

UMaine Today

CREATIVITY AND ACHIEVEMENT AT THE UNIVERSITY OF MAINE

SPRING/SUMMER 2016

Michael Lewis

Landscape as language



University of Maine softball players cheer for Janelle Bouchard (20) after she crushed a home run in the team's 14-1 win over host Albany in the America East Championship. The title gave the Black Bears a berth in the NCAA Division I Regional at Athens, Georgia, where they lost to the No. 16 host Bulldogs and to Oklahoma State. This was UMaine's third NCAA Regional appearance since the softball program was instituted in 1979. The league champion Black Bears (28-21) also fielded a number of individual league honors. Bouchard, a catcher from Kennebunk, Maine and the squad's lone senior, was Player of the Year. Erin Bogdanovich of South Portland, Maine was Pitcher of Year and the tournament Most Outstanding Player, and Alyssa Derrick of Coventry, Rhode Island was Rookie of the Year. Bouchard and Bogdanovich also were National Fastpitch Coaches Association All-Northeast Region Third Team selections.

Photo courtesy of Dave Williams, Beyond the Print



IN APRIL, a daylong University of Maine symposium highlighted the research, scholarship and creative achievement of more than 500 undergraduate and graduate students. Participants in the 2016 UMaine Student Research Symposium, organized by Graduate Student Government and the Center for Undergraduate Research, presented their work and engaged in dialogue with people from Maine communities, including those benefiting from the research.

Opportunities like these for undergraduate and graduate students are among the important distinctions of the University of Maine. UMaine's world-class faculty and their graduate students lead scientific and technological discovery, scholarship and creative achievement. These researchers also mentor undergraduates who, in turn, make their own significant contributions.

Students and their faculty mentors are essential to public research universities fulfilling their roles in helping to shape a better world. At UMaine, our founding came with a mandated mission of statewide engagement. That means our footprint is the entire state — border to border.

As the state's only public research university, we turn knowledge into solutions for the public good, and ask what the state needs and how we can help. We prioritize what we do to meet those needs statewide, ensuring that engagement — connecting to and partnering with enterprises across Maine — is front and center.

This level of engagement is no small measure of how our students will go on and define tomorrow.

Stories about our high-caliber engagement and the difference it makes are found in this issue of *UMaine Today* magazine.

Susan J. Hunter, Ph.D.
President



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By Michael Lewis

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Great works

IN APRIL, sculptor Andreas von Huene of Woolwich, Maine spent a week at the University of Maine mentoring students and creating a piece of art that will be permanently installed on campus. His residency is part of the Littlefield Gallery Artist-in-Residence Series at UMaine, now in its second year.

Last year, sculptor Mark Herrington of Franklin, Maine was in residence and in the coming academic year, Kazumi Hoshino of Nagoya, Japan, will be on campus as part of the sculpture visiting artist series, sponsored by UMaine and Littlefield Gallery in Winter Harbor.

In the Littlefield Artist-in-Residence Series, artists join the UMaine community in the fall to give a lecture and demonstration. In the spring, they spend a week on campus, collaborating with students and completing their works on-site.

The visiting artist series brings professionals to work side by side with students and helps form a sense of community at UMaine, says Greg Ondo, a UMaine assistant professor of art and a sculptor. From Herrington, von Huene and Hoshino, young artists can be inspired to make their own contributions.

When von Huene returned April 25, he carved a 1-ton, 12-inch diameter piece of salt-and-pepper granite. For his design, he collaborated with Tim Shay, using the Indian Island, Maine sculptor and his family members as models. His work is part of a growing body of granite sculptures on campus.

The series is funded in part by the University of Maine's Cultural Affairs/Distinguished Lecture Series and the Department of Art. ■

Last year, sculptor Mark Herrington of Franklin was in residence at UMaine, culminating in his work "Tec.ton.ic," installed near UMaine's Sculpture Studio, across from the Collins Center for the Arts.



Pulitzer Prize-winning journalist Amy Ellis Nutt, fourth from the left, meets with journalism students.



TO CELEBRATE 100 years of the Pulitzer Prizes, the University of Maine Department of Communication and Journalism and Bangor Public Library hosted three winners of journalism's top award.

Amy Ellis Nutt of *The Washington Post*, Kathleen Kingsbury of *The Boston Globe*, and Jim Sheeler of Case Western Reserve University visited journalism classes March 24–31, and led public presentations.

The event offered an unprecedented opportunity to bring multiple Pulitzer Prize-winning journalists to the area to engage the public on topics of public interest while impressing upon the community the essential civic role of quality journalism. For UMaine students, learning directly from veteran practitioners awarded journalism's highest honor is invaluable.

Pulitzer Week was made possible by a grant from the Maine Humanities Council with support from the University of Maine Humanities Center and the UMaine Department of Communication and Journalism's Alan Miller Fund for Excellence in Communication and Journalism.

Since 2007, the Department of Communication and Journalism has brought respected journalists to campus through the Alan Miller Fund. Pulitzer Prize-winning journalists who have previously visited campus courtesy of the fund include UMaine alumna Bettina Boxall of the *Los Angeles Times* and Mark Feeney of *The Boston Globe*. ■

Role of journalism

Empire building

COULD THE rise of the Mongol empire, considered the greatest empire on Earth, be linked to climate change?

Aaron Putnam thinks so.

In 2010 and 2011, Putnam, previously at Columbia University and now the George H. Denton Assistant Professor of Earth Sciences at the University of Maine, traveled to the Tarim Basin in northwestern China to develop a record of how quickly the mountain glaciers of the Tien Shan retreated at the end of the last ice age.

He was surprised to stumble upon clues linking much more recent climatic changes to a momentous event of human civilization.

Putnam, a UMaine alumnus, was accompanied by his father, David, an archaeologist and climate scientist at the University of Maine at Presque Isle.

The interdisciplinary team also included researchers from the Lamont-Doherty Earth Observatory of Columbia University; University of New South Wales; China Meteorological Administration; University of Nevada, Reno; the Swiss Federal Institute of Technology; University of California, Irvine; and Xi'an Jiaotong University.

“My broad goal is to unearth the record of past climate to decipher how the climate system responds to forcing factors, such as atmospheric CO₂, and under what circumstances the climate system could jump abruptly,” says Putnam, the recipient of a five-year, \$591,000 Faculty Early Career Development (CAREER) grant from the National Science Foundation.

Nestled between China’s Kunlun and Tien Shan mountains, approximately 85 percent of the Taklamakan Desert has little to no vegetation.

During their travels in the Taklamakan, the second largest shifting-sand desert in the world, the researchers found unusual sediments — stands of dead, water-loving trees, as well as sediments deposited by water.

They collected wood and bivalve shell samples from the Taklamakan Desert and the Lop Desert, which historically was the site of a large lake.

Using radiocarbon dating methods, the researchers found living trees, water-loving reeds and a huge Lop Nor lake that were present as early as A.D. 1180 until as late as A.D. 1820.

Wetter conditions may have fueled Mongol empire military conquests by providing “greener” mid-latitude Asian deserts, producing more food resources for the cavalry horses.

The researchers also suggest that the southward expansion of the grasslands in response to colder, wetter conditions beginning in the late A.D. 1100s helped provide food for the horses that the cavalry relied on for transportation across the Eurasian deserts. ■

“

Given that the Mongol rise was fueled by horsepower, and that horses are fueled by grass, and that grass requires water to grow, I do think that **climatic factors may have played an important — if not essential — role** in the spread of the Mongol empire.”

Aaron Putnam

UMaine alumnus and assistant professor Aaron Putnam in Tien Shan

Photo by David E. Putnam





Inventor James Ferguson also created the SMARTY (Smart Materials And Research Technology for You) to reduce head trauma during a fall.

Head strong

ALBA-TECHNIC'S impact-resisting material has a soft inside layer that absorbs blows by deforming, buckling and moving in multiple directions. The outside layer — made of a dilatant material that is usually soft — also absorbs shock. And when the material system sustains a big blow, the dilatant layer stiffens, spreading the load over numerous honeycomb cells. During testing on AMC's linear impact machine, blows are delivered to a crash test dummy wearing a helmet containing inventor James Ferguson's patented dilatant/honeycomb material. The machine producing the hits at up to 12 meters per second approximates a head-on collision between two football linebackers each running 25 mph. UMaine researchers also conduct drop testing, computer simulations and laser scanning.

INVENTOR AND entrepreneur James Ferguson uses his head. And with assistance from University of Maine researchers, he's creating a material to help other people protect theirs.

The founder and CEO of Alba-Technic LLC in Winthrop, Maine has developed a patented, shock-absorbing material system to shield the brain from injury.

Ferguson, a former nuclear power plant engineer from Scotland, compares the state-of-the-art material to a second skin that absorbs and disperses blows before they reach the brain.

His product was a hit in the Head Health Challenge III in 2015. Ferguson was one of five, among 125 international entrants, to garner a \$250,000 prize and advance to compete for the \$500,000 grand prize.

The challenge is a collaboration of the NFL, Under Armour, GE and the U.S. Department of Commerce's National Institute of Standards and Technology. The competition is being held to support development of advanced materials that better dissipate impact, improving protective gear for football players and military personnel.

Ferguson and University of Maine researchers, led by mechanical engineering professor Vincent Caccese, are working to improve the material system. Testing is underway in the Advanced Biomechanics Lab for Injury Reduction and Rehabilitation in UMaine's Advanced Manufacturing Center. Early next year, Ferguson will submit the final entry to Head Health Challenge III. ■

Literary legacy

AN ENDOWED chaired professorship in literature named in honor of best-selling author and University of Maine alumnus Stephen King has been established at his alma mater with the help of a \$1 million award from the Harold Alfond Foundation.

The Stephen E. King Chair in Literature will support a faculty position in the Department of English in honor of King's "substantial body of work and creative impact."

The endowment for the faculty chair position, the first for the English Department, is held at the University of Maine Foundation. A search to fill the position is expected to begin this fall.

"The Harold Alfond Foundation is delighted to make this grant in honor of Stephen King and in support of Maine's flagship university," said Greg Powell, chairman of the Alfond Foundation's Board of Trustees. "This chaired professorship is a tribute to Mr. King's outstanding literary accomplishments and his deep commitment to Maine."

University of Maine President Susan J. Hunter called the endowed chaired professorship "an exceptional gift that honors the tremendous literary legacy of UMaine's most well-known and beloved alumnus." ■



King is an inspiration for students who are fascinated by literature and its contributions to human culture. **The opportunity to study with the King Chair gives them one more reason to choose UMaine.**

Emily Haddad, Dean of the College of Liberal Arts and Sciences





Frank Drummond has spent three decades studying the biology, ecology, disease susceptibility and pesticide exposure of bees in Maine.

Bee cause

Frank Drummond empowers Maine's mightiest pollinators to protect landscapes and crops

By Amanda Clark

FRANK DRUMMOND likes hard workers. He's helped them find homes at farms all across the state and has welcomed many to live right next to him.

From his Winterport, Maine home, Drummond monitors how these bee populations change from year to year. He watches as they forage for mud and leaves for their nests, and nectar and pollen to feed their young.

"They are quite fascinating," says Drummond of the tiny native mason bees that inhabit the wooden nest boxes he built into the side of his house three decades ago.

For the last 30 years, Drummond, pro-

fessor of insect ecology at the University of Maine, has focused on Maine's 275 native species of bees, as well as the millions of commercial honey bees annually trucked into the state to aid in crop pollination.

Drummond has dedicated his prominent career to the tiny buzzing bees' health, conservation and efficiency as pollinators.

He is well aware of the benefits of bees.

Without the critical pollination services these beloved bees provide, Maine's beautiful landscape and agricultural sector would be dreary. And in recent years, the precarious health of honey bees has kept Drummond and researchers across the country on constant vigil.

“The basis to our landscape are the plant communities. So really, the insect pollinators are the keystone species or the foundation of our plant communities, which we enjoy so much when we go for hikes or walk through meadows,” says Drummond.

“Without bees, not only would we not have nuts or fruits to eat, but we would not have the wonderful, colorful wildflowers we see across the landscape.”

SINCE 1988 when he joined the UMaine faculty, Drummond has created an eclectic, interdisciplinary bee research community that includes entomologists, ecologists, biologists, horticulturists, anthropologists and economists.

“No one in the state has done as much to promote bee health as Frank. He’s truly a leader in the field,” says Kourtney Collum, a Ph.D. student in anthropology and the environment who studies pollination management strategies.

“I’ve met few people with as much passion for and commitment to their job as Frank.”

His Deering Hall office is lined with ecology textbooks, homemade bee boxes, and towering stacks of scientific journals and beekeepers magazines. His office door is covered in a patchwork of bee posters and cutout cartoons, including one that reads, “What’s all the buzz in the blueberries?”

His lab is a veritable hive of activity, with graduate students, undergraduate researchers and lab technicians conducting independent and collaborative research projects exploring issues ranging from flower nutrition and genetics to pesticide exposure and management strategies used in modern agricultural systems.

“One of the great things about being a bee researcher is that it’s a relatively small, tight-knit community, and it’s not uncommon for researchers to trade advice on protocols and to help decipher what results might mean,” says Kalyn Bickerman-Martens, a Ph.D. student in ecology and environmental science who is researching bumblebee health.

“I kind of imagine Frank as being the center of that community,” she says.

Through his bee research, Drummond also is heavily involved in wild blueberry research, ensuring the industry remains profitable for Maine farmers. He helps farmers evaluate their fields to see if the landscape is sufficient to have high numbers of native bees, or if they should invest in honey bees or alternative flowers resources.

According to David Yarborough, UMaine Cooperative Extension wild blueberry specialist, blueberry production in Maine has increased from 20 million to 100 million pounds in the past 10 years.



Ph.D. student Kalyn Bickerman-Martens collects bee species at the Sunhaze Meadows National Wildlife Refuge to study the health of bumblebees in Maine.

Yarborough credits much of this to a greater understanding of native and honey bees. And he credits the increase in understanding largely to the tireless efforts of Drummond.

“Frank is one of the key people in ensuring the understanding and importance of honey bees and how to keep them healthy,” says Yarborough. “He is one of the most renowned bee researcher in the country. He is very well known, and Maine’s wild blueberry industry truly appreciates his research and the resources he provides to growers.”

BORN JUST outside London, England, Drummond and his family moved to South Africa before making their way to Rhode Island when he was 6 years old.

His fascination for bees took flight when he was 13.

“I collected insects — a lot,” he says with a smile. “There was a natural history institution that was within walking distance of my house, which was quite convenient.”

And a neighbor taught him how to manage honey bees.

Drummond went on to pursue an undergraduate degree in botany from the University of Rhode Island. He met his wife, Eleanor Groden, while studying for a master’s degree in entomology from Michigan State University, where he focused on population ecology of insect pests and how to design sustainable agricultural systems without the use of pesticides.

Drummond’s awareness of the importance of bees to agriculture took root while pursuing his Ph.D. in biology at the University of Rhode Island.

“What captured my interest in bees was their intimate mutual connection with flowering plants. The idea that through coevolution they have both given rise to adaptations that benefit each other’s survival and fitness fascinated me,” Drummond says.

He revisited his interest in honey bees in 1981 when he and his wife accepted a joint position at the University of Massachusetts as Cooperative Extension fruit specialists. They purchased more than 20 colonies of honey bees, and started a pollination and honey-making business.

When Drummond and Groden accepted a joint position at UMaine in 1988 as insect ecologists, the belongings they packed up and moved included their 30 hives — which equated to nearly 1.5 million honey bees.



The Growers Toolbox

UMaine RESEARCHERS have created a pollinator growers toolbox to increase blueberry growers’ interest and understanding of native bee conservation. The kit includes GIS and budget tools, video and planting list. The UMaine research team includes professors Samuel Hanes and Cynthia Loftin, and Ph.D. student Brianne Du Clos. Du Clos is studying the spatial patterns of landscapes surrounding wild blueberry fields. She is hoping to determine what effect landscape pattern has on the ability of native pollinators to successfully pollinate Maine wild blueberry fields. She is developing the GIS tool, called the *BeeMapper*, to help growers assess their native bee habitats.



Maine Bumble Bee Atlas

PH.D. STUDENT Kalyn Bickerman-Martens is working on the *Maine Bumble Bee Atlas*, a multiyear survey using citizen scientists to document the diversity and distribution of Maine’s bumble bee fauna. The project, in partnership with the Maine Department of Inland Fisheries & Wildlife, is working to coordinate and train volunteers, maintain and analyze survey data, and assess the status of all bumblebee species documented in Maine. The researchers just completed the first year of their project, in which 65 individuals contributed data, 3,700 bumblebee specimens were collected and up to 400 images were received.



Pollinator Demonstration Gardens

A TWO-YEAR UMaine project led by assistant professor Alison Dibble; professor Lois Berg Stack; master’s student Megan Leach; and professor Frank Drummond focuses on supporting native and honey bee populations by increasing beneficial pollinator-visited flowers across Maine’s landscape. They planted pollinator demonstration gardens at the capped Pine Tree Landfill in Hampden and at G.M. Allen’s blueberry farm in Orland to demonstrate strategies that can be adopted to help keep bee communities thriving in the state. The project is funded by the Natural Resources Conservation Service, in partnership with Casella Waste Systems and G.M. Allen and Son, Inc. Dibble also is compiling a historical baseline database of all the bee species that have been documented in Maine.

Bee cause

Since joining the University of Maine in 1988, Frank Drummond has created an eclectic, interdisciplinary bee research community that includes entomologists, ecologists, biologists, horticulturists, anthropologists and economists.



Since joining the UMaine community, Drummond estimates that he has advised nearly 80 undergraduate students and 30 graduate students.

Initially, he says it was difficult to find undergraduate students interested in working as research assistants. Today, he says, when he has 12 undergraduate research positions, he has more than 20 applications.

“As a researcher and teacher, Frank is constantly learning and growing, which inspires others to do the same. I’m always amazed by his vast knowledge,” says Megan Leach, a UMaine ecology and environmental studies master’s student examining flower nutrition, determining if bee floral preference is due to pollen and nectar nutritive content.

Other important contributions to understanding bee health and pollination are being made by Drummond’s other graduate students. Eric Venturini has studied specific bee forage plants for Maine and the economic benefits of their establishment on farms. Alex Bajcz has assessed the ability of blueberry plants to offset flower loss, and Lee Beers has studied the ability of blueberry flowers to avoid frost damage and the genetic basis for this tolerance.

Research scientists who work with Drummond — Venturini, Judy Collins, Elissa Ballman and Jennifer Lund — are studying bumblebee diversity statewide, soil nesting bee ecology, transmission of mummy berry disease by bees, and honey bee exposure to insecticides.

What Drummond enjoys most about being a mentor, he says, is the “continual intellectual challenge.”

He expects his students to become experts and to surpass him in their knowledge of their own research niche. That way, he is always learning.

“I learn a lot from brainstorming and being exposed to how different people perceive and think about how to answer a question. The students are always challenging me and are always creatively coming up with methods that I hadn’t thought about,” Drummond says.

ALTHOUGH DRUMMOND has been researching native bees for nearly three decades, his research on honey bees emerged in 2006 when Colony Collapse Disorder (CCD) made headlines around the world. The poorly understood phenomenon occurred in the mid-2000s in Europe and North America, and resulted in massive honey bee colony losses; mortality jumped from 10 percent during winter months to 40 percent. The mysterious declines left scientists and beekeepers dumbfounded and eager for answers.

Drummond and his colleagues set out to help solve the mystery.

In 2009, Drummond was awarded funding as part of a \$4 million grant to determine the factors involved in CCD. In 2012, he was awarded \$3.3 million as part of a \$6.6 million grant awarded to a seven-state collaborative

research project to research pollination and bee pollinator health of New England’s major bee-pollinated crops: wild blueberry, cranberry, apple and squash.

Researchers in the seven states established apiaries and, essentially, undertook a clinical epidemiology study, monitoring the bees until they died, then trying to piece together the factors that resulted in their demise.

They found that the bees’ health, like an individual with a suppressed immune system, was being affected by multiple factors that were piling on top of each other, leaving the colonies extremely susceptible to parasites, disease, infection and, ultimately, collapse.

The No. 1 factor was varroa, the pin-sized, parasitic mite that feeds on the blood of larval bees and is a vector for a variety of infections. Other factors included the Israeli acute paralysis virus (IAPV), the fungal pathogen *Nosema ceranae*, pesticide exposure, loss of habitat and floral resources, and limited genetic diversity in the U.S. honey bee stocks, which allows pathogens and parasites to adapt to only a handful of genotypes, making the honey bee populations highly virulent.

Today — nearly 10 years since Drummond began researching CCD — overwintering colony losses average nearly 40 percent in the United States.

Drummond works with beekeepers and farmers to implement strategies that can help combat the factors driving CCD. Some of these include the use of miticides and pesticides, splitting the hive, drone trapping and sugaring.

Miticides and pesticides are the most commonly used method for large-scale beekeeping operations to eliminate the varroa mite from hives. But while mite numbers do decrease, the chemicals also impact the honey bees’ health.

“It’s kind of a tricky situation. If the levels build up too much, you are also stressing the honey bees,” Drummond says.

Another concern, he says, is that the varroa mite has become tolerant and resistant to a lot of these strategies, leaving beekeepers scrambling to find innovative methods. Some new methods include using a pathogen to attack the mites; a technology called RNA interference that interrupts the development and survival of mites; and breeding more tolerant and resistant bees.



The Bee Module

THE BEE module project — initiated in 2012 by UMaine botanist Alison Dibble and funded by the USDA and the University of Maine — is an experiment to see which plants elicit the most bee visitations. The goal is to create a list of plants for pollinator plantings intended to support native bees and honey bees. More than 80 different plants and four locations were involved, including UMaine’s Rogers Farm and Blueberry Hill Farm, plus two commercial blueberry fields in Blue Hill. The project aims to encourage gardeners and farmers to invest in pollinator plantings to increase bee numbers on a landscape level.



Policy of Pollination

PH.D. STUDENT Kourtney Collum is examining the factors that influence farmers’ adoption of pollinator conservation practices in Maine and Prince Edward Island, Canada. Since 2013, Collum has been conducting a comparative study of the pollination management practices used by lowbush blueberry growers in the two locations. Collum’s dissertation research examines the ways blueberry growers are adapting to the declining abundance and rising price of honey bees, on which they depend for crop pollination. Her research focuses on the influence of agricultural policy, and formal and informal agricultural institutions on growers’ farm management practices.



Island Bees

UMAINE ALUM Sara Bushmann is conducting a survey of wild bee species on Maine islands, with a geographic focus on Penobscot, Blue Hill and Frenchman Bay. With assistance from The Nature Conservancy, College of the Atlantic, Maine Coast Heritage Trust, and the Pollination Security Project at UMaine, Bushmann travels to islands, collects wild bees, and identifies and documents the species. She hopes to understand if islands harbor rare bee species, which species commonly travel across the ocean to arrive at an island and which flowers island bees visit most frequently. In 2013, Bushmann earned her Ph.D. studying the ecology of wild bees found in Maine’s blueberry ecosystem. Frank Drummond was her adviser.

“All of these techniques can be used in concert, so the mites can be managed. That way you aren’t just relying on a single control method, like a pesticide,” Drummond says.

THOUGH CCD shook up the bee research community in the early 2000s, Drummond says there were some silver linings.

“What has really been nice is the interest the general public has shown in wanting to make a big difference in saving bees,” he says.

Drummond adds that the number of people who have started raising honey bees has increased dramatically, as has the number of people planting wild-flowers and flowering garden plants to provide food sources for bees. Even kindergarten and high school students have become more aware of the benefits and importance of bees.

“I think that’s very powerful and it will help us conserve not only honey bees, but a lot of the native bees that may even offset a lot of the current problems occurring in honey bees,” says Drummond.

Another silver lining was the increase in funding.

“When I started working on bees, especially the native ones, there was almost no money available for pollination and bee conservation work. Most of the money available to entomologists was focused on pest management strategies,” Drummond says.

More funding allowed Drummond and his colleagues to take on more graduate and undergraduate students for researching commercial and native bees.

“Frank has excelled at collaborative work over the course of his career, working with scientists and stakeholders from a variety of disciplines to create a holistic picture of the status of Maine’s bee communities,” says Brianne Du Clos, a UMaine Ph.D. student in ecology and environmental science.

“He has provided opportunities for the next generation of pollination ecologists to discover the diverse wild bee communities of Maine and address the problems bees face in the state,” says Du Clos, who is studying the spatial

patterns of landscapes surrounding wild blueberry fields. She is working to determine what kind of effect this has on the ability of native pollinators to successfully pollinate blueberry fields.

MAINE IS the second-largest importer of honey bees, trucking nearly 85,000 hives to the state annually to pollinate Maine’s native lowbush blueberries, *Vaccinium angustifolium*. Lowbush blueberries are obligate crops — meaning they are pollinated primarily by bees.

Each imported hive containing approximately 50,000 honey bees costs around \$100. A 40 percent loss in overwintering hives can dramatically impact growers’ profitability.

Fewer pollinating bees mean less fruit and less money.

As bees forage for food, they pollinate flowering blueberry plant by depositing pollen on the flower’s stigma, the receptive part of the plant’s female reproductive organ. The pollen germinates and fertilizes the flower to produce the tiny, deep blue

fruits that are one of Maine’s top agricultural products.

According to the U.S. Department of Agriculture, bees provide pollination to 80 percent of all flowering plants and 75 percent of fruits, nuts and vegetables grown in the country.

“From a human perspective, bees are important for the diversity of our diet. But in a broader sense, they are important for the successful reproduction of many plants,” says Lois Berg Stack, professor of sustainable agriculture and ornamental horticulture with University of Maine Cooperative Extension, who has worked with Drummond for nearly 25 years.

Though Drummond and his colleagues have been working to help beekeepers decrease honey bee colony losses, they’ve also turned their attention to a less studied pollination force — Maine’s native bees.

“Native bees have been here since the retreat of the glaciers, and are a natural and permanent aspect of the landscape, but they are poorly understood,” Drummond says.

Bees provide pollination to **80 percent** of all flowering plants and **75 percent** of fruits, nuts and vegetables grown in the country.

Even at fairly low densities, native bees can efficiently pollinate a blueberry field, explains Drummond. But like many plant and animal populations, their numbers can fluctuate tremendously over time, which can cause unease in farmers who need a reliable source of pollination from year to year.

Although honey bees can pollinate many types of crops and can be an instant pollinator force for growers, they do have their limits.

Honey bees have not evolved historically with some of the crops that have a North American origin, such as Maine’s wild blueberries, Drummond says. On a bee-per-bee basis, many species of native bees are more efficient pollinators compared to honey bees.

Also, Maine is cold. Especially for honey bees that are adapted to warm Mediterranean climates.

“In Maine, sometimes it’s so cold that the honey bees don’t go out to forage,” Drummond says. “The good thing is, the native bees evolved in Maine, so they are very well adapted to cooler temperatures, and they will go out and forage.”

As an applied bee researcher, Drummond is mainly focused on the species that are the most efficient and dominant pollinators in Maine’s blueberry fields.

“You may be focused on bee biology and ecology, but you are embedding it in the agricultural ecology that the bees are working in. That means having knowledge of the pesticides used, insecticides, which ones are more nasty to bees, which ones aren’t, which residues stay on flowers and impact bees, all the way to the effects of soil fertility on the plant that may indirectly affect the bees,” says Drummond.

That wide range of research knowledge leads Drummond to communicate with a diverse spectrum of individuals.

“What I admire most about Frank is his ability to communicate science effectively to any audience,” says Du Clos. “Whether he’s speaking to beekeepers, wild blueberry growers, gardeners or scientists from different disciplines, he always makes scientific information exciting and approachable.”

ONE OF Drummond’s most memorable research projects occurred in the late 1980s, when he and his UMaine

How to create a bee-friendly landscape

THE BASIC needs of bees are similar to those of humans — food, water and shelter. Trees, shrubs, fruits, vegetables and flower gardens provide important floral resources for the approximately 276 species of native Maine bees and honey bees brought in to aid in crop pollination. Tips to help create bee-friendly landscapes in Maine:

- ✓ Plant large patches of flowers — 3 feet by 3 feet or larger — to attract bees.
- ✓ Provide plantings that bloom in succession throughout the season.
- ✓ Focus on sunny sites, as most good bee plants do best in full sun.
- ✓ To expand your bee plant list, consider plants in the Aster family (“composites,” such as sunflower, dahlia, *Echinops* spp., sneezeweed, *Erigeron* spp.) and mint family (catmint, basil, lemon balm, salvia, bee balm).
- ✓ Leave a few weeds or “wild spots” at the edges of your landscape. Many weeds offer good bee resources.
- ✓ Float a piece of wood in a birdbath to provide a landing platform for bees to use while drinking.
- ✓ Try to use pesticide-free plants, as some pesticide residues can impact bee health.
- ✓ Leave bare patches of sandy ground for ground-nesting native bees.
- ✓ Provide bunch grasses to attract bumblebees that nest at their base.
- ✓ Build nest blocks and hang bundles of dried hollow stems, such as those from elder or raspberry, to attract cavity-nesting native bees.



colleague, Connie Stubbs, noticed a high abundance of mason bees on the blueberry fields that run adjacent to his property in Winterport. They became fascinated with the species *Osmia atriventris* — the Maine blueberry bee. After studying the bees' life history, they found they were efficient pollinators and fairly easy to manage, and had evolved to only fly during blueberry bloom.

The researchers developed a way for blueberry growers to inexpensively and efficiently enhance the native pollinators' habitat by providing nest sites along the edges of their fields. The bees' proliferating populations increased the farmers fruit production drastically.

"Frank embodies UMaine's role as a land grant institution at its best. He has advanced science while helping important industries be more sustainable and productive," says Samuel Hanes, a UMaine professor of anthropology, who helped create a pollinator toolbox to increase blueberry growers' interest and understanding of native bee conservation.

"UMaine and Maine farmers have been fortunate to have a long history of entomologists, going back to Edith Patch, producing cutting-edge science promoting the public good."

Recently, Drummond has been documenting the

comeback of the yellow-banded bumblebee, which started to decline in the late 1990s and nearly disappeared from Maine by the mid-2000s. He is working to determine what caused the species' initial decline, as well as what contributed to its dramatic comeback.

And in the last couple years, Drummond has been researching how much exposure honey bees get to pesticides in Maine.

He has enlisted the help of beekeeper citizen scientists to collect pollen statewide, which is sent to a chemistry lab to determine the pesticide content. With the help of Cynthia Loftin, a UMaine professor of spatial and landscape ecology, Drummond will use a model to determine whether certain landscapes in Maine can be associated with higher pesticide exposure in honey bees; knowledge which could inform management strategies.

This spring, Drummond was on sabbatical and traveled to see colleagues who work with bees at Penn State University, University of Tennessee, and USDA Bee Labs in Tucson, Arizona and Rio Grande Valley, Texas.

This summer, Drummond and Lund, a UMaine entomology research technician, will look at the impact of two pesticides commonly used in blueberry production. Lund

has worked with Drummond for the past six years and co-teaches his beekeeping course.

They hope to determine whether there is a synergistic relationship between the two products that, in the laboratory setting, increased the mortality of bees by 800 percent when simultaneously exposed.

Drummond's dedication to bee health is evident in the many awards

he has received, including a sustainable agriculture award in 2000; a public service award in 2001; an outstanding research award in 2012; the UMaine 2013 Presidential Research and Creative Achievement Award; and the Cooperative Extension Applied Research Award in 2014.

"Frank has a true passion for learning and has been a tireless proponent for bee research and the health of bees in Maine. He is imaginative, down-to-earth, compassionate, approachable and caring toward his students, not just academically, but also personally," says Collins, a research technician who has worked with Drummond for nearly 30 years.



What has really been nice is the interest the general public has shown in **wanting to make a big difference** in saving bees." Frank Drummond

Drummond modestly stresses that his accomplishments would not have been possible without the dedication of many other UMaine researchers from interdisciplinary backgrounds, including Alison Dibble, assistant professor of pollination ecology; Aaron Hoshide, ecological economist; Xuan Chen, assistant professor of economics; George Criner, professor of agricultural

economics; Nuri Emanetoglu, associate professor of electrical and computer engineering; Herbert Aumann, adjunct professor in electrical and computer engineering; and visiting computer simulation modeler Hongchun Qu.

"Frank is an exceptional researcher with great methodological creativity, but that's not enough to do what he does successfully," Hanes says.

"What makes him stand apart is his ability to see other people's perspectives, whether they're farmers or academics. Both groups are highly diverse, but Frank manages to convey understanding and respect to everyone. That's no small task." ■

Top forage plants for a bee garden in Maine



Purple coneflower
Echinacea purpurea



Butterfly milkweed
Asclepias tuberosa



Borage
Borago officinalis



White meadowsweet
Spiraea alba var. *latifolia*



Anise hyssop
Agastache foeniculum



Summersweet
Clethra alnifolia

Photo by Lois Berg Stack



White wood aster
Eurybia divaricata



Greek oregano
Origanum vulgare hirtum

Photo by Lois Berg Stack

Swish

Basketball standout Liz Wood makes it look easy

By Beth Staples

WHEN LIZ WOOD was young, she sped up and down her Virginia driveway in her battery-powered Barbie Jeep.

The biology major with a premed concentration, and captain of the women's basketball team is still a driving force. The last four years, two of her athletic goals included an America East conference playoff title and a ticket to NCAA March Madness.

In 2016, the Black Bears came tantalizing close to both, but fell one agonizing point short, 59–58, to UAlbany in the conference championship game.

Despite the not-the-way-it-was-supposed-to-end season, Wood's future will likely include more basketball — at the professional level — and more classes — in medical school.



“Being a student-athlete has shaped me for the rest of my life,” she says.

In 2012, Wood opted to attend UMaine for her educational and basketball experiences, in part, because she liked the direction coach Richard Barron and staff had the Black Bears headed.

“I just really loved the vision they had for me and the program,” she says. “Maine is a beautiful state. I love the people. I love the campus. I really felt I could make a difference here.”

In 2012–13, her first season wearing a Maine blue uniform, the going was often tough for the 4–24 squad. League coaches still recognized Wood's talents, choosing her as America East Co-Rookie of the Year.

The next two campaigns, Wood and her teammates continued to develop. In 2013–14, when

the squad catapulted to 17–16, Wood was named to the America East Second Team and America East All-Defensive Team.

In 2014–15, the Black Bears took another leap. They added another half-dozen victories to finish 23–9 and earn a share of the AE regular season title.

Wood, then a junior, garnered a slew of honors, including being named to the America East First and America East All-Defensive teams.

In 2015–16, when the Black Bears, who again were co-champions of the AE regular season and finished 26–9, the inspirational leader was named to the AE second team, All-Defensive team and All-Academic team.

THE COMMUNITY was ripe for UMaine hoops to make a comeback, says Wood. Ready and appreciative.

Fan support was tremendous on the Bears' new home court — the Cross Insurance Center in Bangor, Maine.

On Senior Day — UMaine's last home regular-season contest — nearly 3,500 enthusiasts thanked the elite eight for their efforts and results.

The Black Bears responded, blasting Binghamton 69–37 to clinch a tie with UAlbany for the regular season AE title.

While striving to continually improve and win the league championship, Wood says it was important for her to cherish each moment with her teammates.

“Basketball is one thing, but the relationships I've created here with my teammates and my coaches, that's the best part. That's definitely unforgettable,” Wood says.

WHILE WOOD is recognized as one of the best to ever play for the women's program, she also has earned as many kudos for her in-class academic prowess.

The honors student had a 3.95 GPA. In March, she and teammate Sigi Koizar were named to the 2015–16

CoSIDA (College Sports Information Directors of America) Academic All-America Team.

The summer after her sophomore year, Wood participated in a NASA-funded cancer biology internship at Colorado State University. She explored whether radiation that astronauts experience in space may cause cancer that's different than what afflicts people on Earth.

In 2015, Wood received the Dean Smith Award for outstanding academic and athletic achievement, citizenship and community service. She also was the 2015 America East Female Scholar-Athlete of the Year, and the Outstanding Graduating Student in the College of Natural Sciences, Forestry, and Agriculture.

WOOD ISN'T sure exactly when she knew she wanted to be a doctor, but it may have been when she was a young girl mending her Barbie dolls. A couple of them lost their heads, she says matter-of-factly.

What sealed the deal was being in high school and watching a three-hour open-heart surgery while job-shadowing an orthopedic surgeon.

“I was fascinated,” she says. “As an athlete, the human body has always

fascinated me.”

As has learning about how the body works, and how it can be treated and healed.

Wood says her honors coursework prodded her to think deeply about what matters. Her research on preventing Type 2 diabetes explored energy expenditure, nerve function, fat storage and calories.

Handling multiple commitments has provided her with opportunities to hone her time management, communication and leadership skills, as well as deal in a mature manner with setbacks and frustrations.

After a post-graduation trip to California with senior teammates, Wood hopes to pursue a professional basketball career, then attend medical school. ■

Liz Wood isn't sure exactly when she knew she wanted to be a doctor, but it may have been when she was a young girl mending her Barbie dolls. **A couple of them lost their heads, she says matter-of-factly.**

Support from strangers

Winner of President's Research Impact Award focuses on work in suicide prevention

MELISSA JANKOWSKI was approaching the parking garage stairwell when she encountered a young man. He spun around and locked eyes with her. Frightened, she hurried to class. But there was something about his distant look that made her determined to search for him and ask if he was all right.

When she returned to the parking garage, he was gone.

Days later, Jankowski heard the news: A 22-year-old student jumped to his death from the facility.

She knew then that she wanted to pursue research on suicide prevention.

“I looked at him and instantly knew something wasn't right,” Jankowski says of the encounter six years ago. “What did I see? Could others see it? Could someone have saved him?”

Jankowski, now a first-year student in the University of Maine Clinical Psychology Doctoral Program, is conducting research with Assistant Professor Rebecca Schwartz-Mette that examines how suicide risk may manifest during at-risk individuals' interactions with strangers.

While existing research explains risk in the context of established relationships, no known studies apply theories of suicide to interactions with strangers. Understanding how suicide risk can appear in everyday interactions could improve the ability to identify those who need support the most, according to the researchers.

Jankowski received UMaine's 2016 Presidential Research Impact Award for her work that has particular significance in Maine, where the suicide rate is 20 percent higher than the national average, with one suicide every two days. In rural states, access to mental health care can be challenging, and many individuals go unnoticed until it is too late, says Jankowski, who is from Cassville, Missouri.

She hopes her work will inform clinical practitioners and community members. ■





Professor of Art Michael Lewis and alumna Helena Bosse discuss a painting in progress.

Landscape as language

For half a century, artist Michael Lewis created an innovative body of art and inspired generations

By Margaret Nagle



Mystic Garden #3, 2008

IT STARTED with a tree and a couple kissing under it," explains the man in the knit cap, a mix of pride and apprehension in his voice. "That's when the idea ran away with me."

"Is that a problem?" asks Michael Lewis, the University of Maine professor leading the directed study in studio art class. "I look forward to what is going to happen next."

Lewis looks around the room at the loose circle of students sitting in the large studio. "How about some other reactions," he says, then listens attentively to the ebb and flow of the feedback to their classmate.

"Your painting is beginning to develop an interesting and playful narrative — something you do really well," Lewis says. "That's the thrill of painting: Just trust your instinct. Let it unfold."

The man nods and the next student props up three of

her canvases for the group to critique. Peer reactions are mixed; they don't all agree on what works and what doesn't in the paintings.

Lewis listens. And waits.

"It's not just about reproducing an image in a photo that you're working from. You have to focus on the meaning and feeling you're trying to convey," he says. "When you make the image, it's got to come from some deep part of your consciousness."

Each student in turn talks about the paintings he or she has started as part of the next class assignment. They talk about the impetus for their paintings, the elements in the landscape, the locations.

Lewis continues to prod: What is the painting going to be about?

"Get your experience — your feeling — onto the canvas.



Prayer for Peace (Edge of a Plowed Field) #9, 1998

What are the expressive variables that you can use? What does the kind of light in the image convey? What mood does the weather evoke?

"What's the scale of the figure against the landscape? What kind of space is depicted? How do you make the paint surface more sensual? You have to be sensitive to all those things."

With the bar set, the high expectations enumerated, the huddle breaks and the students turn to their easels. The artists, ages 20 to 78, will spend the remainder of the five-hour weekly class attempting to move their oils or acrylics on canvas to the next level. Lewis circulates, engaging in one-on-one mentoring.

"I'm the provocateur, helping them stretch their imaginations," Lewis says of his role in the classroom for the last 50 years.

LEWIS CAME to Maine in 1966 to join the flagship university's fledgling art department.

He was 25.

By his own admission, he had a lot to learn. And he had great teachers, starting with the legendary Vincent Hartgen, founder of the UMaine art department and the University of Maine Museum of Art.

Lewis will say he also learned from his students, most of whom were only a few years younger. And he learned from Maine, where the nonstop intersections with the natural world helped him connect the dots with the artists, filmmakers and philosophers he was discovering — from Freud and Jung to Fellini and Bergman.

Lewis says he and his wife, May, and their children came to Maine never intending to stay.

They just never found a reason to leave.



Jumping Towards the Light #9, 2007

The result is a legacy.

In his half-century at UMaine, and with strong support from May, Lewis created an innovative, continuously evolving body of paintings and drawings that were exhibited in galleries in Portland, Maine; New York City, Boston; and Baltimore. His paintings were acquired for private collections and museums alike.

The Fogg Museum at Harvard has 27 of his paintings, drawings and prints in its permanent collection. His work also is in the collections of the Albertina museum in Austria, the Portland Museum of Art, Colby College Museum of Art and the University of Maine Museum of Art.

The viewing public has the highest praise for what Lewis accomplishes in his work. He extends an invitation to explore both the beauty of the physical landscape and the personal, unseen inner realms of emotion and spirit.

For countless people, UMaine and art are synonymous with Michael Lewis.

Lewis is quiet, modest and deep, and people seek his counsel, fully aware that they won't always like what they'll hear in his honesty.

Colleagues describe him as a stabilizing force. He was instrumental in helping to set the foundation for the highly professional Department of Art it has become, making it a vigorous and ideal place to learn with creative and active artist-teachers and scholar-teachers.

“(Mike’s) effect on people goes beyond his art,” says UMaine art professor Laurie Hicks. “You can’t go around the state and not have his name brought up if you’re talking about art. I think it’s because of the thousands of students he’s taught, but also the way they left his class, better for having been there.”



Doubt, 2007

FROM THE start, Lewis found the UMaine Department of Art a rewarding work environment. In 1966, the native of Brooklyn, New York was one of three faculty members working with Hartgen, the department’s larger-than-life founder who championed the arts in Maine.

“Vincent’s greatest lesson was to keep busy and think big,” Lewis says. “He wanted everyone in the department to be having shows, to teach and to do lots of community service. He was tireless. He wanted the department at UMaine to be known all over the state.”

Lewis earned a master’s degree in painting from Michigan State University in 1964 and spent two years teaching art in Kingston, New York, to grades K–6, where he says the students helped him more clearly understand the penetrating, undermining effects of racial discrimination. In addition, they underscored the pure joy of creating.

At UMaine, he also learned from his students, including one who called him out one day for his narrow critiques that left little room for “other ways of thinking.”

“I was growing as a person and an artist, as were my students,” Lewis remembers of those first three years of teaching. “Interactions like that were a godsend and made me start to realize that, as a teacher, I needed to be sensitive to a spectrum of possibilities.

“I also began to be open to intuition and the subconscious as important aspects of the creative process. It helped free up my thinking.”

Through the years, Lewis’ art reflected engaged enlightenment. Many of his earlier works were influenced by Freud’s ideas of the subconscious. He then explored Jung’s more expansive ideas of the “creative” subconscious and the collective unconscious. Lewis moved from carefully



Mystic Garden #6, 2008

deliberate painting to more spontaneous, inventive methods.

He came to trust his instinct, feeling that it led to experience with deeper, more spiritual realities.

That confidence to innovate progressed with the development of the technique that has come to define him — the turpentine wash. Ironically, he discovered it in the heat of frustration.

The year was 1975, the start of the first of two six-year stints as chair of the Department of Art. It was the year he also completed an MFA in painting from the State University College, New Paltz.

Lewis had already struck a balance between the teaching he loved and his obsessive studio habits. But he worried that the addition of administrative duties would eat into his creative time.

One night in the studio, he wasn't happy with a drawing

he'd just started and, impulsively, wiped a turpentine-laced rag across the image. That eventually gave rise to the wash technique, bringing him exciting new expressive opportunities.

LEWIS HAD been in Maine 17 years before his paintings took on the difficult challenge of using landscape as entry into hidden realities. In his personal and professional pursuit of greater understanding of mysticism and spirituality, he communed with nature on daily walks, often with trusted friend Kyriacos Markides, UMaine professor of sociology and a scholar of mystical reality.

In his studio, Lewis' paintings reflected the effect of Maine on his subconscious. And the turpentine wash technique allowed him to let the new insights flow into his work.



The Opening Heart #3, 1990

“When I started working with the wash, it was really exciting because I had no idea beforehand what each painting was going to look like. It was like dreaming,” Lewis says.

“I would move the paint intuitively and spontaneously, and let it gravitate toward landscape, but the goal wasn't to show you a particular place.”

Lewis doesn't paint landscapes, says his colleague Hicks. He paints ideas. Thoughts. Possibilities. He uses the landscape as a medium; in many ways, the landscape is simply the language.

“Most of the landscapes he ever painted don't (physically) exist. He doesn't go out and paint in the world,” she says. “He has created concrete enough language so people see places with depth and beauty.

“He creates a language that bridges the real world and world of ideas.”

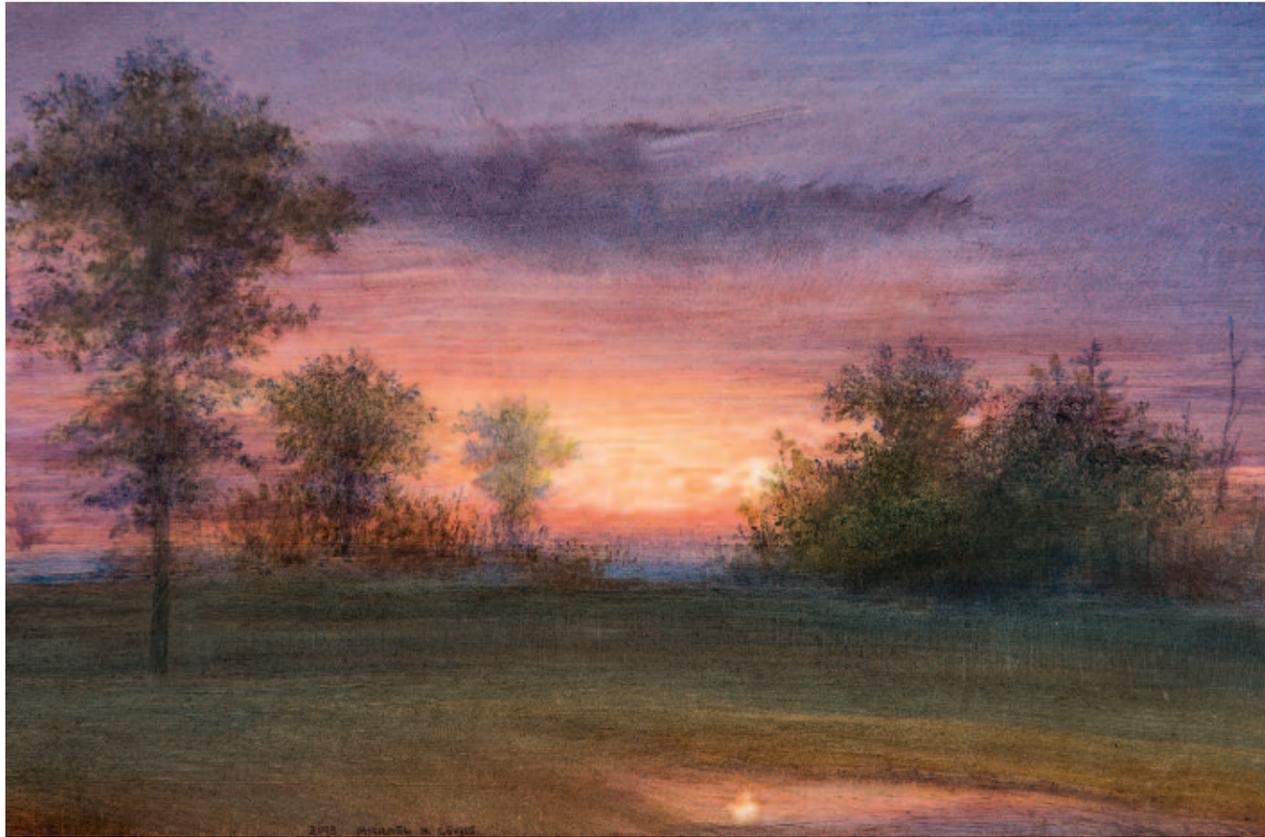
PAINTING AND teaching are parallel passions, Lewis says.

“I enjoy being in an exchange with students who are just getting excited about what the possibilities are and that renews my excitement,” he says. “Some of the students have incredible facility. Others may not, but they have intense imaginations and feelings. Sometimes you see the aha moment in class and sometimes it happens 10 years later.”

Lewis says his bottom line: Keep making art.

“For some students, success is continuing to work; for others, it is New York recognition in a complex and varied art scene,” says Lewis. “Even if you're in a small, rural town, what you do as an artist is rippling out into the surrounding environment. Do what you love. Believe that your work will inspire people. And support (creativity) where and when you can.”

Helena Bosse of Milford, Maine, came to UMaine as a



Mystic Garden #7, 2008

first-generation college student in her 40s. Her first painting class was with Lewis.

"I had never painted with oils," she says, "but I've been painting ever since."

Bosse earned a degree in art education from UMaine in 1990 and went on to teach art in schools in Milford, Bradley and Alton. She also teaches painting courses in the Gateway Seniors Without Walls program.

Like so many of Lewis' students, Bosse took every course she could from him as an undergraduate. When it came to his last class this past spring, before he retires in August, she and a handful of former students had to enroll.

"I've tried to be the kind of teacher he is, approaching students gently, being understanding of their feelings," says Bosse. "He always picked out something good, but he didn't accept it just to make you feel good. He would give you

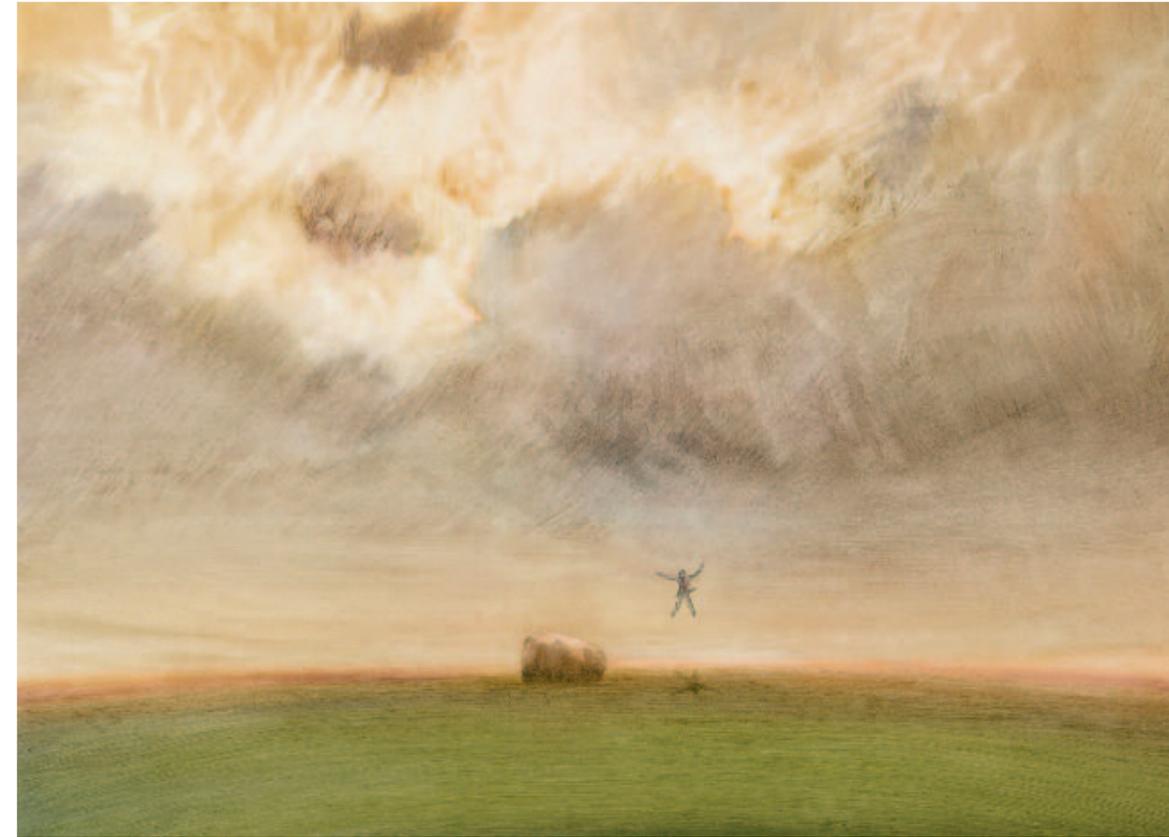
what you needed and asked you the hard questions. He didn't make it easy."

Charles Yoder was a student from Dedham, Maine, who studied art from 1966–69 at UMaine. In the early '70s, he worked in the Leo Castelli Gallery that represented such artists as Andy Warhol and Robert Rauschenberg. Then, for nearly a dozen years, Yoder curated for Rauschenberg.

In 2002, Yoder's exhibition at UMaine, *Natural Resources*, featured 23 oils on canvas. Two years later, he was in a group exhibition at Vose Galleries in Boston: *Realism Now: Traditions & Departures, Mentors and Protégés*.

His mentor featured in the show: Michael Lewis.

"I feel in his work what I hope to realize in my best work: for lack of a more exacting word, a Zen-like quality," Yoder says. "There is a rhythm and cadence, like good music. They offer restoration."



Jumping Towards the Light #2, 2007

Today, in addition to being a sought-after artist, Yoder teaches silk screen and lithography at the School of Visual Arts in New York City, a gig he's had for almost 40 years.

"I like the exchange between (me) and the students and the other instructors," he says. "I feel at ease in my role and responsible to help wherever and whenever I can. I think I may have got these basic ideas from Mike. Also this thing that, by doing your art in a serious and continuous manner, you become a positive example to your students and to yourself."

Leslie Bostrom was a UMaine first-year student from Poughkeepsie, New York when she took an evening painting class from Lewis in 1970 that changed her major — and her life.

"What has always resonated with me was his pure enthusiasm for the art-making process, his intellectual engage-

ment with art theory and history, his unbending code about the importance of production (spending many hours in the studio) and his emphasis on the primacy of drawing and observation," says Bostrom, who earned an MFA in painting from the Rhode Island School of Design, and is an artist and professor of art at Brown University.

She teaches painting, printmaking and drawing.

"Michael believed in craft, but also in stretching the rules and allowing for contingency. He had an essentially democratic attitude toward style and an eclectic curiosity about everything, encouraging a wonderful openness to experimentation.

"I'll be forever grateful that Michael was my first teacher and mentor," Bostrom says. "I was lucky to be able to absorb his wisdom, optimism, creativity and confidence, and carry those with me through my own career." ■



Marine matters

Noah Oppenheim takes his experience from DMC to D.C.

By Beth Staples

THESE DAYS, Noah Oppenheim has swapped his diving gear for a suit and tie. Rather than surveying juvenile lobsters on the floor of the Gulf of Maine, for the last few months he's been researching legislation being taken up on the floor of the House of Representatives.

The University of Maine graduate student is a marine affairs staffer in the Washington, D.C. office of Rep. Jared Huffman of California.

In February, Oppenheim began a yearlong paid Sea Grant Knauss Fellowship that provides educational experiences to graduate students interested in national policy decisions affecting marine and lake resources. It's a natural fit for Oppenheim, who's pursuing a dual master's degree in marine biology and marine policy at UMaine's Darling Marine Center in Walpole.

He is one of two UMaine students who received a 2016 fellowship. Karen Pianka, who also is pursuing a dual master's in marine biology and marine policy, is an executive aquaculture fellow with NOAA's Fisheries Aquaculture Program.

Oppenheim, a native of Falmouth, Maine says he's been adjusting to the climate in Washington, D.C. — political and otherwise. Depending on whether Congress is in session, he may have a succession of 30-minute meetings with constituents, environmental nongovernmental organizations and industry groups. He also briefs Huffman on environment-related matters, and researches and writes bills.

Oppenheim's interest in lobsters, marine science and the environment took shape during a class project at Waynflete School in Portland. During each month's lowest tide, he and other students conducted a census of juvenile lobsters. That project, he says, set him on his academic and career path.

Today, all of those survey sites on the Maine coast are permanently underwater due to the rising sea level.

In California, much of Huffman's six-county district that extends from the Golden Gate Bridge to the Oregon border is in the midst of a multiyear drought. As of mid-

April, the condition of 74 percent of the Golden State ranged from severe drought to exceptional drought.

Oppenheim lived on the West Coast while he earned a bachelor's degree in biology at Reed College.

He has sought out diverse and complementary work and research. The Divemaster has studied the northern red-legged frog, artisanal fisheries and hammerhead shark migration in the Galapagos Islands. He's also been a crew-member on sailing vessels in the South Pacific, worked in the Bering Sea as a groundfish observer for NOAA and as a deckhand on a salmon fishing vessel in Alaska.

Oppenheim made a splash early in his graduate career when he published a paper after recording lobsters cannibalizing their young at night on the ocean floor off Pemaquid Point.

Prior to the fellowship, Oppenheim was the best student oral presenter at a Prince Edward Island, Canada symposium. He shared his predictive models that serve as a warning system for the Gulf of Maine and southern New England lobster fishery.

The models — which utilize juvenile lobster abundance estimates and environmental indicators — forecast that commercial landings may decline in the region in the next several years.

"All good science is accompanied by uncertainty, and my forecasts aren't a perfect window on the future. But, I have a lot of confidence in the power of this new information to help lobster fishermen, dealers and fishery managers make good decisions," Oppenheim says.

"The health of the lobster fishery is a key part of the economic health of the state of Maine. Diagnosing problems early should enhance outcomes significantly."

He credits research professor Rick Wahle, his adviser and mentor, with opening doors and allowing him to piggyback on his years of enlightening lobster research.

Oppenheim says his various work and research projects, and the knowledge he's gaining about policymaking, will enable him to work at the intersection of marine science regulation and fisheries in Maine. ■

Being a deckhand "taught me a lot about **what it means to be a fisherman.** It gave me a lot of perspective."

Noah Oppenheim



Photo by Glori Berry, courtesy of Avian Haven

A northern saw-whet owl rescued Thanksgiving Day 2015 in Turner, Maine recuperates in an outdoor flight cage at Avian Haven in Freedom, Maine. Photo right: UMaine interns Krystal Poulin, left, and Alexandra Jimenez release finches.

For the birds

Avian Haven interns help rehabilitate injured patients for their return to the wild

By Beth Staples

AS A CHILD, Alexandra Jimenez followed squirrels and cracked open nuts for them. Today, her desire to help animals is still strong.

The University of Maine junior from Montville, Maine is majoring in animal and veterinary sciences, with a preveterinary concentration. Much of her academic work has involved cows and sheep at UMaine's J.F. Witter Teaching and Research Center.

But last summer, Jimenez spread her wings. She interned at Avian Haven, a rehabilitation facility in Freedom, Maine dedicated to returning injured and orphaned wild birds to their natural habitat.

The experience, she says, was exhilarating and transformative.

On her first day at the facility, a co-worker

invited her to help feed a barred owl so young it hadn't yet opened its eyes. Nestlings' eyes open after about a week.

"That was my very first day and I was getting my feet wet up to my neck. I have learned more than I ever thought I could about birds," says Jimenez, who is considering minoring in wildlife ecology and wants wildlife rehabilitation to be the focus of her veterinary career.

The toughest part of the internship, she says, is when patients die. While devastating, Jimenez says coping with death is part of life — and this learning experience.

"There's a feeling of accomplishment to see them fly off and start their new life," she says. "It's an unpaid internship, but the abundance of unique experiences makes you feel rich."



In July, Jimenez released finches with intern Krystal Poulin, who graduated in May 2015 from UMaine with a degree in wildlife ecology with a concentration in conservation.

Like Jimenez, Poulin says helping birds heal, grow and gain strength, then take flight is a satisfying part of the incredibly gratifying internship.

Poulin says it's rewarding to reverse the negative impact of human creations and activities — whether that's habitat destruction, cat predation, lead poisoning, or car and window strikes — through wild bird rehabilitation.

Studying wildlife was natural for Poulin, who grew up in Sabattus, Maine in a family of outdoor enthusiasts. She is fascinated by bird anatomy and behavior.

IN THEIR internship, Poulin and Jimenez say they gained an appreciation for the hard work associated with rehabilitative care.

Five days a week, hourly from about 8 a.m. until 8 p.m., they fed wild baby birds, including owls and kestrels. During patient intake, they assisted with examination, feeding, testing for parasites and bandaging wings.

They also cleaned the outside flight cages — there are 14 of varying sizes and shapes built for multiple species — as well as the Pool Hall, an all-season facility for aquatic birds.

Choosing one or two favorite aspects of the internship is difficult, Poulin says, because “every experience every day is my favorite.” Which all added up to helping her solidify her plans.

“When I left college, I had no idea what I wanted to do. I have confirmed that this is definitely something I really, really enjoy,” she says.

“It brings me so much happiness. There are long days and I love every minute of it. Marc (Payne,

Avian Haven co-founder and co-director) told me when you're in rehab and love what you're doing, that you can't tell time.”

The fact Jimenez and Poulin are interested in wildlife rehabilitation as a career is good news for Diane Winn, who opened Avian Haven in February 1999 with Payne.

“Avian Haven's primary mission is returning birds to the wild, but our secondary mission is educating and training rehabilitators,” says Winn, a retired Colby College sensory perception psychologist.

“We hope that some of our interns will be among the next generation of rehabilitators. Others should find their skill sets enhanced by their experiences here, so that they can become more effective in careers such as veterinary medicine or wildlife biology,” she says.

“Alex and Krystal are among the best interns we have ever had, and we look forward to working with more (UMaine) students in the future.”

MARY BIRD would like other UMaine students to have internship opportunities at Avian Haven, as well.

The former UMaine instructor who continues to work with faculty and students in the College of Natural Sciences, Forestry, and Agriculture, is a member of Avian Haven's board of directors and a volunteer driver.

She's committed to helping sustain Avian Haven by growing operating and endowment funds, forging stronger collaborative relationships with UMaine and other institutions, and cultivating the next generation of rehabilitation professionals.

In 2008, Bird was introduced to Avian Haven after helping rescue a chimney swift nesting whose nest had been dislodged in a storm.

She was awed.

“The Avian Haven staff and volunteers didn't cuddle and coo over these creatures, but rather respected their wildness and did all that could be



We hope that some of our interns will be among the **next generation of rehabilitators.** Others should find their skill sets enhanced by their experiences here.” Diane Winn



In 2015, Avian Haven cared for 2,134 birds representing 134 species. Birds are treated for a variety of reasons, including lead poisoning, car strikes and cat predation. Photos clockwise from top left: a patient is fed during intake; Alexandra Jimenez cleans the aquatic tank under the watchful eye of a loon in the Pool Hall; and Krystal Poulin examines an X-ray.

done to minimize the stress of human contact so that when recovered, the birds could return safely and successfully to lives in the wild,” she says.

A bird's release may come days, weeks or months after it arrives. Photos of some releases, including details about where and how the birds were rescued, are shared on Avian Haven's Facebook page.

Each release signifies a healthy beginning and there were numerous fresh starts in 2015 alone. Last year, Avian Haven cared for 2,134 birds — a record number.

Since the facility opened, Winn, Payne and Avian Haven staffers have treated more than 12,000

birds, including loons, herons, hummingbirds, bald eagles, robins, crows, mourning doves, barred owls, falcons, turkey vultures, ospreys, hawks, blue jays, pigeons, starlings and sparrows.

Birds unable to return to the wild sometimes remain at the facility as residents and “adopt” admitted juveniles.

In addition to being educationally valuable, the internship provided Poulin and Jimenez with opportunities to advance part of Avian Haven's mission to “remedy the unfavorable effects of humanity's actions, promote tolerance for the needs of all life, and contribute to balance on Earth.” ■



Phage hunters

In a genomics course, first-year students participate in national research and learn how to think like scientists

By Amanda Clark

THERE IS a long list of learning objectives for the phage genomics course in which first-year undergraduates conduct hands-on research. They learn how to purify and isolate novel bacteriophages — viruses that infect bacterial hosts — from soil samples.

The students learn how to characterize their individual phages — which are around 65 nanometers in diameter and can only be viewed using an electron microscope. The undergrads learn essential laboratory techniques, including microscopy, aseptic methods and comparative genomic analysis.

They learn how to analyze data and design unique experiments. And they learn to read and think like scientists.

But most importantly, the first-year UMaine students learn how to learn. Because without that knowledge, the rest is moot.

“It is not a sink-or-swim situation,” says Sally Molloy, assistant professor of genomics and co-instructor of the course. “We teach students how to learn so they can function in any learning situation in the future, whether that is in STEM fields or the humanities.”

The yearlong course is sponsored by the Howard Hughes Medical Institute (HHMI) and is part of a nationwide program called the Science Education Alliance Phage Hunters Advancing Genomics and Evolutionary Science (PHAGES) research course.

The national program that started in 2008 now involves 70 campuses and 4,800 undergraduate researchers. To date, Molloy says nearly 100 UMaine students have completed the program.

Jillian Doyle of Wilmington, Massachusetts, left, and Tessa Lilley of Winterport, Maine examine plaques made by their phage Cassandra. They are two of the 54 first-year students enrolled in the two-semester immersion course designed to increase and retain undergraduates pursuing degrees in biological sciences.

UMaine's course, BMB/HON 150/155, is a joint effort of the Honors College and the Department of Molecular and Biomedical Sciences. It is now required for all incoming and transfer students in the molecular and cellular biology program.

In the classroom, students try to figure out how their isolated virus is related to many of the others that have been isolated across the United States through HHMI's program.

The procedures students learn to analyze phages closely resemble those used to understand more complex genomes, such as the human genome. By comparing their phage with others that infect the same host, students develop an understanding of the evolution of genomes.

Keith Hutchison, professor emeritus in the UMaine Department of Molecular and Biomedical Sciences, has been teaching the course since its inception five years ago.

"Before we had our first students, I went to a national meeting and I was listening to these students who had just completed their first year presenting their work. I remember thinking, 'I wish my graduate students could talk this well,'" he says.

Hutchison is now amazed when he listens to the first-year students in his own classroom.

"Many institutions don't even have laboratories, let alone a laboratory like this. Often, before the students even get a job, they have to go on to get a master's or a job working in a lab in order to get into graduate school," Hutchison says. "Our students are prepared for that by the time they walk out of the classroom at the end of their first year."

THE MICROSCOPIC phages the students isolate resemble tiny lunar landers that attack bacterial hosts of the species *Mycobacterium smegmatis* — nonpathogenic organisms found in soil, water and plants. Bacteriophages are considered the most numerous biological entity on Earth. For

every bacterium in the world, scientists estimate there are at least 10 phages that can attack it. This makes the phage an incredibly effective educational tool because the amount of scientific discovery available to students is seemingly endless, Molloy says.

Every phage that is isolated is unique.

"Incorporating fundamental research in the classroom is one way to motivate students to become more autonomous learners," says Molloy. "Students cultivate an intrinsic curiosity that promotes independent learning and a desire for more research opportunities outside of the classroom."

In addition, training on a transmission electron microscope (TEM) during a student's first year is almost unheard of, says Kelly Edwards, lab technician for the Electron Microscopy Laboratory.

"The students may have some kind of picture in their mind of what this thing looks like. But when you put it in the TEM, you actually see the creature that you have isolated and grown up and purified. It's really exciting for the students," Edwards says.

The information that students gather helps them classify what type of virus they have isolated, which goes into HHMI's national database.

"It's a big deal," she says.

AT THE end of the first semester, UMaine students select one DNA sample from the isolated phages to get sequenced, which provides the precise order of nucleotides in a DNA molecule. Only one sample is chosen because the process costs around \$1,500, which is covered by HHMI.

When students return for the spring semester, they conduct independent research projects using computer-based analyses to understand the biology of their individual phages and the structure of its genome.

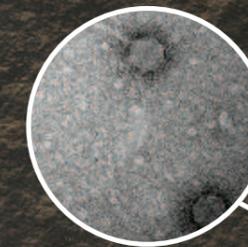
At the end of the year, students make a similar decision about who will represent the class at the national meeting at HHMI headquarters in Virginia.



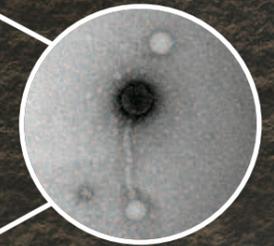
UMaine has pushed me to strive for excellence and has allowed me to pursue research that I never expected I would have the opportunity to do as a first-year student." Ethan Thibault

Discovered phages

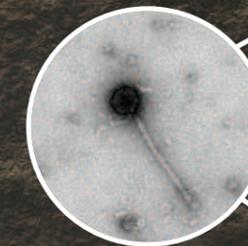
Since 2001, 11 phage genomes have been sequenced and annotated by UMaine students. The viruses found in soil samples are now part of a national database coordinated by the Howard Hughes Medical Institute. Below are images of four UMaine discoveries:



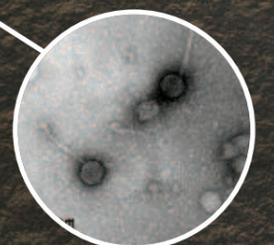
Greg
Isolated by Adam Marcotte and subsequently sequenced



Cassandra
Isolated by Tessa Lilley and Jillian Doyle



IHOP
Isolated by Christian Zwirner and subsequently sequenced



Tabular Gherkin
Isolated by Randall Hernandez and Jenna Lutes

Ethan Thibault, an honors student from Colchester, Vermont who is double majoring in microbiology, and molecular and cellular biology, was one of two students selected in spring 2015 to present at the national phage conference.

"Not only did we get to perform research beyond most freshmen experiences, we gained practice writing manuscripts, and reading and analyzing scientific journal articles," says Thibault, who plans to pursue graduate studies after he graduates in 2018.

"I learned how to be a researcher and skills that will help me for the rest of my scientific career," he says.

Because of those skills, Thibault was accepted to a National Science Foundation Research Experience for Undergraduates, which included a paid internship at South Dakota State University, working with salinity tolerance of prairie cordgrass.

"UMaine has pushed me to strive for excellence and has allowed me to pursue research that I never expected I would have the opportunity to do as a first-year student," says Thibault.

Max Dorman of Keene, New Hampshire, a molecular and cellular biology major in the Honors College, also presented his research at HHMI's national meeting in 2015, alongside Thibault.

"To me, the phage course was what every course should be like," Dorman says. "There was full-group discussion; there was debate; there was learning; there were experiments."

A life-changing skill that Dorman learned in the course was how to develop a growth mind-set. In order to do that, he says, you must "embrace failure as a part of the learning process."

It's a skill that Molloy hopes all her students take from her class because, in science, the answer is not always apparent.

"That's the biggest part of this course — teaching students how to learn, how to apply information to new problems, and to tackle things that would at first seem impossible," she says. ■

THIS FALL, Nicholas Fried of Millers-town, Pennsylvania, the 2016 University of Maine valedictorian, will be an M.D./Ph.D. student at Louisiana State University Health Sciences Center, Schools of Medicine and Graduate Studies in New Orleans. He plans to become a primary care physician in a medically underserved community and conduct research in zoonotic epidemiology. Fried was an honors student who majored in animal and veterinary sciences, with a minor in chemistry. **IN THE LAB:** In the laboratory of UMaine chemistry professor Howard Patterson, Fried assisted in research on the degradation of pharmaceutical contaminants in water. He also collaborated with veterinarian and UMaine associate professor James Weber on his honors thesis research to determine the genetic relatedness of *Haemonchus contortus*, a parasitic worm of small ruminants, found in domestic sheep and white-tailed deer in Maine. **IN THE FIELD:** In 2013–14, Fried spent two summers as a biological

field technician stationed in northeastern Montana, participating in the United States Geological Survey's testing of a sylvatic plague vaccination for prairie dogs. In addition, during one of his spring breaks, he worked at the USGS National Wildlife Health Center in Madison, Wisconsin, assisting in the lab work associated with the project. **IN MEDICINE:** Fried also participated in Michigan State University College of Osteopathic Medicine's Summer Undergraduate Physician-scientist-training Education & Research (SUPER) program. In SUPER, he conducted Lyme disease research and shadowed physicians in multiple disciplines. **IN HIS SPARE TIME:** On campus, Fried was a peer tutor in biology, physics, chemistry, organic chemistry, biochemistry and medical physiology. He was a member of the UMaine Health Professions Club and the service organization Operation H.E.A.R.T.S. Fried also helped found and served as vice president of EWE-Maine Icelandics sheep club at J.F. Witter Teaching and Research Center. ■

Health care

Valedictorian heads into medical research, practice

Space bound

NASA to test prototype of UMaine wireless leak detection system

By Elyse Kahl



UMaine's wireless leak detection devices are expected to be ISS-bound in August. WiSe-Net Lab researchers also are exploring wireless technology with practical applications on Earth, including projects addressing issues related to veterans, aging and rural broadband.

THIS SUMMER, a wireless leak detection system created by University of Maine researchers is scheduled to be onboard a

SpaceX rocket bound for the International Space Station (ISS).

The prototype, which was tested in the inflatable lunar habitat and Wireless Sensing Laboratory (WiSe-Net Lab) on campus, could lead to increased safety on ISS and in other space activities.

This is the first hardware from UMaine in recent history that is expected to function in space for a long period of time, according to the researchers.

In advance of the Aug. 1 launch, UMaine researchers are working with NASA to prepare three of the wireless leak detector boxes for flight.

In April, electrical engineering graduate students Casey Clark and Lonnie Labonte tested the payload, performed an electromagnetic interference (EMI) test, and completed the Phase 2 safety review of the prototype at NASA Johnson Space Center in Houston, Texas.

The project was one of five in the nation to receive funding from NASA-

EPSCoR for research and technology development onboard ISS.

Ali Abedi, a UMaine professor of electrical and computer engineering, was awarded the three-year, \$100,000 NASA grant through the Maine Space Grant Consortium in 2014. Collaborators on the project include Vincent Caccese, a UMaine mechanical engineering professor, and George Nelson, director of the ISS Technology Demonstration Office at the NASA Johnson Space Center.

LEAKS CAUSING air and heat loss are a major safety concern for astronauts, according to Abedi. It is important to save the air when it comes to space missions — find the leak and fix it before it's too late.

The project involves the development of a flight-ready wireless sensor system that can quickly detect and localize leaks based on ultrasonic sensor array signals. The device has six sensors that detect the frequency generated by the air as it escapes into space and triangulate the location of the leak using a series of algorithms. The device then saves the data on SD cards that are sent back to Earth.

The device is fast, accurate and

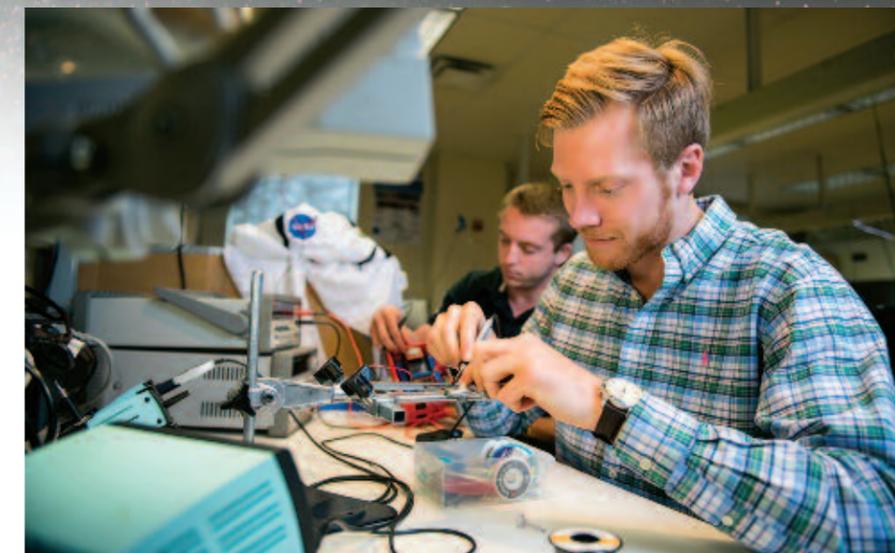
capable of detecting multiple leaks and localizing them with a lightweight and low-cost system, according to Abedi.

"Our goal is to push the boundaries of hardware and software to design a highly accurate, ultra-low-power and lightweight autonomous leak detection and localization system for ISS," says Abedi, who directs the WiSe-Net Lab.

Similar systems on the market require astronauts to walk around with a device, scanning walls to detect holes. The UMaine prototype offers a "set-it-and-forget-it" solution, says Clark of Old Town, Maine, who graduated in May and begins work this summer as a ground segment engineer at SpaceX in Hawthorne, California.

"This is the first step in a very progressive movement to monitor structural parameters of spacecraft and the ISS," says Labonte of Rumford, Maine.

THE PROTOTYPE, developed by Clark and Labonte, includes components that were both created with a 3-D printer and bought off the shelf. Their work followed that of UMaine Ph.D. student Joel Castro and postdoctoral fellow Hossein Roufarshbaf, who developed a leak localization algorithm in a previous NASA EPSCoR project.



In the WiSe-Net Lab on campus, electrical engineering graduate students Lonnie Labonte, left, and Casey Clark collaborated with professor Ali Abedi to develop the leak detector box prototypes.

The additional funding allowed the researchers to make the system more rugged and capable for microgravity environment testing at the NASA Johnson Space Center and, ultimately, onboard the ISS.

ISS astronauts will install the three identical boxes that will collect data for two intervals of about 30 hours.

While the hardware is in space, the UMaine team will be on standby until data collection is completed.

"The system is designed to be auto-

mated. So we do not interact with the device during onboard operations," Clark says.

NASA will send the information to UMaine researchers for analysis and processing.

Once the hardware returns to Earth on a re-entry vehicle sometime next year, the team will observe how well the devices survived the launch, deployment and return, with the intention of proposing a new design for the next generation, the researchers say. ■



Seeing forests *and trees*

Stephen Shaler is on cutting edge of composite product development

By Beth Staples

AS A BOY SCOUT, Stephen Shaler enjoyed camping in the woods and figuring out how things worked. In the 1970s, the environmental movement captured his imagination, particularly as it related to forestry and sustainability. Today, the University of Maine wood scientist who lives lakeside in a forest setting researches how wood products are made and how they can be improved. He says it's rewarding to be at a university where forestry is valued and research makes a positive difference in people's lives.

"Forests are really important to everybody in this world; it's one of most important ecosystems — it's important to animals, it's important to water and it's also important for the products that it gives," says the director of the School of Forest Resources.

"If you've got a sustainably managed forest, there's nothing more environmentally responsible than using that forest to make things for people, for society. That's not all forests are for but that's certainly one of the things."

Shaler is the principal investigator for two projects that involve testing wood and composite materials to determine if they're suitable for building construction.

University of Maine wood scientists and engineers are evaluating the performance of cross-laminated timber (CLT) made from solid-sawn and composite lumber from trees grown in Maine and the northeastern U.S. In the 1990s, CLT was developed in Austria as an alternative to stone and concrete. It was recently incorporated in the International Building Code and can be used in building construction in the United States, providing it meets manufacturing standards. It has been described as plywood on steroids.



For Stephen Shaler, director of UMaine’s School of Forest Resources and associate director of the Advanced Structures and Composites Center, science is a way to improve products and provide innovative, sustainable solutions.



This is the **first new U.S. species to be tested in over 80 years.** There aren’t a lot of new species available for construction material, so historically, it’s **very significant on a lot of fronts.**”

Jeff Easterling

One project is a collaboration with the Northeastern Lumber Manufacturers Association (NELMA). After getting feedback from NELMA about what research would help the industry and forestry managers, UMaine won a \$300,000 grant from the U.S. Department of Agriculture. The competitive grant includes testing wood from trees that members of the Civilian Conservation Corps (CCC) planted during the Great Depression.

In the 1930s and ’40s, the CCC — formed by President Franklin Delano Roosevelt to provide jobs and promote conservation — planted seedlings of Norway spruce, a species native to Europe. The species adapted to soil conditions and grew relatively quickly in the Northeast climate, says Russell Edgar, wood composites manager at UMaine’s Advanced Structures and Composites Center.

Those trees now top 80 feet and are ready to harvest.

While Norway spruce has long been approved for construction in Europe, it must be approved in the U.S. as well because of climate and soil differences. So at UMaine’s accredited testing laboratory, researchers assessed Norway spruce to see if it met U.S. industry standards.

They employed destructive testing — bending, tension, compression and shearing — to learn the strength values of about 1,200 pieces of lumber milled from Norway spruce grown in Maine, Vermont, Wisconsin and New York.

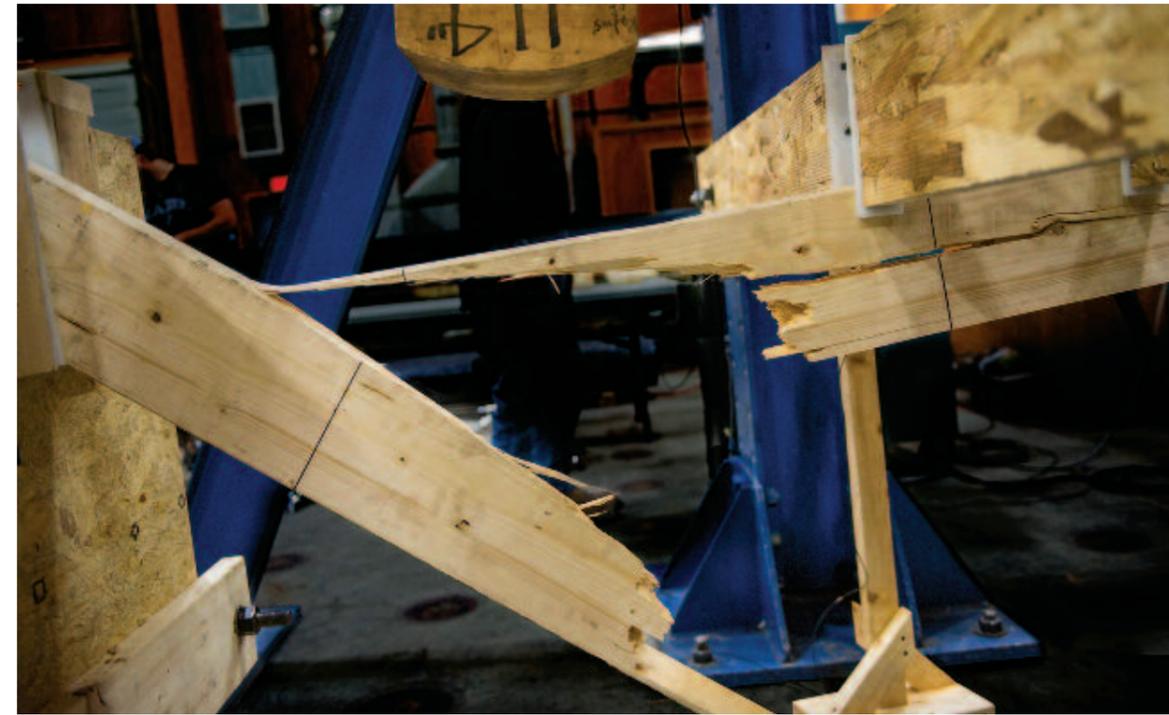
If the lumber meets industry standards, it will be included in the Spruce-Pine-Fir South grouping of species for construction-grade dimensional lumber.

Preliminary evaluation results look promising, says Shaler, an associate director of the Composites Center and professor of wood science.

JEFF EASTERLING, president of NELMA, says being able to introduce Norway spruce into the lumber market is nearly a once-in-a-lifetime opportunity.

“It’s a big deal. This is the first new U.S. species to be tested in over 80 years. There aren’t a lot of new species available for construction material, so historically, it’s very significant on a lot of fronts,” he says.

It’s gratifying that efforts undertaken in the Depression-era could prove to be a boost for today’s economy, Easterling says.



University of Maine scientists and students in the Advanced Structures and Composites Center evaluated strength values — including bending and tension — of about 1,200 pieces of lumber milled from Norway spruce that grew in Maine, Vermont, three regions of New York and Wisconsin. The wood is from some of the 3 billion trees the Civilian Conservation Corps planted during the Great Depression that have grown up to 100 feet in height, with diameters of up to 26 inches.

“We’re reaping benefits of what they (CCC) did,” he says. “It opens up a broader wood basket for mills in the Northeast.”

Jethro Poulin, sales manager at Milan Lumber Co., in New Hampshire, and Alan Orcutt, mill manager at J.D. Irving’s Dixfield Sawmill in Maine, say more lumber translates into added hours for workers, increased production and potentially more jobs.

Having a larger supply of lumber also could enhance East Coast mill operations’ ability to compete, says Orcutt, a UMaine graduate. And if Norway spruce passes the tests, private landowners will be able to sell their timber.

In addition to the economic boost, UMaine students have benefited from taking part in the testing.

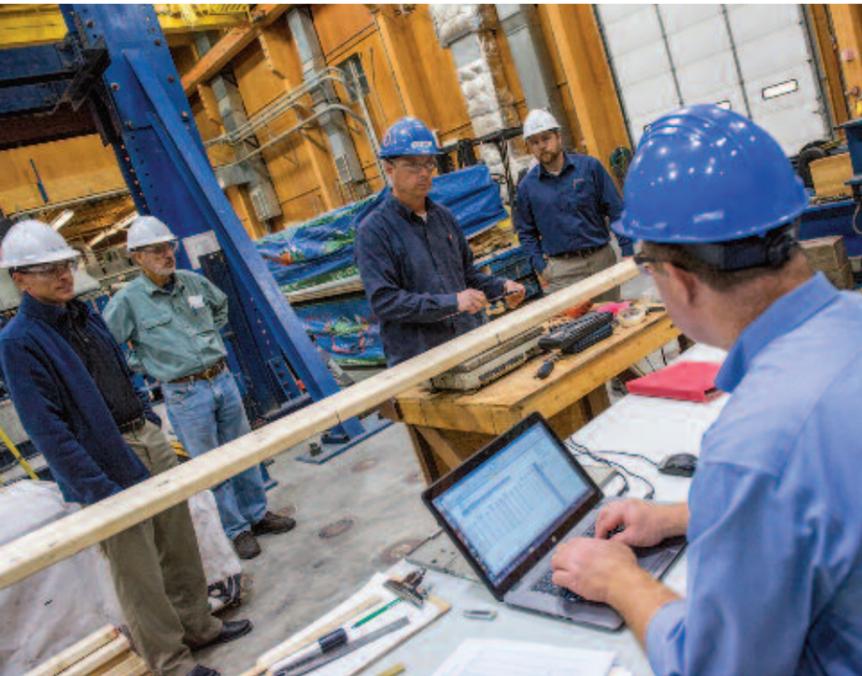
Benjamin Farber, a UMaine undergraduate from Danbury, Connecticut, says being a project research assistant has been one of his best academic experiences.

“I’m learning a lot about the mechanical properties of wood — this is basically my entire field put into this one trial and I’m able to learn step-by-step what’s going on and why it is important to my field,” says the forest operations, bioproducts and bioenergy major who’s concentrating in wood science.

IN A RELATED project, Shaler and colleagues evaluated the performance of cross-laminated timber (CLT) made from solid-sawn and composite lumber from trees that grow in Maine and the northeastern U.S.

CLT is sometimes referred to as plywood on steroids.

The plywood product consists of two-by laminated lumber or composite — two-by-fours, two-by-sixes, or two-by-eights — stacked at right angles — with as few as three and as many as nine laminated layers — and bonded with an adhesive.



The Advanced Structures and Composites Center has an ISO 17025-accredited testing laboratory that is a valuable resource to collaborators such as the Northeastern Lumber Manufacturers Association. Norway spruce was tested to determine if it meets industry standards and can be included in the Spruce-Pine-Fir South grouping of wood species for construction-grade dimensional lumber. Preliminary results look promising, say UMaine wood scientists.

The strong, stable panels are used as full wall segments, as well as in floors and roof systems. The massive timber construction product — developed as an alternative to stone and concrete in the 1990s in Austria — is used in homes and mid-rise commercial buildings in Europe and Canada.

In Europe, CLT has had building code approval for a couple decades. Shaler says CLT structures of 10 or so stories have been built there, and designs have been made for a 60-plus-story CLT and steel building. In Italy, CLT buildings have been erected because of their demonstrated structural integrity during earthquakes, he says.

And since CLT was incorporated in the 2015 International Building Code, it now can be used for construction in the U.S., providing it meets manufacturing standards.

Two firms in the West are approved for manufacturing CLT made with Douglas fir and larch — tree species native to that region, Shaler says.

Enter UMaine to test how CLT made with tree species that grow in Maine and the northeastern forests of the United States fare. University scientists are evaluating the strength, thermal and moisture properties of CLT made with Spruce-Pine-Fir South.

Provided Norway spruce passes U.S. industry standards, it, too, will be part of the Spruce-Pine-Fir South grouping. Pleasant River Lumber in Dover-Foxcroft, Maine has provided the SPF-South lumber for testing.

UMaine also is testing a hybrid CLT panel made from a combination of solid-sawn SPF South lumber, as well as an engineered wood composite — laminated strand lumber (LSL) — produced by Louisiana-Pacific in Houlton, Maine.

IN SUMMER 2015, UMaine graduate student Nicholas Willey led a student team that carefully built about 45 4-foot-by-8-foot CLT panels. They then proceeded to break the panels during tests for flexure, shear, block shear, delamination and fatigue.

Willey and Shaler are collaborating on the project with colleagues in a variety of fields, including Edgar; Bill Davids, professor of civil engineering; Doug Gardner, professor of forest operations, bioproducts and bioenergy; Roberto Lopez-Anido, professor of civil engineering; Robert Rice,

professor of wood science; Mehdi Tajvidi, assistant professor of renewable nanomaterials; and Jaya Tripathi, a master's student in wood science.

In addition to large-scale testing at the world-class UMaine Composites Center, CLT and LSL are being examined on a smaller scale in Nutting Hall. As well as gauging a structure's stability, Shaler says it's necessary to know what the indoor environment of a CLT structure will be like.

That's where Tripathi comes in. The resident of Nepal is evaluating hygrothermal movement — heat and moisture transfer — and thermal insulation value in an LSL-spruce-LSL hybrid CLT design. Sensors embedded in CLT panels measure moisture content, humidity and temperature under a variety of conditions.

If CLT made of SPF South and LSL stacks up well, that could translate into new markets and increased commercial value of forests in the Northeast.

The construction industry is interested in this building system, Shaler says, because crane operators can quickly erect prefabricated CLT structures that have had door and window openings precut at the factory.

CLT has other advantages, Shaler says, including pleasing aesthetics. CLT structures also result in a smaller carbon footprint than structures built with energy-intensive materials, such as steel or concrete.

Trees pull carbon dioxide out of the atmosphere, says Shaler. And when trees are turned into wood for lumber, the absorbed carbon remains sequestered. And after mature trees are harvested in sustainable forests, newly planted trees also remove carbon from the atmosphere.

At the University of Massachusetts, for instance, a four-story, nearly 90,000-square-foot facility being built with cross-laminated timber and a wood-concrete composite is expected to have zero carbon emissions.

Habib Dagher, founder and director of the UMaine Composites Center, says the university's research on new uses for local wood species could open the door for a CLT manufacturer to locate a plant in the state.

"We are now exploring opportunities to build a pilot CLT building in Maine, a project that will bring together Maine architects, engineers, contractors and wood suppliers to build this expertise in Maine," he says. ■



Willey makes a case for CLT

NICHOLAS WILLEY once planned to be a lawyer.

Then, at his mother's suggestion, the then-Caribou High School student attended the free University of Maine Pulp & Paper Foundation program, "Consider Engineering," that gives juniors insight into the field.

"It really opened my eyes to what engineering encompassed," Willey says.

And persuasively made the case for Willey — who enjoys science, math and innovation — to pursue an engineering career.

More than six years later, he's well on his way.

In 2014, Willey earned a bachelor's degree in civil engineering from UMaine. Now he's a graduate civil engineering student and a graduate research assistant at the Advanced Structures and Composites Center.

For his master's project, Willey is collaborating with university wood scientists and engineers to evaluate the performance of cross-laminated timber (CLT) made from solid-sawn and composite lumber from trees that grow in Maine and the northeastern U.S.

He's enjoying learning about properties of wood, as well as developing problem-solving and managerial skills.

Willey says it's also exciting to be part of a project that could benefit people, the environment, industries and the economy.

"You'd like to think the product you're working on is something that will come into light some day so that you can say, 'I put my stamp on that. My name is on that product. I helped develop it. I helped to make it what it is,'" he says.

After he's earned his graduate degree, Willey says he'd like to run his own company and perhaps one day live in a home built with CLT.

Back to the future

Ph.D. student mines ancient coastal middens to inform fisheries challenged by warming Gulf waters

By Beth Staples

AT AGE 7, Sky Heller was captivated digging through a trash heap protruding from an eroding bank near her family's old farm in the foothills of rural Pennsylvania. "When I found out I could do it for a career, I've never looked back," says the Ph.D. student in anthropology and environmental policy at the University of Maine.

These days, the only looking back Heller does is to explore the past with the intent to inform the future.

It's important to her that archaeology — or knowledge gained from studying past humans through material remains — is directly relevant for people today.

Heller earned her master's in quaternary climate studies with a focus in prehistoric archaeology from the university's Climate Change Institute (CCI). She also is a Chase Distinguished Research Assistant.

For two years, she was an Integrative Graduate Education and Research Traineeship (IGERT) Research Fellow. IGERT, sponsored by the National Science Foundation, is a program of CCI and the School of Policy and International Affairs. Its focus is adaptation to abrupt climate change.

For her Ph.D. project, Heller is analyzing 4,200-year-old small fish bones from middens — ancient trash heaps — along the coast with the goal of benefiting future fisheries in the continually warming Gulf of Maine.

As she told visiting middle-school students at the Hudson Museum's Archaeology Day: "I look at people's garbage and figure out what they ate."

Zooarchaeology — analysis of animal remains from archaeological sites — reveals what people ate and what the environment was like during a time period.

Heller is exploring a number of topics, including fish behavior, biology and fish morphology, tides and ocean circulation in the Gulf of Maine and North Atlantic region, fisheries policy, archaeological theory and anthropological theory.

"I was accused once of having academic schizophrenia," she laughs. "With archaeology, it's all right to be interested in everything."

In addition to answering an interesting archaeological question and filling a gap in New England history, Heller's findings may prove useful to people who

In Sky Heller's lab on campus, there is more than a ton of soil containing 4,200-year-old fish remains and shells.

5 tools archaeologists dig

- ✓ Camera
- ✓ Notebook
- ✓ Trowel
- ✓ Marker
- ✓ Screen



want to catch fish in the Gulf of Maine — just as people have for the past 10,000 years.

Scientists say the Gulf — sometimes called a sea within a sea — is warming faster than 99 percent of the planet’s oceans.

SINCE THE early 1980s, the temperature in the Gulf of Maine, which extends from Cape Sable in Nova Scotia to Cape Cod in Massachusetts, has annually climbed about a half-degree. Estimates indicate its temperature will climb another 4 degrees Fahrenheit by the end of this century.

To prepare for that future, Heller is investigating what the Gulf’s ecosystem was like 4,200 years ago. It was warm then, too, likely because of how it developed as a body of water rather than because of human-caused climate change.

To learn which small fish species thrived then in the Gulf of Maine, Heller excavated three rapidly eroding archaeological sites from the Archaic period (approximately 10,000 to 3,000 years ago) along the coast of Maine and New Hampshire.

Many days last summer, Heller and a research team dug at a site in Seabrook Marsh, in the shadow of Seabrook Station nuclear power plant in New Hampshire. The team included Brian Robinson, her adviser and an associate professor in the Department of Anthropology and CCI, and the recipient of the 2016 College of Liberal Arts and Sciences Teaching and Advising Award; anthropology major Emily Blackwood from Auburn, Maine; and Peter Leach, a doctoral student at the University of Connecticut and UMaine alum.

It also included Heller’s husband, Andrew Heller, an archaeologist, and Richard Boisvert, state archaeologist for New Hampshire.

To reach the midden, they timed the outgoing tide to have enough water to paddle canoes from the launch site through a canal to the bay, then toward the site in a salt marsh in another canal. When the midden was exposed during a four-hour window around low tide, the team dug, took photographs and did paperwork.

The results: more than a ton of soil containing 3,600- to 4,200-year-old tiny fish bones and shell remnants. That soil now fills more than 100 plastic gallon bags in her lab.

Last year, Heller also excavated a site in Blue Hill, Maine. And two summers before that, she collected fish remains and shells from a site in Sorrento, Maine. She says it was critical to complete excavation at these valuable sites because sea-level rise and extreme weather are swiftly eroding them.

The team also collected soil for future archaeologists to have material to explore questions they want to answer about the same time period.

Heller says prior research, including that by UMaine professor emeritus David Sanger, revealed that swordfish, a warm-water species, lived in the Gulf of Maine up to about 4,200 years ago.

Swordfish remains, as well as tools made from the upper jaws of the predatory fish, have been recovered. But around 4,200 years ago, Heller says swordfish — which move to warmer water in the winter and cooler water in the summer — suddenly disappeared from the Gulf of Maine. And oysters and quahogs, no longer present in significant numbers in the Gulf, did exist then in large quantities.

The reason, she says, may involve currents.

Today, the cold water in the Labrador Current flowing south from the Arctic Ocean feeds the Gulf of Maine. But when the Gulf formed around 15,000 years ago during the glacial retreat, the Labrador Current may have been weaker.

In that scenario, the powerful Gulf Stream from the Gulf of Mexico could have coursed into the Gulf of Maine. Fish that follow the warm Gulf Stream, including swordfish and other smaller warm-water species, would have come with it.

DURING PRIOR digs at the sites, Heller says archaeologists didn’t screen for tiny bones of small fish. The fish bones she identifies and analyzes may provide insight into what a healthy, warm Gulf of Maine ecosystem was like prior to massive fishing pressure.

It also could provide information about how the abrupt cooling affected the Gulf of Maine ecosystem and the marine resources that people relied on culturally and economically.

The record, Heller says, will reveal changes in marine species’ ranges in what’s called a temperature-driven alternate ecological state.

The Gulf, she adds, may be returning to such a state.

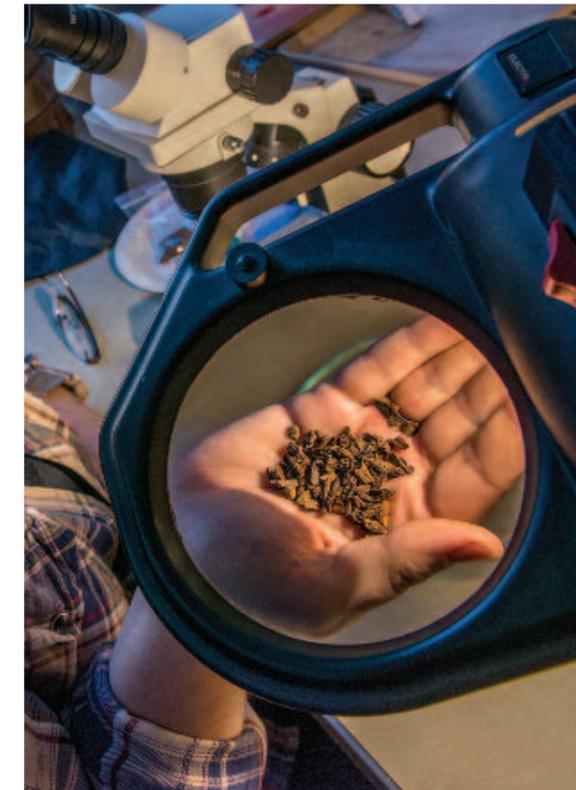
In 2012, NOAA reported the average sea surface temperature from the Gulf of Maine to Cape Hatteras, North Carolina was the warmest in 150 years (57.2 degrees F). The prior 30-year average was 54.3 degrees F.

The warming has had consequences for those who fish.

One recent ripple effect was the record-setting ocean heat wave of summer 2012, the ensuing early glut of lobsters in Maine and the subsequent price crash. Lobsters and cod are two traditional Gulf species that are on the move north into cooler waters, Heller says. And black sea bass also are moving north — farther into the Gulf.

According to a 2009 NOAA report, for 40 years, half of 36 fish stocks being studied in the Northwest Atlantic Ocean have been migrating north.

Heller will share her findings with people who fish for a living, and with marine stakeholders who craft conservation and sustainability policies aimed at helping fisheries adapt as the Gulf warms. ■



Sky Heller examines soil for fish bone fragments.



THINK CHOCOLATE

PEOPLE WHO ate chocolate at least once a week performed better on multiple cognitive tasks, compared to those who ate chocolate less frequently, according to a new study

Researchers hypothesized that **regular intake of cocoa flavanols** may be one of several mechanisms explaining the **cognitive benefits of chocolate.**

by researchers at the University of Maine, University of South Australia and Luxembourg Institute of Health that has garnered international attention.

The research team — University of South Australia nutritionist and psychologist Georgina Crichton; UMaine psychologist and epidemiologist Merrill “Pete” Elias; and cardiovascular researcher Dr. Ala’a Alkerwi of the Luxembourg Institute of Health — published their findings in the journal *Appetite*.

With age, education, gender and race controlled, cognitive tasks underwent multiple tests. In addition to improved cognitive performance, those who ate chocolate weekly, compared to those who never or rarely did, had higher total and LDL cholesterol, but lower glucose levels. Hypertension and Type 2 diabetes also were lower in regular chocolate consumers. Positive associations between chocolate eating and cognitive performance remained with control for these variables, other risk factors for cardiovascular disease, and consumption of other food and beverages.



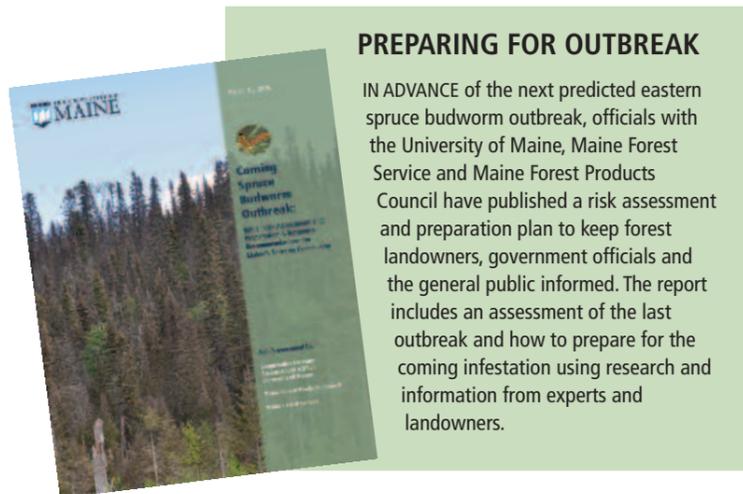
FIVE YEARS OF RISING TIDE

THE ADVANCE Rising Tide Center at the University of Maine marked its fifth anniversary this spring. Funded by the National Science Foundation, the program seeks to develop systemic approaches that can be institutionalized at colleges and universities to increase the representation and advancement of women in academic science, technology, engineering and mathematics (STEM), and social-behavioral science careers.

The initiative also has improved hiring, mentoring, peer-review, and promotion and tenure processes across the campus, says Jeffrey Hecker, ADVANCE principal investigator, and UMaine’s executive vice president for academic affairs and provost.

“The Rising Tide Center has elevated and enriched the UMaine community. We’ve come a long way in five years,” he says, “and commit to continuing the work.”

This fall, the ADVANCE Rising Tide Center will become the UMaine Rising Tide Center. Its mission will expand to include female faculty from all disciplines, with the goal of improving gender equality on campus and throughout the community.



PREPARING FOR OUTBREAK

IN ADVANCE of the next predicted eastern spruce budworm outbreak, officials with the University of Maine, Maine Forest Service and Maine Forest Products Council have published a risk assessment and preparation plan to keep forest landowners, government officials and the general public informed. The report includes an assessment of the last outbreak and how to prepare for the coming infestation using research and information from experts and landowners.

sprucebudwormmaine.org



INTOXICATION CAN lead to risky behavior. In copepods, that can get them killed.

Rachel Lasley-Rasher studies the tiny crustaceans that become intoxicated from grazing on blooms of toxic phytoplankton. The University of Maine marine researcher says the common calanoid copepods *Temora longicornis* show no immediate adverse health effects after eating the harmful algal bloom species *Alexandrium fundyense*. But their behavior changes rather dramatically.

After ingesting the toxic phytoplankton, copepods swim faster and straighter than usual, says Lasley-Rasher, who is based at the Darling Marine Center. This ramped-up behavior increases their encounters with predators by as much as 56 percent, which means they’re more likely to be eaten.

By swimming faster and straighter, they are displacing themselves farther in their environment, increasing the probability of a predatory encounter. They’re also creating a larger wake, allowing predators to detect them from a greater distance.

“Copepods swimming in a more risky manner could have larger consequences on the ecosystem,” says Lasley-Rasher. “Predators consuming ‘intoxicated’ copepods allow the toxin to travel up the food chain. Further, as these copepods are consumed, fewer remain to control the spread of the harmful algal bloom.”

ADVANCING STEM TEACHING

THE MAINE Center for Research in STEM Education (RISE Center) at the University of Maine has been awarded more than \$1.9 million from the National Science Foundation to create a model NSF Teaching Fellowship Program to improve STEM teacher recruitment, preparation, professional development and retention in rural high-need schools.

The grant builds on the infrastructure created in the Maine Physical Sciences Partnership (MainePSP) and the Maine Elementary Sciences Partnership (MaineESP), including teacher leadership. The MainePSP is a collaboration among the RISE Center, almost 30 Maine school districts and some nonprofit partners, including the Schoodic Institute, the Maine Mathematics and Science Alliance, the Institute for Broadening Participation, and the Maine Department of Education.

The grant will support 22 fellowships in a six-year program for STEM professionals and recent graduates with bachelor’s degrees in science, technology, engineering or mathematics. Students awarded fellowships will enroll in UMaine’s Master of Science in Teaching Program to earn teaching certification, and will make a four-year commitment to teach in high-need Maine school districts. The first cohort will begin in fall 2016.

“This grant will help **empower our next generation of STEM educators** as they work to equip rural Maine students with the skills they need to succeed in the 21st century.”

Sens. Susan Collins and Angus King





SHARP FOCUS

TRASH AND pollutants often end up in tidal marshes — the intersections between land and sea. And sea-level rise, frequency of storm surges and coastal development also harm the reservoirs that teem with life.

That makes it tough for songbirds, including saltmarsh sparrows, who mate, build nests and feed in tidal marshes. The dearth of saltmarsh sparrows is one of the findings of University of Maine scientists and researchers from collaborating universities and agencies participating in the five-plus-year project of the Saltmarsh Habitat & Avian Research Program (SHARP).

The cooperative undertaking included about 200 participants who estimated the population sizes of 23 wetland bird species across nearly 2,000 surveyed locations in 10 states from Maine to Virginia. SHARP’s mission is to promote long-term conservation of tidal marsh birds and the ecosystem that supports them by advising research-based management action in the northeast U.S.

Since 1998, the number of saltmarsh sparrows has dropped nearly 11 percent annually in Maine, says UMaine research professor Brian Olsen, a principal investigator with SHARP. That means the birds are on a path to extinction in 50 to 80 years.

“ We know we’re losing tidal marsh habitats on the East Coast. **We know we’re losing birds** in those marshes and we know that local actions can halt those losses.”

Brian Olsen

MAINE ECONOMICS

THE MAINE Development Foundation (MDF) and University of Maine School of Economics (SOE) are releasing a series of quarterly reports analyzing critical economic indicators in the state.

Among its programs, MDF staffs the Maine Economic Growth Council, an independent body created to develop a long-term vision for Maine’s economic growth and develop indicators to assess progress toward that vision. The council publishes “Measures of Growth,” an annual report analyzing the state’s progress on more than 20 critical economic indicators. The quarterly economic reports by MDF and SOE further explore these topics.

The first quarterly economic report, “Productivity in Maine,” was written by UMaine economics professor Todd Gabe in 2013. Since then, six more reports have been issued on topics, including water quality, energy and land conservation.

The latest report, “The High Seasonality of Tourism in Maine,” also was written by Gabe and was released in February 2016.



TALLEST CHESTNUT

FORESTERS WITH the Maine Forest Service and the University of Maine have measured what is believed to be the tallest American chestnut tree, *Castanea dentata*, in North America, exceeding the height of the next-tallest known tree by 20 feet.

The 115-foot-tall tree is growing in a reserved forest in Lovell, Maine on land bequeathed to the University of Maine Foundation. The Volk family owned the property for more than 100 years prior to donating it to the foundation. Douglas Volk (1856–1935) was a famous American portrait and landscape painter.

The discovery of this tree is significant. The species has been ravaged by an invasive blight. It is estimated that there are only a few dozen large surviving trees.

The Maine Chapter of The American Chestnut Foundation has partnered with UMaine’s Barbara Wheatland Geospatial Analysis Laboratory to use remote sensing from airplanes to help locate the few remaining native American chestnut trees in an effort to conserve the genetics, and to learn about the soils and forest conditions in which they are growing.

POPULAR POSTS

■ **Holocene climate**

Paul Mayewski, director of the University of Maine Climate Change Institute, has been rated one of the most-cited and influential climate change authors. His article “Holocene climate variability” was ranked No. 58 of the all-time top 100 papers on climate change by Carbon Brief, a website in the United Kingdom that covers developments in climate science, climate policy and energy policy. As of August 2015, Mayewski’s paper, published in November 2004 by *Quaternary Research*, had been cited 852 times.

■ **Gender roles**

“Gender Roles and Society,” a 2003 encyclopedia entry by University of Maine sociology professor Amy Blackstone, is the most downloaded, full-text article currently available in DigitalCommons@UMaine. The article’s had nearly 20,300 downloads. Digital Commons is a service coordinated by UMaine’s Fogler Library.

■ **School reform**

Ian Mette, an assistant professor of educational leadership at the University of Maine, had the most downloaded article of 2015 in the *Journal of Cases in Educational Leadership*. The paper, “Turnaround, Transformational, or Transactional Leadership: An Ethical Dilemma in School Reform,” appeared in the December 2014 issue. It was downloaded more than 1,500 times last year, according to the journal’s website.



2.3 million views

University of Maine Cooperative Extension’s Experts on Demand video, “How to Look for and Avoid Bedbugs in Hotel and Motel Rooms,” by Extension Professor James Dill went viral when cited by online media.



HEARING BATS

ERIK BLOMBERG, assistant professor in the Department of Wildlife, Fisheries, and Conservation Biology at the University of Maine, wanted to bring the massive

declines in bat populations to the public's attention and to educate residents about the extensive services that the animals provide to humans.

He also wanted to improve monitoring methods used to evaluate Maine's bat populations to increase efforts to conserve them.

Blomberg has created a pilot citizen science-based bat-monitoring project called BatME to test the feasibility of using handheld detectors to monitor bat populations in Maine.

Two months in summer 2015, 20 Maine Audubon volunteers collected more than 4,000 detections of bats with handheld bat detecting units produced by Wildlife Acoustics. The equipment — purchased with funding from the Maine Outdoor Heritage Fund — included an acoustic microphone that attaches to an iPad, recording bat echolocation calls and identifying the species.

Maine is home to eight species of bats, three of which are protected under the Maine State Endangered Species Act.



MAINE SCHOOLS IN FOCUS

THE COLLEGE of Education and Human Development at the University of Maine has launched a new online resource, "Maine Schools in Focus," for educators and policymakers statewide.

The website features informative, research-based briefings to enlighten and stimulate dialogue about issues in Maine public school education today.

"Our goal is to advance the cause of our children and schools by making these issue-focused resources available to anyone interested in public education and its future in Maine," says Susan Gardner, interim dean of UMaine's College of Education and Human Development.

Gordon Donaldson, UMaine professor emeritus of education, serves as editor and wrote the first three "Maine Schools in Focus" posts. He works with an advisory board that includes Associate Research Professor Janet Fairman, Lecturer in Educational Leadership George Marnik, Associate Professor of Educational Leadership Sally Mackenzie and former MSAD 75 Superintendent J. Michael Wilhelm.

Other authors are expected to include College of Education and Human Development faculty and school leaders in Maine spanning different educational disciplines. Contributions from the public are welcome.



COLD CORALS IN WARMING WATERS

EARLIER THIS year, students Ashley Rossin and Elise Hartill spent five days collecting red tree corals, *Primnoa pacifica*, from the Tracy Arm fjord near Juneau, Alaska.

The corals were collected off the fjord's wall, as deep as 100 feet below the ocean's surface. Red tree corals are normally found in deep water, but the fjord creates an effect called deep-water emergence, where deep-sea organisms can live at shallower depths because the conditions are the same, says Rossin.

The research team, led by professor Rhian Waller, is evaluating how pH and temperature changes affect the development and efficiency of cold-water coral reproduction. The researchers hope their observations will shed light on the implications climate change will have on coral organisms and marine ecosystems.

Live corals were shipped for analysis to a lab on Kodiak Island. The samples also will come to Maine, where researchers at UMaine's Darling Marine Center will evaluate changes in morphology and reproduction under experimental conditions.



MAPPING THE HUMAN EXPERIENCE IN HISTORY

A UNIVERSITY OF MAINE-led digital humanities research project to study and, ultimately, "map" how Holocaust survivors use spatial terms to describe their experiences has been awarded a more than \$73,000 grant from the National Endowment for the Humanities.

UMaine Professor of History Anne Knowles, a pioneer in applying a geographic information system (GIS) to history, was awarded the NEH Digital Humanities Start-Up Grant for the project, "Visualizing Spatial Experience in the Holocaust."

Spatiality refers to experiences, both lived and imagined, that are embedded in space and time.

In the Holocaust, two kinds of spatiality operated simultaneously — the spatiality of Nazis and of their victims. The Nazis created and destroyed many places in order to carry out the Holocaust. Their victims also shaped places to the extent they could. Both groups experienced the places of the Holocaust and endowed them with meaning, significance and emotion.

"Maintaining the complexity of these spatial perspectives is essential to a full understanding of the geographies of the Holocaust," said the seven-member research team. "Our long-term goal is to develop historical-geographical methods to visualize, analyze and integrate the complex spatial interactions between and among perpetrators and victims of the Holocaust, including built, planned and experiential landscapes."

Knowles has edited several books on historical GIS and is an internationally recognized leader in the digital and spatial humanities. Her many awards include a 2015 Guggenheim Fellowship.

In her digital humanities research, Knowles has studied the spatiality of Nazi plans and actions by building historical GIS data sets of concentration and labor camps, creating new mappings of the spatial implementation of the Holocaust.

This project could be a first step toward development of a methodology to enable close, comprehensive analysis of the spatialities of human experience at the scale of significant historical events, such as the Holocaust, the researchers say.

Historian Anne Knowles and her research team will develop a new hybrid methodology to study the **spatial, experiential context of Holocaust survivor testimony.**

AWARD-WINNING ATLAS

HISTORICAL ATLAS OF MAINE has received the 2016 American Association of Geographers Globe Book Award for Public Understanding of Geography. The atlas, the result of a 15-year scholarly project led by University of Maine researchers, offers a new geographical and historical interpretation of Maine, from the end of the last ice age to the year 2000. The volume was published by University of Maine Press, a division of UMaine's Raymond H. Fogler Library. The folio-size *Historical Atlas of Maine* is edited by UMaine historian Richard Judd and UMaine geographer Stephen Hornsby, with cartography by Michael Hermann. It tells the principal stories of the many people who have lived in Maine over the past 13,000 years — the history of Native peoples, European exploration and settlement, the American Revolution, Maine statehood, agricultural and industrial development, and the rise of tourism and environmental awareness.

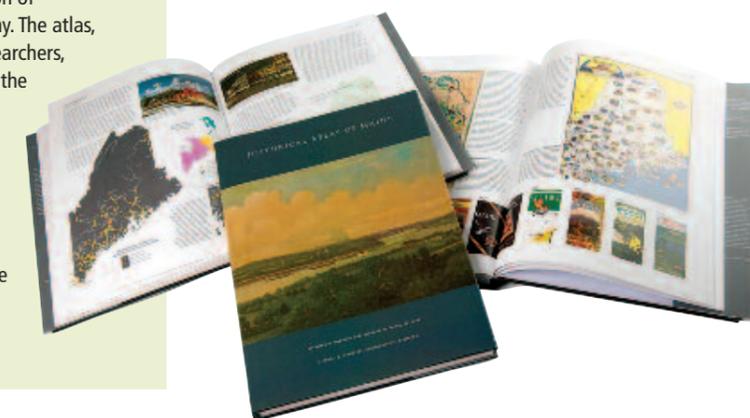




Photo by Edwin Remsberg

RECORD HARVESTS

IN 15 YEARS, University of Maine Cooperative Extension's statewide Maine Harvest for Hunger program has distributed more than 2.19 million pounds of food to people in Maine experiencing food insecurity. In 2015, record-breaking donations of over 318,000 pounds of food went to 188 distribution sites and directly to individuals. Nearly 500 program volunteers in 14 counties collectively logged more than 5,000 hours.



FALKLAND ISLAND TWEETS

FOR A second year, University of Maine Cooperative Extension 4-H connected K-12 students in Maine and across the country to UMaine researchers in the field as part of its Follow a Researcher™ program.

The program gives students a glimpse into a scientist's world by providing live expedition updates, including tweets, and facilitating communication between the youth and scientist. It is offered by UMaine Extension with support from UMaine's Climate Change Institute (CCI) and the Maine 4-H Foundation.

In January and February, participants watched as Kit Hamley, a graduate student at CCI, traveled 300 miles off the southeastern coast of South America to the Falkland Islands, home to some of the world's largest penguin, seal and seabird colonies.

Hamley, who is pursuing a master's degree in quaternary and climate studies, is researching an extinct species of fox called the warrah. The animal was the only native terrestrial mammal in the Falklands at the time of European arrival in the 1760s, Hamley says, and the last one was hunted to extinction in 1856. Using field and laboratory techniques, she hopes to learn how and when the animal arrived in the Falklands.



**MANDELA
WASHINGTON
FELLOWSHIP**
FOR YOUNG AFRICAN LEADERS

THE UNIVERSITY OF MAINE has been selected as one of 37 institutions nationwide to partner with the Mandela Washington Fellowship for Young African Leaders. Beginning in mid-June, UMaine will host 25 emerging public management leaders from Sub-Saharan Africa for a six-week academic and leadership institute, sponsored by the U.S. Department of State.

The Mandela Washington Fellowship, the 2014 flagship program of President Obama's Young African Leaders Initiative (YALI), empowers participants through academic coursework, leadership training, mentoring, networking, professional opportunities and support for activities in their communities. Fellows have established records of accomplishment in promoting innovation and positive change in their organizations, institutions, communities and countries.

The 25 Mandela Fellows at UMaine are among 1,000 young African leaders ages 25 to 35 who were selected from more than 43,000 applications.



I use the IRA charitable rollover to make annual gifts and to add to our endowed scholarship. I ask the administrator to send the checks directly to the Foundation. It is efficient from a tax standpoint, and a convenient way that my wife and I can **support the programs we care about at the university.**" Gary Cran '62



Photo by Dave Cleveland, Maine Imaging

Using the Charitable IRA Rollover

THE PROTECTING Americans from Tax Hikes (PATH) Act of 2015 made permanent the Charitable IRA Rollover provision of the Pension Protection Act of 2006. A taxpayer age 70½ or older may roll over — transfer — up to \$100,000 annually from his or her individual retirement account (IRA) or Roth IRA for a qualified charitable distribution. The amount transferred will be excluded from the income of the taxpayer for federal income tax purposes. The amount transferred does not generate a charitable income tax deduction, but it does count toward the taxpayer's minimum required distribution.

Through strategic use of the IRA charitable rollover:

- Avoid a higher tax bracket than might otherwise result from taking a required minimum distribution into income
- Complete a pledge or create a fund
- Advance a bequest already planned for the university and receive a tax benefit
- Make a significant lifetime gift and enjoy the impact
- Support favorite charities with annual gifts

Please contact the University of Maine Foundation if you need assistance with sample transmittal letters, or if you would like to discuss making the Foundation a beneficiary of any portion of your retirement funds.

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