

Zaro's previous research at Wawakiki Spring, 20 kilometers from Cola de Zorro, found that from A.D. 1200–1400, inhabitants responded to a growing population and shrinking agricultural yields by diversifying their production and moving into a less populated intervalley area. His continued work along the coast at sites such as Cola de Zorro is beginning to demonstrate a highly engineered landscape six to eight centuries ago, complete with intensive stone-faced agricultural terraces, lengthy irrigation canals, farmsteads and coastal villages that exploited one of the world's richest fisheries.

At UMaine, Zaro is collaborating with Stephen Norton of the Climate Change Institute and soil chemist Susan Erich to analyze samples from last summer's fieldwork. By comparing and contrasting the findings from sites such as Wawakiki and Cola de Zorro, a more complete anthropogenic portrait of the region will emerge. Zaro hopes his approach will contribute to the ongoing debate regarding global change, and the role humans — past and present — potentially play.

"People need to start thinking globally," Zaro says. "We can't only think about life within our political borders. We need to start thinking about humanity as very interconnected, both spatially and historically. Climate change doesn't know these boundaries. What happens in our area affects differentially, perhaps adversely, what happens in another area." ▮

UMaine undergraduate Laura Labbe spent last summer conducting fieldwork on the southern coast of Peru.

Pieces of the bigger picture

UNTIL LAST SUMMER, Laura Labbe's idea of what it meant to be an archaeologist could be summed up in two words: Indiana Jones.

That all changed when Labbe, a University of Maine junior from Biddeford, Maine, had the opportunity to research human-induced desertification in southern Peru. She spent a month working alongside anthropology professor Gregory Zaro and his colleagues from State University of New York – New Paltz.

"It was unlike anything I could get in the classroom," says Labbe, who received a grant from the Department of Anthropology's Getty Archaeological Study Fund for her work. "It was a really great learning experience. I got to experience what it's like to be an archaeologist."

Instead of raiding lost arks, Labbe's work involved a lot of hiking up steep coastal hills and scooping up sediment with plastic utensils. She has spent the academic year analyzing the soil and water samples that she and Zaro collected.

The fieldwork wasn't glamorous, but Zaro says such experience is invaluable, especially for undergraduate students motivated to learn.

"Fieldwork has grueling moments, but when you can tie that into the bigger process, that's when it becomes interesting," Zaro says.

Zaro's own interest was sparked during a field school in Belize that he attended before graduate school. Though he had always been interested in archaeology and anthropology, the hands-on research "matured me a great deal and it really injected me with a passion for my own work and working with others." He encourages his own students to pursue such opportunities.

"Whether Laura or any other student continues along, I want it to slingshot them into a world where they can explore learning outside the classroom," Zaro says. "I want them to make connections and find meaning between these worlds of anthropology, climate science and the classroom."

First star I hear tonight

THERE'S MORE to the sky than meets the eye. That's why students at the University of Maine want to listen to the stars and planets.

With the installation of a radio frequency monitoring station on the roof of UMaine's Bennett Hall, the students hope to eavesdrop on the clicks and beeps common to radio astronomy — a field they haven't experienced hands-on because of a lack of equipment.

"The textbooks all mention other radio observatories, but you just see pictures of them in the book," says engineering physics junior Seth Bolduc of Norridgewock, Maine. "This will be something you can see."

Seeing radio astronomy come to UMaine was a dream of Paul Smitherman, a graduate student in the Department of Spatial Information Science and Engineering. A few years ago, Smitherman purchased an old-style satellite dish, followed by a receiver from a radio astronomy supply company. And he began tinkering.

Christopher Miller, left, a junior in engineering physics from Penobscot, Maine, and physics seniors Aaron Tanenbaum of Orono, Maine, and Alexander De Carlo of Bangor, Maine, prepare the equipment for the radio astronomy station installation on the roof of Bennett Hall.

"I put it all together and did some experiments, but then it kind of got away from me for a year or so," Smitherman says.

At the time, he was living in an area that didn't allow residents to get satellite TV. When a member of the housing office knocked on Smitherman's door to inquire about the dish, he admitted he was "picking up waves from the stars."

"Everybody thought I was crazy," Smitherman says. He dismantled the dish and stored it behind his rental property until it could find a new, permanent home.

With help from Smitherman and some funding from the College of Engineering, Student Government, and the Department of Physics and Astronomy, members of UMaine's Society of Physics Students began retrofitting the satellite dish for the radio frequency monitoring station.

The students also raised money for an amplifier and other accessories, created a metal stand to support the satellite dish on the roof, and searched for archaic satellite dish parts.

When they came up empty-handed for some pieces, the students replicated them from old photographs.

The satellite dish and amplifier installed this spring will be able to record sounds from the sky to a computer inside the building.

At first, the satellite dish will remain stationary and students will use the Earth's rotation to collect data at different places in the sky, says Bolduc, who also is treasurer of the Society of Physics Students.

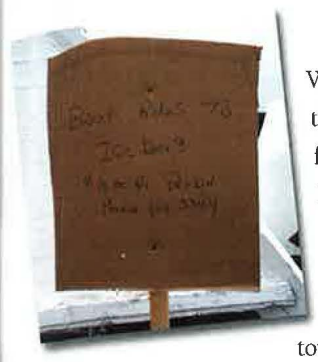
Eventually, the satellite dish will rotate using a motor that will be controlled from the computer inside the building.

"Students at the university will have a really unique experience," Bolduc says. "It also will augment the opportunities for senior projects."

For Smitherman, it's a dream come true to see the project reaching completion.

"It's exciting," he says. "You can learn a lot of physics by doing it."

Tapping heritage tourism



WHEN YOU THINK of all the tourist destinations in the world, postcard views, delicious food and wildly good times come to mind. But in Newfoundland, one town has turned its root cellars — a vestige of the region's hardscrabble past — into a drawing card for visitors. It is one of many heritage-based tourism efforts in Newfoundland that could be relevant to Maine's coastal towns.

Natalie Springuel, a member of the University of Maine Marine Extension Team, spent six months in the Canadian province researching the rise of tourism in the wake of the cod fishery collapse and subsequent cod moratorium of 1992. For 500 years, cod had been the province's major industry, and when the fishery dried up, tens of thousands of Newfoundlanders were out of work.

"What can we in Maine learn from Newfoundland?" asks Springuel, who is based at the College of the Atlantic in Bar Harbor, Maine. "In Newfoundland, tourism is a really important part of their economic revitalization approach."

Members of the UMaine Marine Extension Team, a collaboration of Maine Sea Grant and University of Maine Cooperative Extension, live and work along the coast, providing Maine citizens educational and applied research programs in coastal community development, ecosystem health, fisheries and aquaculture.

Springuel's outreach includes working with tour operators, guides, naturalists, those in sustainable tourism and fishermen, to name a few. Though she plans to write a book based on her research in Newfoundland, some of her findings have immediate and practical resonance for Down East towns.

Maine's economy is already diverse, and unlike Newfoundland's, it has been for centuries. But there are many parallels between the two regions, and those parallels — a dramatic coastline, a relatively pristine rural setting and an authentic heritage of working the sea — are central to tourism efforts on both sides of the border.

"What's interesting is that as tourism is really emerging, there are some beautiful models," Springuel says. "When you look at the real success stories, it's tourism that highlights that maritime heritage."

"So many people I met are really looking to tourism to help them diversify their local economies."

Natalie Springuel

Ironically, those success stories often rise from unpleasant events and circumstances in province history. For instance, root cellars were a necessity for year-round sustenance on the island. Today, Elliston calls itself the root cellar capital of the world with 150 of them. Springuel found exhibits based on an ill-fated seal hunting expedition and successful tours to outlying ports that were abandoned, ghost-town style, when the government closed entire communities in a cost-saving effort to centralize services.

"Newfoundlanders figured out how to turn hardship into a compelling thing that the public wants to learn about," she says.

Springuel's research, conducted as an "experiential tourist," included interviews, travel and dialogue with locals, visitors and those working in the tourism industry. She found the greatest successes came when residents weren't just supportive, but active and invested.

Photos courtesy of Natalie Springuel

Preventable childhood illness

A NEW STUDY by a University of Maine economist estimates the cost of preventable, environmentally related childhood illnesses in Maine — including lead poisoning, asthma, childhood cancer and neurobehavioral disorders — totals $380.9 million annually.

Environmental economist Mary Davis says her study presents a conservative assessment of the damaging effects of childhood diseases and the costs of caring for these children. A report on her study, *An Economic Cost Assessment of Environmentally Related Childhood Diseases in Maine*, also estimates the potential reduction in lifetime income and educational opportunity for children permanently afflicted by diseases.

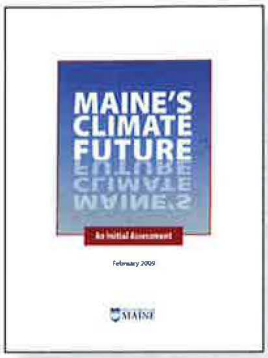
"It is important to note that the economic costs outlined in this report represent preventable childhood illnesses, and, as such, could be fully avoided if environmental exposures in children were eliminated," Davis wrote in her report.

Davis, an adjunct faculty member in UMaine's School of Economics, says she conducted her research independently because of her interest in children's health issues and the plethora of environmental initiatives expected to surface in the Maine legislature as a result of LD 2048, An Act To Protect Children's Health and the Environment from Toxic Chemicals in Toys and Children's Products, which passed last year. The bill requires Maine to adopt a list of priority chemicals of high concern, forces manufacturers to disclose the toxic chemicals they add to products, and authorizes the state to require safer alternatives.

The report is "directly relevant to the state's investment in the process that the new law has set into motion," Davis says.

experts on topic

Climate Change



AN ANALYSIS of the state's future in the context of changing climate in the 21st century is the focus of a recently released, 70-page report, *Maine's Climate Future: An Initial Assessment.* Requested by Gov. John Baldacci in 2007, the analysis was led by the University of Maine's Climate Change Institute, with support from Maine Sea Grant and several UMaine academic departments. It considers past climate change, recent evidence of accelerated rates of change, and the implications of continued change in Maine as a result of greenhouse gas emissions and associated pollutants. The report stresses the need for Maine to have a plan for adaptation. It also highlights opportunities for the state to benefit from a changing climate, and identifies gaps in the information needed for a positive transition. A PDF of the report is online:
climatechange.umaine.edu/mainesclimatefuture/

They Would Not Take Me There

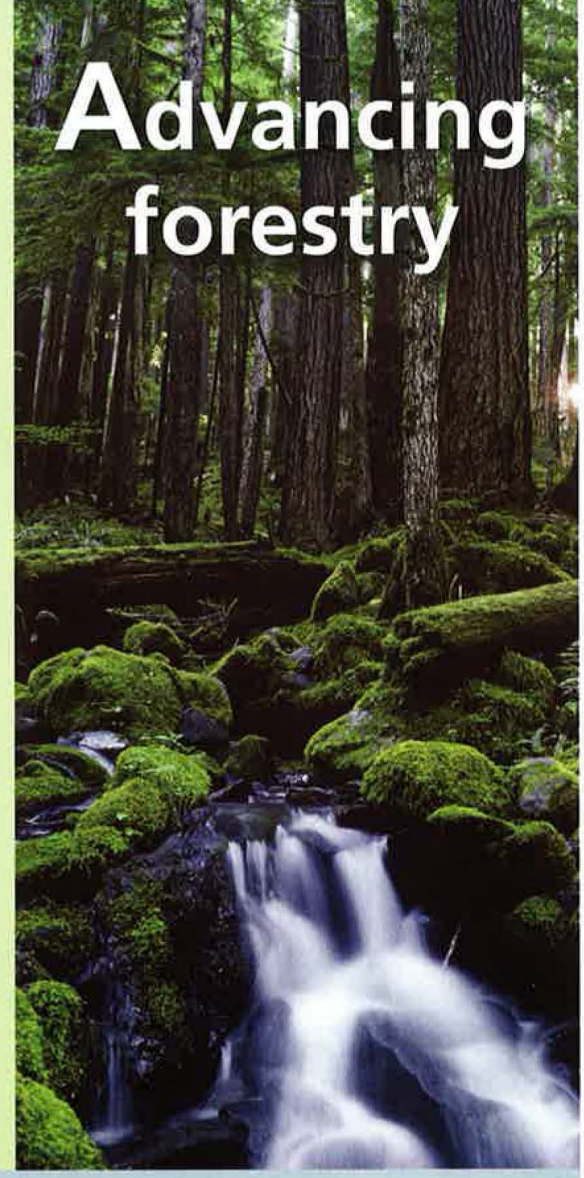
TO COMMEMORATE the 400th anniversaries of French explorer Samuel Champlain's founding of Québec and naming of Lake Champlain, the Canadian American Center at the University of Maine released a new narrative map detailing the 13 years the 17th-century cartographer traveled throughout the St. Lawrence River valley in search of the elusive Northwest Passage.

The nearly 40-inch by 60-inch bilingual map, titled "They Would Not Take Me There: People, Places, and Stories from Champlain's Travels in Canada, 1603-1616," was developed by Michael Hermann, senior cartographer at the Canadian American Center, and Margaret Pearce, assistant professor of geography at Ohio University. UMaine professor of French Raymond Pelletier, associate director of the Canadian American Center, provided translation.

The map, which is based on Champlain's published journals, features excerpts written by the adventurer, indigenous place names and extensive narrative details of the five locations where Champlain spent long periods of time — Tadoussac, Québec, Montréal, Morrison Island and the Penetanguishene Peninsula.

This spring, the map won a third place national award in the thematic category in the Cartography and Geographic Information Society's 36th Annual Map Design Competition.

Advancing forestry



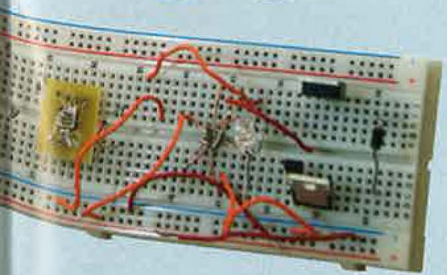
THE UNIVERSITY of Maine has received a $350,000 grant to join the National Science Foundation's Center for Advanced Forestry Systems (CAFS), an effort by seven universities to help the forest industry in Maine and across the nation address important issues facing forest managers.

CAFS membership will provide funding for UMaine graduate student research. It also will link UMaine researchers and the Maine forest industry at the national level to cooperatively find solutions to common problems.

UMaine will focus on improving computer models used to predict the future growth and development of Maine's forests. Models can predict future wood supplies that support traditional forest products, as well as emerging markets for bioenergy and bioproducts.

"UMaine will bring a unique approach to this national research because its focus and expertise has been on naturally regenerated forests with many tree species, while other universities in CAFS have been focused on plantation forests of single species," says Robert Wagner, director of UMaine's School of Forest Resources.

The goal of the CANEUS Fly-by-Wireless Sector Consortium is to minimize cables and connectors in the aerospace industry by providing reliable, lower-cost, higher-performance alternatives for a vehicle or program.

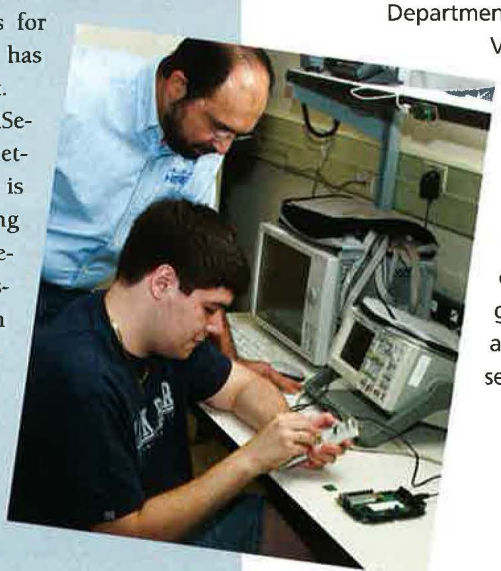


Flying wireless

THE CANEUS FLY-BY-WIRELESS Sector Consortium, part of an international nonprofit organization that serves the aeronautics, space and defense communities, has tapped University of Maine Assistant Professor of Electrical and Computer Engineering Ali Abedi to help them pull the plug.

No, it's not closing down. The consortium is powering up to create wireless micro and nano technologies for aerospace applications, and has named Abedi to lead the effort.

Abedi directs UMaine's WiSe-Net Lab for wireless sensor network research. Currently, he is working on a novel coding scheme for a battery-free wireless sensor communication system that he says can perform in harsh environments where the battery-powered sensors now used in NASA's space shuttle cannot function.



Picture this

A WEB-BASED photo gallery is one of the latest teaching tools in the field of animal science.

The gallery now includes more than 1,700 images in a dozen categories of animal husbandry ranging from beef cattle to sheep and goats. It is designed to aid in college-level courses, as well as Cooperative Extension outreach.

The Animal Science Image Gallery (anscigallery.nal.usda.gov) was established in 2003 by the Animal Science Education Consortium and the National Agricultural Library with the help of a more than $200,000 USDA Higher Education Program Challenge Grant. Since 2007, the American Society of Animal Science has provided oversight of the peer-reviewed submissions of photos, animals and video to assist in animal science teaching and learning.

Department of Animal and Veterinary Sciences Chairperson Martin Stokes, a member of the Animal Science Education Consortium, helped establish the gallery and serves as editor for the section on nutrition.

Local long stems

A BOUQUET of cut flowers can say so much, so beautifully. And now with help from University of Maine Cooperative Extension researchers and Master Gardeners, farmers in the state are able to convey those messages — and more.

For the past five years, Barbara Murphy of Oxford County Extension has studied the economic viability, necessary growing conditions and best varieties for Maine farmers interested in cultivating cut flowers. In 2007, she was joined by Gleason Gray of Penobscot County Extension.

"Research has shown the crop has tremendous potential; there's a high dollar-per-square-foot return," Murphy says. "It's a crop many growers can do to complement their other crops."

Early trials demonstrated the benefits of growing flowers in hoop houses to extend Maine's growing season. Also piloted was a solar energy collection system for warming the soil.

Now Murphy and Gray are branching out into vegetables with research comparing greenhouse- and field-grown varieties.

Reflections of climate change

SOME OF THE MOST dramatic evidence of climate change today is found in the planet's lakes and reservoirs, according to three researchers from Miami University, the University of Maine and University of Alberta – Edmonton, writing in a February issue of *Science* magazine.

These inland waters that are important regulators in the global carbon cycle are among the natural resources threatened by climate change. As sentinels, they already are showing signs of decreased biodiversity and water quality.

The three researchers — Craig Williamson, Jasmine Saros and David Schindler — suggest that global lake observatory networks are needed, in addition to ongoing research to tap the clues found in freshwater sediments about the effects and mechanisms of climate change over time.

"The outlook for lakes and reservoirs and the ecosystem services that they provide is bleak," wrote the scientists. "Yet records from these inland waters may provide the insights necessary to address the dual challenges of climate change and increased human domination and their effects on lakes and the larger landscape."

How green is the gulf?

CALCULATING THE AMOUNT of chlorophyll in the Gulf of Maine is the focus of research by University of Maine doctoral candidate Michael Sauer.

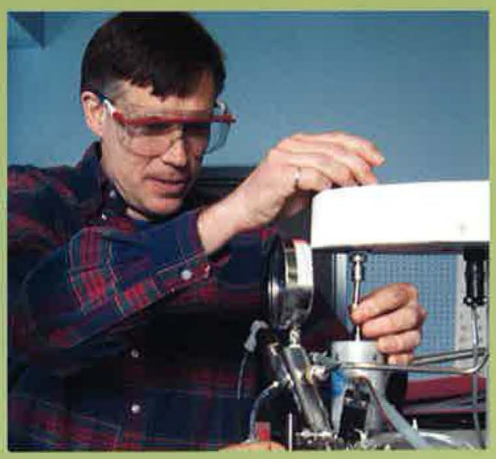
Sauer, who is based at UMaine's Darling Marine Center in Walpole, Maine, has received a $30,000 NASA Earth and Space Science Fellowship to create a more accurate calculation of the amount of chlorophyll in the water. He is using optical equipment, sensors and data from Gulf of Maine Ocean Observing System (GoMOOS) buoys to compile information about temperature, salinity and light absorption in the water column.

Algorithms used for NASA satellite chlorophyll imagery are based on the open ocean, where phytoplankton is the primary ocean color source. However, the current method of measuring chlorophyll from satellite images can't discern it from colored, dissolved organic matter (clear, yellowish-brown river water). Misinterpreting the color of the ocean results in misunderstanding the health of the ocean ecosystem.

Sauer was one of two UMaine graduate students to receive NASA fellowships last year. Oceanography doctoral candidate Margaret Estapa is studying the release of carbon from mud delivered from the Mississippi River to areas along the Gulf Coast.

"UMaine is the perfect place for biofuel research because of the state's abundant natural resources. This new product could change the way we fuel our lives."

Peter van Walsum
Associate Professor of Chemical and Biological Engineering



With a three-year, $712,000 award from the U.S. Department of Energy, University of Maine chemical engineers Peter van Walsum, left, and Clay Wheeler are conducting research to convert pulp mill and marine algae processing plant by-products into high-quality biofuel. Hardwood extract from the kraft pulping process and seaweed by-products from the extraction of carrageenan, a natural food additive, will be fermented into organic acids, such as acetic and butyric. The acids then will be chemically upgraded into fuel alcohols, such as ethanol and butanol. Industrial collaborators in the project include Old Town Fuel and Fiber, a nearby kraft pulp mill in Old Town, Maine, and FMC BioPolymer in Rockland, Maine, the only seaweed carrageenan manufacturer in North America. *Chondrus crispus,* the seaweed known as Irish moss, is a source of carrageenan.

Photos by Linda Healy and Michael Mardosa

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alternate plans

IN THE PAST DECADE, more and more University of Maine students have applied for the opportunity to experience Alternative Spring Break.

What started with 20 students and UMaine community members traveling to South Carolina to spend a week repairing homes of low-income families has grown to a contingent of more than 92 volunteers who this year headed to seven locations nationwide and one international destination.

In March, volunteers worked with the Gesundheit Institute in West Virginia; Plateau Restoration in Utah; Florida Trail Association; Boys & Girls Clubs of Northeast Florida; the Nature Conservancy in Georgia; and Habitat for Humanity and Community Collaborations (Hurricane Ike relief), both in Texas. In May, students and an adviser are scheduled to work with International Volunteer HQ in Cusco, Peru.

The Alternative Spring Break Endowment Fund was established in the **University of Maine Foundation** in 2008. Income from the fund supports Alternative Spring Break functions and trips.

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