FALL | WINTER 2019

UMaine Today

CREATIVITY AND ACHIEVEMENT AT THE UNIVERSITY OF MAINE

GOING TO EXTREMES What can Everest tell us about our planet's future?

Raymond H. Fogler Library at the University of Maine is the state's largest library. For countless members of the UMaine community, Fogler Library is "the third place" in their lives, behind those places they call home and work. For an estimated 550,000 visitors annually, it is a foundation for research, study, reading and gathering. With over 750,000 annual page views, Fogler Library's website serves as a gateway to its collections, including online resources accessed 1.9 million times a year.
Photo by Adam Küykendall

Enjoy this outstanding edition of *UMaine Today* — such a fine testament to the variety of creative, scholarly and research accomplishments of our university. This issue looks closely at the fascinating activities going on all around us. You will find reports of "High achievers," the Mount Everest expedition team, and "Framing Maine," a beautiful photo-essay that celebrates Maine's bicentennial and history.

Everyone learns best, and innovation happens, when engaged in doing meaningful work. This issue demonstrates many examples of teams working together to discover and learn — students with faculty, students with other students, and faculty collaborating with colleagues at other institutions. These include such pieces as "What's the attraction?" a story about research on Maine songbirds, and "Secondhand chic," about the culture of reuse.

Our goal moving forward is that all students — graduate and undergraduate — have the opportunity to be a part of research or scholarly activity as a fundamental part of their UMaine experience. In fact, for the 2019–20 academic year, we will focus on one of our new Strategic Values, that of "fostering learner success." A key element of that initiative, which I call "research learning," is to bring more research into the classroom, encouraging faculty to incorporate their own research and scholarly activity into their daily classroom explorations.

We at the University of Maine are so excited about all of the extraordinary accomplishments that are taking place on our campus, across our state and, indeed, throughout the world. Enjoy these articles. And I invite you to send me an email to let me know what you think, umpresident@maine.edu.

Joan Ferrini-Mundy
President

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Photo by Mariusz Potocki

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UMaineToday online

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Maine Environmental DNA initiative to support coastal ecosystems

A $20 MILLION GRANT from the National Science Foundation EPSCoR program will fund a five-year initiative that aims to revolutionize environmental monitoring, ecological understanding and sustainability of coastal ecosystems.

The University of Maine is partnering with Bigelow Laboratory for Ocean Sciences and other collaborators in education, government agencies, citizen's groups and local industry statewide.

The Maine Environmental DNA (Maine-eDNA) initiative represents a multi-institutional partnership that will position Maine as a national leader in the understanding and sustainable use of coastal ecosystems, and in addressing the statewide workforce needs in critically important areas, including biotechnology, ecology, environmental and data sciences, says principal investigator Kody Varahramyan, UMaine vice president for research and dean of the Graduate School.

Organisms leave traces of DNA, the universal code for life, wherever they go — in the water, air or soil. **These traces can be collected, identified and linked back to those species, much like evidence at a crime scene.**

Environmental DNA (eDNA) is like a genetic fingerprint of a marine ecosystem. Organisms leave traces of DNA, the universal code for life, wherever they go — in the water, air or soil. These traces can be collected, identified and linked back to those species, much like evidence at a crime scene.

The resulting data can show where, when and how species and groups of organisms have interacted with each other and their coastal habitats.

Collected eDNA can be combined into larger and more comprehensive data sets that scientists can reanalyze to answer ever-evolving questions about how coastal systems work — and what makes them resilient or susceptible to change.

The Maine-eDNA program will continue statewide, multi-institutional marine-related research following the completion of the Sustainable Ecological Aquaculture Network (SEANET) program, the NSF EPSCoR project awarded in 2014. As noted in the newly released University of Maine System *Research and Development Plan*, Maine EPSCoR has a critical role in improving R&D infrastructure and capacity statewide. ◆

In the project, whole shell geochemical analysis will be conducted on populations of foraminifera, single-celled organisms found throughout the fossil record. Materials from coastal archaeological sites also will be radiocarbon-dated to refine the chronology of regional fishing practices.

11,000 years of Gulf of Maine temps

TO ENHANCE LONG-TERM ENVIRONMENTAL PREDICTION AND PLANNING, a five-year study led by a University of Maine paleo-oceanographer will focus on the past 11,000 years of Gulf of Maine temperature trends and variability.

Katherine Allen, a UMaine assistant professor in the School of Earth and Climate Sciences, and the Climate Change Institute, has received a more than $584,000 National Science Foundation CAREER Award to study Gulf temperatures from the early Holocene to the present. That includes the last 30 years when the Gulf of Maine has been warming faster than most of the rest of the world's oceans.

The award follows an NSF-funded collaborative research project led by Allen in 2016 that focused on Pacific Ocean stratification since the last ice age.

Allen will lead a multidisciplinary team of researchers and Native American students from New England on a 10-day expedition in the Gulf of Maine to collect plankton and to core ancient marine sediments. Ancient marine sediments are a rich archive of the habitat in which they were deposited. In her research to understand past ocean chemistry and biology, Allen analyzes the chemical composition of marine microfossils — shells — that have accumulated on the seafloor for thousands of years.

Whole shell geochemical analysis will be conducted on populations of foraminifera, single-celled organisms found throughout the fossil record. One planktonic species, *Neogloboquadrina incompta,* is of particular interest in the study of long-term temperature change in the Gulf of Maine and other high- and mid-latitude regions.

In addition, materials from coastal archaeological sites will be radiocarbon-dated to refine the chronology of regional fishing practices. A focus will be to test a hypothesis regarding the beginning and end of intensive swordfishing in the Gulf of Maine. ◆

Advanced Structures and Composites Center students and staff show off a boat roof from a 3D-printed mold made with a new biomaterial, nanocellulose reinforced polylactic acid, developed at UMaine.

3D printing with wood products

A NEW RESEARCH COLLABORATION between the University of Maine Advanced Structures and Composites Center and the Department of Energy's Oak Ridge National Laboratory (ORNL) will advance efforts to 3D print with wood products, creating a new market for Maine's forest products industry.

U.S. Sens. Susan Collins, Lamar Alexander and Angus King joined Daniel Simmons, assistant secretary for energy efficiency and renewable energy at the U.S. Department of Energy (DOE), as well as leaders from UMaine and ORNL, in Washington, D.C., on May 2 to announce the launch of the large-scale, biobased additive manufacturing program.

The $20 million effort, competitively funded by DOE's Advanced Manufacturing Office, aims to strengthen regional manufacturing by connecting university–industry clusters with DOE's Manufacturing Demonstration Facility (MDF) at ORNL. It also recognizes UMaine's global leadership in composites materials

"This groundbreaking effort builds on more than 20 years of composite materials research, including cellulose-filled-thermoplastic extrusion work by professor Douglas Gardner, structural composites work by professor Roberto Lopez-Anido, and cellulose production by professor Hemant Pendse and his colleagues in chemical and biological engineering," says the project's principal investigator Habib Dagher, executive director of the Advanced Structures and Composites Center. "Our challenge: Can we cost-effectively print at 500 pounds per hour with 50% microcellulose and nanocellulose, and achieve specific strength and stiffness properties similar to aluminum? Can we use bioresins and biofibers in the process so that the printed composites are green and full recyclable? In other words, can we print with 50% wood by weight?"

ORNL and the UMaine research team will work with the forest products industry to produce new biobased materials that will be conducive to 3D printing a variety of products, such as boat hull molds, shelters, building components, tooling for composites and wind blades. They also will position the industry to print large, structurally demanding systems, including boats. ◆

Harnessing forest ecosystem integrity, resilience data

COMPILING DATA TO BETTER ASSESS, UNDERSTAND AND FORECAST complex forest landscape changes is the goal of a four-year, multidisciplinary regional project led by the University of Maine.

The project, led by Aaron Weiskittel, UMaine professor of forest biometrics and modeling, and Irving Chair of Forest Ecosystem Management, was awarded $6 million from the National Science Foundation, with $3 million contingent on project progress and availability of funds.

Expertise and facilities from UMaine, the University of New Hampshire and the University of Vermont will be used to build a digital framework that integrates, analyzes and visualizes complex data streams across the region's vast forest. Emerging computational, monitoring, remote sensing and visualization technologies will be integrated into a digital framework that will create a natural laboratory for scientific experimentation by providing comprehensive spatial and temporal measurements of the forest that can be readily accessed by scientists, land managers and policymakers.

"Leveraging Intelligent Informatics and Smart Data for Improved Understanding of Northern Forest Ecosystem Resiliency (INSPIRES)" also aims to strengthen workforce development and broaden participation in STEM education, particularly among students with diverse backgrounds, skills and interests.

INSPIRES will draw from a variety of established programs and disciplines, including data science, ecology, electrical engineering, computer programming and communication. Faculty and students from the three institutions will collaborate on the development of a virtual, regional Complex Systems Research Institute that will facilitate ongoing analysis of natural ecosystem integrity and resilience from multiple scientific perspectives. The institute will include large-scale simulations from alternative futures, such as climate variability, atmospheric pollution, land use and changes in regulatory policies. More information is online: crsf.umaine.edu/inspires. ◆

"Forests are changing rapidly, while the technology to better monitor them is, too. **This project will help support and sustain northern New England's unique working forests, which many rural communities rely on for their livelihoods."**

Aaron Weiskittel

The additive metal manufacturing advantage

THE UNIVERSITY OF MAINE ADVANCED MANUFACTURING CENTER (AMC) is offering additive metal manufacturing services and training to facilitate the adoption of 3D metal printing in businesses statewide.

The new Center for Additive Manufacturing of Metals (CAMM), based at AMC, focuses on the process of fusing small metal particles through 3D printing to form solid metal objects. The bound metal-deposition modeling process is ideal for small parts used in tooling or fixturing.

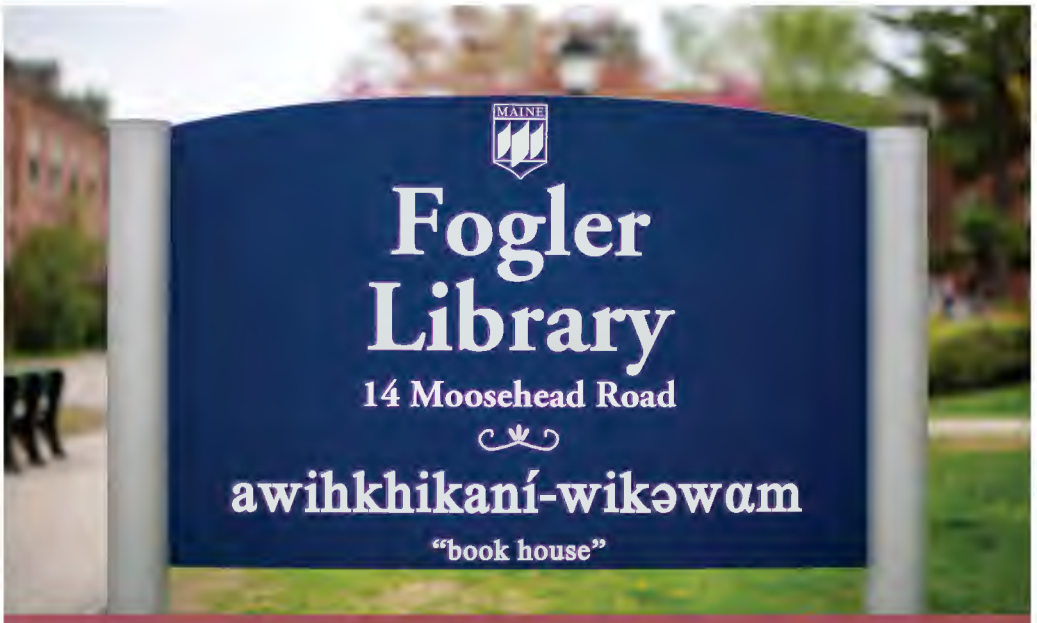
Funding for the center comes from a nearly $500,000 Maine Technology Institute Cluster Initiative Program grant, with matching funds from the university and 35 Maine companies, bringing the total to $1 million. The funds also will be used as a partial match for a $750,000 U.S. Economic Development Administration grant to AMC. With matching funds, that grant totals $1.5 million.

CAMM is working with the partner companies, including GE Power in Bangor and Pratt & Whitney in North Berwick, to produce parts, as well as test and conduct research on the process.

The center is training company personnel, and UMaine staff and students on the new technology, and is the only Maine facility currently offering these services. CAMM was awarded "Innovator of the Year" at the Manufacturers Association of Maine's annual summit.

By using CAMM services, companies can create a product and realize the potential of adding the technology to their facility before spending thousands of dollars on a new machine. ◆

At the Center for Additive Manufacturing of Metals, three machines use metal powder mixed with wax and a polymer binder to create structures with similar properties to metal parts produced by casting or subtractive processes, such as milling or turning.



Many of the exterior signs in phase one of the project were designed to create an awareness of place while also evoking the traditional activities of the location and the presence of multiple, living languages.

Bilingual signage — English and Penobscot

NEW UNIVERSITY OF MAINE BUILDING AND ROAD SIGNAGE on campus is now bilingual — English and Penobscot.

Signs for Memorial Gym and New Balance Student Recreation Center note the names in Penobscot — *attali-milahəyawələtiməkˑ* — translated as "place where you play a variety of games." At Fogler Library, *awihkhikaní-wikəwɑm* means "book house"; at Wells Conference Center, m*ɑ*wikamikʷʷtranslates as "community meeting house"; and at Cutler Health Center, *sɑkələmálsəwɑkan mɑwte* translates as "get your health together."

The project, now in its first phase with the installation of 10 signs across campus and internal signage throughout the halls of UMaine's Wabanaki Center, developed from conversations between the UMaine Wabanaki Center and Wabanaki communities in Maine over the last few years regarding the relative invisibility of Indigenous people, places, history and languages at the university, and the specific need for Penobscot language signage on the Orono campus.

"One of the goals of the signs is to show students and visitors that the university's campus is on Wabanaki territory," says Darren Ranco, director of Native American Programs at UMaine.

A Penobscot Language Signage Committee met regularly in the spring 2018 semester, working extensively on the Penobscot translations, writing historical content for the signage and reviewing Indigenous signage used at other universities. The project plan and translations were reviewed by the Penobscot Nation Tribal Council.

The committee envisions the signage as an opportunity to make the unseen places, people, languages and historical narratives of indigenous communities visible and meaningful, as well as to create a more inclusive and respectful space for native students on campus. ◆

Secondhand chic

As part of a five-year research project looking at Maine's reuse economy, Cynthia Isenhour, a professor of anthropology and climate change, conducted a statewide survey of more than 600 households. Each object shown here represents a different way Maine residents acquire secondhand items and includes the percentage of survey respondents who participate in that form of reuse.

17%
Cord chair: Bought through Facebook

57%
Canoe paddle: Received from friends or family

16%
Purse: Found at a transfer station

28%
Ring: Bought as antique/vintage

18%
Phone: Bought through a national online platform such as eBay or Gazelle

28%
Brass lobster: Bought as antique/vintage

Cultural anthropologist digs into the roots and relevance of Maine's reuse economy, and its sustainability value

By Elyse Catalina | Photographs by Holland Haverkamp

For many summer visitors, the thrill of the hunt is part of the Maine vacation experience.

That might mean stopping at a renovated chicken barn to find a used book for afternoons lounging by the lake or visiting antique stores in search of the perfect lamp to complete the interior design of a summer home.

But for many Maine residents, the exchange of secondhand goods plays a more practical role in everyday living, from back-to-school clothes shopping at consignment stores and thrift shops, to trading in bikes and skis that children have outgrown at swap-and-sell events, to scanning Facebook Marketplace or the printed publication *Uncle Henry's* for furniture, or holding a yard sale to earn a little extra pocket cash.

In Maine, the reuse economy takes many forms. And it has for generations.

The state is home to at least 450 formal reuse businesses, according to research led by Cynthia Isenhour, a professor of anthropology and climate change at the University of Maine.

"It seems Maine has a particularly vibrant reuse economy, and that raises a lot of interesting questions about why, as well as what the advantages might be," Isenhour says.

Isenhour's research collaborator Andrew Crawley, a professor of regional economic development at UMaine, found the number of reuse businesses in Maine, as a proportion of the total number of businesses, is consistently high over time and relative to most other states.

"Reuse is not recycling," Isenhour says. "Recycling takes products, disassembles them into their component parts and makes something new. That process is often time, labor, energy and emissions intensive. The benefit of reuse is that you're using the same product, in its same form, for longer. The act of reusing a secondhand good is that you're offsetting demand for new production, and all of the associated materials and emissions."

While Maine has not yet implemented formal policies to specifically support reuse, some evidence suggests that many communities are contributing to waste-reduction and sustainability goals through reuse, Isenhour wrote in "Maine's Culture of Reuse and Its Potential to Advance Environmental and Economic Policy Objectives," which was published in *Maine Policy Review.*

More than 90 transfer and recycling stations throughout the state offer opportunities for reuse. Through transfer station take-it shops or community donation drives, 65 programs

collected nearly 3,000 tons of reusable materials in 2014, according to the Maine Department of Environmental Protection (Maine DEP).

Strong participation in reuse likely contributes to Maine's standing as a state with one of the lowest per capita waste generation rates in the nation, according to Isenhour.

In her cultural anthropology research, Isenhour is exploring Maine's vibrant reuse markets and their potential to advance social, environmental and economic public policy goals.

Through conversations with residents statewide, archival research and spatial economic modeling, Isenhour and colleagues aim to learn more about the historical construction, contemporary relevance and potential of the secondhand economy in Maine.

In most applications, reusing items as opposed to producing new ones saves water, energy, time and labor, Isenhour says.

"The ecological gains are typically clear, but we have almost no data on the economic and social benefits of reuse or the potential social costs of formalizing reuse practices," says Isenhour, who is a faculty associate in the Senator George J. Mitchell Center for Sustainability Solutions.

In ResourcefulME, a five-year project funded by a $265,000 award from the National Science Foundation, Isenhour explores the potential of secondhand economies in Maine. The project also is a springboard for a May Session digital ethnography field school led by Isenhour and Kreg Ettenger, associate professor of anthropology and director of the Maine Folklife Center.

The project, now in its third year, began with a spatial analysis of formal reuse markets nationwide. Crawley analyzed the formal reused-merchandise retailers in relation to each state's economy and employment figures.

"The work paints a truly interesting picture and sheds light on a sector often ignored in formal economic analysis," according to Crawley. "The growth and size of the reuse sector is growing nationally, and so its importance to the whole economy cannot be underestimated."

People have been talking for a long time about the culture of thrift, Yankee ingenuity, "and we certainly find lots of evidence for that," Isenhour says. "The perception is that it's something Mainers have always done. It simply doesn't make any sense to many Mainers to waste things."

Isenhour and Brieanne Berry, who is pursuing a Ph.D. in anthropology and environmental policy at UMaine, have reached out to Maine reuse business owners, and distributed a household survey to track how and where people buy and dispose of items. Using information from more than 600 respondents, they determined almost 90% of Maine residents participate in the reuse economy, with about 68% taking part by giving things to stores such as Salvation Army or Goodwill.

However, the oversupply of secondhand goods raises other concerns, she says.

"We have this huge amount of supply going into the (national reuse) system, but there is much less demand for secondhand goods," Isenhour says, adding that in Maine, many people are giving away objects, but many also are buying secondhand items, so the gap between donating and buying isn't as significant as it may be in other places in the country.

"A large part of it is still going into the waste stream, but we're also hearing a lot of it is getting shipped overseas, which raises some environmental and social justice issues, as well. Like when you end up damaging textile markets in Africa because they're essentially being flooded with what ends up as waste," Isenhour says.

Incentives are needed to encourage people to buy secondhand, she says, to keep items circulating more often in local regions.

Isenhour and Berry will more fully analyze the survey data while bringing the research to the community level and into households. They plan to work with households in three Maine communities, tracking budgets, conducting consumption inventories and interviewing residents about their history of participation with reuse.

The case studies are designed to determine how much money is saved by buying used items, and to provide deeper ethnographic information about meaning and value. The researchers also hope to learn if people who are participating extensively at the local level have

A Little Free Library houses used books in Old Town.

higher levels of social capital, or trust in their community.

"There's a continuous thread in the social anthropology research which suggests that folks who have reciprocal networks of support for exchange oftentimes have much higher levels of social capital, and also tend to be in much more resilient communities," Isenhour says. "So when shocks come, the market drops out, people that have alternative procurement networks tend to feel much more secure. It's about community ties."

Before moving to Maine in 2013, Isenhour lived in three other states and overseas.

"I've never seen a reuse economy like this," she says of Maine's market. "You're driving down Route 1 and almost every business has some form of reuse or repair — small engine repair, a boat workshop where they're fixing boats, an antique store, a flea market. That to me, as an anthropologist, is so interesting to think about. We can say New England has this culture of thrift, but why? Those are the really interesting anthropological questions — to trace that back — because culture doesn't fall from a tree, it's constructed with the environment."

Maine's unique reuse economy drew Isenhour in as she looked for her next research project.

"My whole career has always had a focus on sustainability and alternative modes of consumption," she says, adding that this project had those elements, among others, including climate adaptation and resilience.

Digitally documenting reuse

In May 2019, a group of University of Maine students traveled statewide, visiting city planners, transfer stations, charity thrift shops, cobblers, used book stores, antique sellers, the office of *Uncle Henry's* and the Maine Department of Environmental Protection, as well as other sites of reuse.

The trips were part of UMaine's first field school in digital ethnography, the study of people and cultures being conducted in an online or digital space.

Eight students participated in the three-week course offered for both graduate and undergraduate credit. The field school was led by Cynthia Isenhour, a professor of anthropology and climate change; and Kreg Ettenger, a professor of anthropology and director of the Maine Folklife Center and Maine Studies program.

While exploring Maine's reuse economy, students learned several ethnographic research techniques, including participant observation, interviews and questionnaires, as well as about research ethics and techniques for data management and analysis.

The course, "Exploring and Documenting Maine's Culture of Reuse," is part of the ResourcefulME research project headed by Isenhour and supported by the National Science Foundation.

For extended field research, the students stayed in one of three communities — Portland, Machias or Farmington — to learn about the reuse economy in those areas. The students' final projects drew on their research results to examine common themes in the reuse economy, including value, supply and demand, and support or care within a community.

Kerry Sack, a student in the Division of Lifelong Learning who earned a bachelor's degree in sociology from UMaine in 1979, says she was surprised to learn the extent to which many Maine businesses, not just thrift stores, participate and rely on reuse.

Final projects are available at umaine.edu/reuse. ◆

Above: Students in UMaine's first digital ethnography field school, including Suman Acharya, right, gather in downtown Bangor to interview owners of reuse businesses. Those businesses included a used comic book store and a cellphone repair shop.

Examining community ties

University of Maine doctoral student Brieanne Berry researches how Old Town, Maine residents use the secondhand economy to make a living and form community ties.

Berry, who is pursuing a Ph.D. in anthropology and environmental policy, is exploring what that city's reuse economy looks like — how and why people participate, and if reuse is used as a strategy during times of economic uncertainty, such as the closing of the local paper mill.

She seeks to learn if reuse is associated with social capital, or the idea that the networks people form can help communities achieve goals.

Berry, who lives in Old Town, also wants to learn what kinds of economic, social and environmental values are generated from reuse.

For the past three years, she has conducted literature reviews and historic analyses on reuse in Maine with Cynthia Isenhour, a professor of anthropology and climate change.

In summer 2019, she began interviewing owners of reuse businesses and organizations in Old Town, as well as residents who buy secondhand goods. She plans to volunteer at reuse establishments, and speak with people who sell and buy items online. Next year, Berry also will follow items that leave Maine and end up in Boston or New York.

Berry earned a bachelor's degree in anthropology from George Washington University and a master's degree in urban affairs from City University of New York's Hunter College.

While in New York City, her research focused on urban sustainability themes, including energy efficiency and waste reduction.

"It's great if we compost, it's really good to recycle, but it's not enough," Berry says. "I was interested in trying to find more ways people were making transformative change."

As a Peace Corps volunteer, she lived in Mali in West Africa for two years and was fascinated with the country's robust reuse economy.

Berry came to UMaine to work with Isenhour on her reuse research, and became a member of the Materials Management Team in the Senator George J. Mitchell Center for Sustainability Solutions.

"This is exactly what I want to do — try to find ways to reduce waste that aren't just furthering the process of consumption," she says of her research, which has garnered several UMaine awards, including the Edith Patch Award and the College of Liberal Arts and Sciences graduate award in research and creativity. ◆

Brieanne Berry, right, volunteers at the Orono Thrift Shop as part of her research on how area residents use the secondhand economy.

"Resiliency is about much more than just money. It's also about these social networks of support and reciprocal relations of exchange," says Isenhour, who earned a Ph.D. in anthropology from the University of Kentucky in 2010 and served as an Andrew W. Mellon Postdoctoral Fellow in Environmental Studies at Centre College before joining UMaine's Department of Anthropology.

In terms of consumption, Isenhour is interested in finding ways to change linear production-consumption-disposal systems into more circular, efficient economies.

For nearly five years, she has been an active member of the Materials Management Team in the Senator George J. Mitchell Center for Sustainability Solutions. Materials management refers to the overall life cycle of objects from raw materials, to products, to end disposal. The group of interdisciplinary researchers aims to engage stakeholders who range from waste producers, such as grocers and restaurateurs, city officials and hospital staff, to waste professionals, including incinerators, composters, digesters, landfill operators and transporters, to regulators, such as Maine DEP and the state Legislature.

"It's a great group of folks coming at the issue of waste and materials management from diverse perspectives," Isenhour says. "Together, we've written policy reviews for the state Legislature, researched the emergent risks of more circular food systems, and helped bring together a statewide stakeholder working group around policies to reduce food waste."

Isenhour says that while ResourcefulME focuses on more than waste reduction, it is still part of the team's research and has the potential to influence policy.

Momentum around reuse is picking up on the policy level, Isenhour says, adding she has heard city or town managers, selectpeople and staff at state agencies talking about it more frequently over the past few years.

"If we know, and we do, that eventually resources are going to become more expensive, then secondhand markets are going to become more vibrant everywhere," Isenhour says. "They already are in cities; the very progressive, forward-thinking places. What does that mean for rural places like Maine? What structures do we have in place to make sure our secondhand economy is fair and strong?"

Reuse initiatives in cities and states nationwide include considering eliminating sales tax on secondhand goods, since they were already taxed once; passing right to repair laws, which are intended to allow consumers the ability to fix their own electronic devices; implementing education campaigns; and organizing repair cafes or hosting materials exchanges.

A lot of money, resources and emissions could be saved if Maine had programs that could help extend the lives of goods already in existence, Isenhour says.

Sweden, for example, gives taxpayers a rebate if they repair rather than replace a product, while New York City hosts materials exchanges and has a robust grant program to encourage reuse, Isenhour says.

"I really want the project to have policy implications," she says. "I'd like it to be useful for the Maine Department of Environmental Protection and the state Legislature. Even beyond Maine, because so many states and cities are really focusing on reuse as one of their primary strategies for sustainability."

Isenhour says she hopes the research can offer policymakers the data they need to inform decisions on designing reuse policies that contribute to local economic development.

"We can think about reuse as an interesting and innovative way to build upon something that Maine already has," she says.

Policies almost always are more effective if you're adding to something that already culturally makes sense to people, Isenhour says.

"If we're thinking about sustainable livelihoods and resilience, why not build on something that's already strong here?" she asks.

Isenhour wonders what lessons could be taken from Maine's strong reuse economy to inform others around the country.

"Our state motto is about leadership. Maine has already tried a lot of this stuff out, so we could be in a leadership position to really focus on reuse as a policy goal."

The current linear economy in much of the world takes resources from the ground to make products that are then used and thrown away. This take-make-waste system is no longer working for businesses, people or the environment, according to the Ellen MacArthur Foundation, a charity based in the United Kingdom that aims to accelerate the transition to a circular economy, which would build economic, natural and social capital.

A circular economy involves gradually decoupling economic activity from the consumption of finite resources, and designing waste out of the system. Underpinned by a transition to renewable energy sources, the system aims to keep products and materials in use, according to the foundation.

While economic growth is often thought of in terms of production, it also can come from efficiency gains, or value captured instead of wasted, Isenhour explains. Economies are currently wasting a significant portion of productivity that ends up being incinerated or landfilled.

For most Maine municipalities, waste disposal is one of the top three costs, according to Isenhour. Funds spent on tipping fees at landfills and incinerators could instead be spent on schools, roads or emergency services, she says.

In addition, there is hidden value in secondhand markets that is not currently being accounted for, Isenhour says. Based on the survey responses, the team estimates that Maine residents spend at least $570 million per year on used products.

UMaine practices reuse in several ways, such as holding sales and clothing drives, and running the Black Bear Exchange food pantry and clothing swap.
Left to right: The annual Clean Sweep Sale features items donated by the university and students who move out of dorms at the end of the semester. The UMaine Police Department collects bicycles abandoned on campus. Those not claimed in six months are donated to local charities.

Maine's secondhand economy

At least **450** formal reuse businesses

More than **90** transfer stations that offer reuse

At least **$570 million** spent on secondhand products per year

65 programs collected nearly **3,000 tons** of reusable materials in 2014

"I think it's this silent contributor that's doing quite a bit," Berry says of Maine's reuse economy. "Not just economically, but socially and environmentally, as well. I think in rural places where they are losing their stores, the towns get so small, there's no reason for a new first-order market to be there, but people can still trade, buy and sell things, and build community that way."

The reuse economy also can benefit rural communities in terms of labor.

"A lot of folks make their living this way — investing their time and energy to find, clean, sort and market used goods that still have value, but that were lost in the system," Isenhour says. "While this labor is definitely undervalued, it is important work — recapturing value through a process of labor and care. While we don't have a good way to account for this value added, we do know that the reuse sector supports a lot of our citizens."

Yard sales are a sure sign of summer in Maine. Whether they are held by families looking to get rid of forgotten items gathering dust or by organizations aiming to raise funds for a cause. Today, they can be all-day shopping excursions for bargain hunters, such as Maine's Ultimate Yard Sale in Cumberland Center and Cornville's 10-mile Yard Sale.

"I think in Maine people get so excited for summer, everyone's just like, 'Let's have a yard sale!'" says Berry, who, in addition to working with Isenhour, is conducting her own research in Old Town, looking at how people use the secondhand economy to make a living and form community ties.

Every Maine resident Isenhour has spoken with about reuse seems fascinated by the topic.

"Perhaps that is because there are a lot of different reasons to be interested in reuse and motivated to participate," she says.

According to the team's survey, most people offer goods for reuse to help those in need or prevent waste. Others simply have too much stuff or say they are concerned about the environment. While some sell used items to make money.

The motivations of those who buy used goods also are complex and complicated, Isenhour says. Many recognize that used goods are more affordable while others are driven by the desire to reduce waste or because they enjoy secondhand shopping and the thrill of the find.

Isenhour and Berry say they were surprised by their survey results, which suggest that while waste reduction is one of the primary motivators for offering and acquiring used goods, many respondents didn't associate waste reduction with environmental concern.

How to contribute to the reuse economy

1. Buy well-made, durable products
2. Purchase more secondhand items
3. Repair rather than replace when possible

Jonathan Lambert, owner of Yankee Cobbler in Bangor, glues new soles onto used shoes.

"I really do think it comes back to this idea of thrift and ingenuity," Isenhour says. "The cool thing here in Maine is that it's not shameful at all for most people to shop secondhand. Instead, if you find something really good, it's like bragging rights: 'You won't believe what I found.'"

Unlike high-end vintage flea markets in places like New York City, Berry says Maine's reuse economy offers something for people of varying means.

"Driving around Maine it feels like there's reuse everywhere," she says. "In every small town, you can go to the take-it shop at the transfer station and find something used, and it's not a big deal if you find it at the dump. People are proud of that."

In the long term, the volume of goods moving through our systems will need to slow in order to cut waste and aid the environment, Isenhour says.

"Reuse is a great way to do that, but we'll likely need stronger support for these systems in the future," she says. ◆

Left: Collectors of used items and antiques sell their wares on a bridge in Machias.

The LaFrance siblings, left to right, Grace, Joanna, Garrett and Sophia.
Photo by Holland Haverkamp

A family of Black Bears

Four siblings attend UMaine at the same time

By Jamie Evans

When Brenda Boucher LaFrance returned to Orono in August to move her youngest daughter, Grace, into a residence hall at the University of Maine, it was deja vu. Not just because she is an alumna, but because she has done this two other times, with three of her older children.

Brenda and Jim LaFrance of Alfred, Maine have four children — Grace, Sophia, Joanna and Garrett — all attending UMaine and thriving. Brenda graduated from UMaine in 1987 with a degree in education, and is an elementary school gifted and talented teacher, and intervention specialist. Jim LaFrance is a kitchen and bathroom designer.

"Being in school with your siblings is really nice because whenever you are feeling homesick, you always have pieces of home with you," says Sophia, a third-year student who enrolled with her fraternal twin sister Joanna; both are biology majors, with concentrations in pre-med, and are in the Honors College.

Garrett, a fifth-year biology major, says having his sisters at UMaine has kept him grounded "and it holds us all accountable for staying on track and keeping each other focused on our goals."

And their goals are big.

All four plan to pursue careers in health care. They say their inspiration stems from their compassion and desire to help and heal others.

Sophia and Joanna plan to pursue careers in pediatric medicine. Garrett, who graduates in December, is headed to graduate school for a career as a physician's assistant or dentist. Grace, who was the most excited of the four to be joining her siblings, plans to be a surgeon.

"I have been left by myself with my parents for the last two (years) while they came here," says Grace, a biochemistry major with a pre-med concentration. "So I am definitely happy to get to hang out with them more than I usually do during the school year."

Having family on campus has had other benefits, Sophia says.

"My twin sister and I have all the same classes, and we study together for every exam. And my brother studies with us for the classes that we have together," she says.

The LaFrance siblings have fully embraced the breadth and depth of the state's only public research university.

Garrett says he loves UMaine's atmosphere.

"There are so many clubs, groups and events to choose from, and everywhere you go there are opportunities to meet good people," he says. "I'm looking forward to seeing Grace make new friends and have a great start to her college career like I did."

Sophia says working with faculty has made her UMaine experience particularly satisfying.

"I love that most of the professors you have are there to help you whenever you need it," she says. "I've visited so many professors' office hours and most of them are always available to give you extra help because they also want you to succeed."

"It is such a beautiful place, and it's hard not to call UMaine home (during) the eight months I'm in school," says Joanna. ◆

Bicknell's thrush and rusty blackbird are now found in the same spruce-fir stands in western Maine, raising questions about what has caused the birds to shift — and overlap — their habitat use.

WHAT'S THE ATTRACTION?

By Cleo Barker | Photographs by Adam Küykendall

In the United States, the population of Bicknell's thrush is relatively stable, while the population in Canada is declining. Declines have been attributed to predation, pollution and habitat loss — especially on the wintering grounds, but also on the breeding grounds.

In the western Maine mountains, Amber Roth studies the habitat use of two songbird species to help inform land management practices

The sun crests the tops of spruce and fir trees, the muted gray of dawn giving way to a bright, cloudless day in the mountains of western Maine. The sweet, warbling notes of a Bicknell's thrush welcome the new day.

Bicknell's thrush is one of many species that make the forested mountains home. Amber Roth and her team of student researchers are working to help keep it that way.

For the past three years, Roth, an assistant professor of forest wildlife management at the University of Maine, has studied the health and habitat of the Bicknell's thrush and the rusty blackbird, two species of migratory songbirds whose populations are declining and are the focus of conservation efforts.

Bicknell's thrush is typically found high in the mountains. The rusty blackbird prefers wetlands at lower elevations. But now both have been found in the same intensively managed spruce-fir stands on the research sites, raising questions about what caused the birds' changes in habitat.

And that's just one piece of the puzzle Roth is addressing when looking at their habitat selection to inform land management strategies.

The rusty blackbird population is declining for unknown reasons, and Bicknell's thrush came close to being federally listed as threatened. Shifts in habitat use could help.

"One of the exciting things that we found during the summer of 2018 was that both of these species (were) using the same spruce-fir stands, which previously was not believed to occur very often because of this elevational divide that normally keeps them apart," Roth says.

"But we're finding that they are willing to use the same stands for nesting, which is an exciting development and creates opportunities for conservation of both species."

Their shifts in habitat use could point to significant changes in the environment caused by certain land management practices, climate change or other factors. Roth and her students seek to understand more about those environmental drivers.

"There is an important role for managed forests in providing suitable breeding habitat, since our management of spruce-fir forest stands is aligned with these birds' needs," says Henning Stabins, wildlife biologist with the land management company Weyerhaeuser that owns some of the land where Roth's research sites are located. "Through our harvesting and regeneration practices, we are creating suitable habitat for both species across the landscape in Maine."

It's just before dawn on a reforested skid trail on the mountainside. The researchers set up mist nets in stands where they think they will find the birds, then play clips of bird calls from an audio device to attract them. The rusty blackbirds, which are more territorial, will investigate the perceived intruder. The more social Bicknell's thrushes will be drawn by the call, thinking there's a new member to welcome to the flock.

Once caught, the birds are affixed with an ID band, a telemetry tag and color bands to aid in identification from a distance.

Roth and her students have used several different types of tags — the most common is a very high frequency (VHF) radio tag that emits a signal that can be tracked by a researcher with an antenna on a receiver. They've also begun using GPS archival tags, which gather and store data on birds' locations. Later, researchers must catch the bird again to access the information.

They also use nanotags, a variant on the VHF radio tag. These send signals to receiver towers that are part of the Motus Wildlife Tracking System, an international collaborative research network that monitors birds and bats across a variety of landscapes, and provides data for migration on a large scale.

The research will help landowners and others learn more about the birds and the conditions that create their preferred habitat, which they can take into account when making management decisions.

According to Stabins, the spruce-fir forest conditions favored by both species are created by even-age management, a common strategy employed by Maine landowners.

"Without our management, the breeding habitat for these species may be more limited across the landscape and rely on natural disturbances like spruce budworm epidemics and fires" to create similar conditions, he says. The research will inform

Forest resources master's students Luke Douglas and Carl Pohlman use radiotelemetry to track rusty blackbird nestlings with VHF radio receivers attached to Yagi antennae. The receivers pick up radio signals from tags attached to the birds, which help researchers find them again.

Alex Barnes, a member of Amber Roth's summer research team, hides in a stand of trees and plays Bicknell's thrush calls to attract the birds so they can be banded and tagged.

whether the current management strategies are meeting the needs of the birds, and what changes to management could enhance their long-term sustainability, Stabins says.

"This research will help us be proactive and address these birds' issues to hopefully help them avoid becoming endangered," says Stabins. "Understanding the benefits of managed forests for these species will further demonstrate the value of the forestry industry in Maine."

The rusty blackbird project began with Carol Foss, senior adviser for science and policy with New Hampshire Audubon Society. For a decade, she has pursued the birds in sites near the Maine-New Hampshire border, and two years ago she collaborated with Roth to further the project.

"Our goal was to include some new forest management techniques in the collection of sites that she's been studying," says Roth, "expanding the scope of the types of management that rusty blackbirds might be using in terms of the different types of forest structures or how they were created."

Roth also noted concerns that rusty blackbirds — nestlings, in particular — could be susceptible to higher rates of blowfly parasitism due to increased temperatures.

"It could be that with warmer temperatures, those parasites are able to thrive more so than they could before," says Roth. "We have a lot of concerns about the role of climate, and temperature and precipitation, and what that means for survival and habitat quality."

Continuing previous work, the researchers are monitoring nesting success, site fidelity and survival, while learning more about how bird blowfly parasites affect survival and where the rusty blackbird population overwinters.

UMaine students have been key in driving the research. Luke Douglas, a forest resources master's student; Emily Tomak, an ecology and environmental sciences student; and Hateya Levesque, a forestry student, all have individual projects focusing on rusty blackbirds.

"Students bring a fresh perspective to everything they experience. When they really engage in the project intellectually, they sometimes come up with insights that the more seasoned researchers haven't thought of," Foss says.

The rusty blackbird research team is looking at the birds' use of commercial forestlands to determine why the population is declining. They are working with landowners to see how birds use areas with different habitat characteristics and land management strategies, such as precommercial thinning, planted stands and herbicide treatments, according to Douglas. They collect vegetation and bird data from nests to learn more about nest site selection, fledgling survival and other factors that contribute to population levels.

Douglas says they're comparing Maine and New Hampshire because Maine has more intensive forestry practices and land management approaches that could be affecting the birds differently.

He has been surprised to see the birds in thinned stands. Typically, they prefer dense, young softwood stands because they'll often build nests on overlapping branches of multiple trees, rather than in areas that have been precommercially thinned and have more space between trees.

"I'm curious to see, once we can collect more data, how many birds choose to nest in thinned stands versus unthinned areas," Douglas says. "Studies focusing on other species have shown that thinning will increase the numbers of some, while decreasing those of others. So it's interesting to see that the rusties are readily using thinned stands. We'll have to see how this choice is affecting their survival."

For her undergraduate thesis, Tomak is examining connections between temperature and parasites found in the nests of rusty blackbirds. She's looking at sites in New Hampshire and Maine, monitoring temperature data around the nests, and looking for trends and possible causes, such as climate change.

"Our hypothesis right now is that during warmer years, there are more parasites in the nest and (they) will affect the health in the long run of those birds," says Tomak. "This year is actually great because it was colder, so we're going to be able to see if that hypothesis stands true. This year, if there aren't as many nest parasites as previous years, then we'll know that there is a solid climate change component to the project."

The sites Douglas and Roth worked on in Maine are farther north, at higher elevation and use different land management practices than the sites Tomak and Foss worked on in New Hampshire.

Foss hopes data from the 2019 and 2020 summer field seasons will yield conclusions on whether and how rusty blackbirds respond to these differences in habitat, and will aid in the development of science-based recommendations for landowners.

"These recommendations would be relevant not only in Maine, but in the Maritimes, as well, and potentially other areas of Canada where intensive forest management is practiced," says Foss. "I hope that our overall research effort identifies factors contributing to the population decline and range retraction, and contributes to long-term conservation strategies for the species."

Until recently, Bicknell's thrush and gray-cheeked thrush were classified as one species. In 1998, they were split into two official species based on differences in body size, feather coloration, song, winter ranges and other factors. Bicknell's thrush has been well studied in New Hampshire, Vermont and parts of Canada, but not so much in Maine.

"It's important to understand what's happening in Maine, because a lot of the birds are located on private industrial forestlands, so there's a lot of potential for forest management to impact them where disturbance by harvesting is less frequent," says Roth. "You've got different types of disturbance regimes in terms of how we manage forests in different states. Understanding what's happening in Maine is really important because it's a big part of the population."

According to Roth, the thrush has a narrow breeding range and is therefore sensitive to any landscape changes within that range. For instance, deforestation on the Caribbean island of Hispaniola, the primary wintering location for the birds, is having a significant effect on the species' population.

"When you have such narrow geographic scope for a species, that elevates the conservation concern. And in addition to that, this is not a species that has a lot of individuals," says Roth.

There is an estimated global population of up to 126,000, which Roth says is small for a songbird. According to the Vermont Center for Ecostudies, the Bicknell's thrush population in the U.S. in 2016 was projected to be 71,618. The American robin, by comparison, has a population of about 310 million, with nearly 245 million spending some of the year in the U.S., according to Partners in Flight.

In addition to the species' high elevation habitat, Bicknell's thrush seems to be using habitat at lower elevations in Maine. Temperature increases related to climate change could influence the birds to move to higher-elevation habitat, but the land management practices also could be making habitat at lower elevations more attractive.

Among the questions: What habitats are the birds using and most successful in? Where are fledglings going and where are they surviving? "That's our important role, to give (landowners) the information they need to make informed, sustainable forest management decisions," says Roth.

Kaitlyn Wilson, a UMaine wildlife ecology master's student, is instrumental to the Bicknell's thrush research. It's the second year she and Roth have worked with the species to study its habitat selection in commercial forests. This summer, she was in the field by daybreak when the birds are active and chances of capture are highest.

Kaitlyn Wilson, a wildlife ecology master's student, left, and Alex Barnes trim a nanotag after attaching it to a Bicknell's thrush. Nanotags are a variant on the very high frequency (VHF) radio tags, which emit a signal that a researcher can track with a receiver. GPS archival tags gather and store data on the bird's location, which can be accessed if the tag is later recovered.

Left to right: Hateya Levesque, a forestry major, and graduate students Carl Pohlman and Luke Douglas examine a juvenile rusty blackbird and record data as they investigate how the species uses commercial forestlands to determine why the population is declining. They're focusing on nest site selection, fledgling survival and other factors that contribute to population levels.

"Their high-elevation habitat is shrinking and is going to continue to shrink as the climate continues to warm," Wilson says.

"And since they're actively managed, our hope is to find out what the birds are using when they're here, so we can make recommendations to forest managers so that they can continue to harvest, but do so sustainably with the birds in mind."

A question Wilson addressed in her research was whether the thrushes would be in stands that had been precommercially thinned. She says that in those areas, she has not found any Bicknell's thrush.

"It means that forest managers need to keep in mind that if you have habitat on a landscape and it's thinned, then maybe leaving patches for the birds to use is an important consideration, but more research is needed to make specific recommendations," she says.

And collaboration plays a role in making research and conservation a possibility. Properties of land management companies span a variety of habitats and management approaches across different states and, in some cases, into Canada.

Mike Turso, a senior wildlife ecology student at UMaine, studies the birds from a slightly different angle. He's testing acoustic monitoring as a method of collecting data to supplement, and possibly replace, radiotelemetry tracking, which is resource-intensive. Acoustic monitoring, if successful, also would be easier to apply on larger scales.

"If acoustic monitoring is an equally or more effective method of monitoring the species, it can be used as a pretty good substitute to assess things like habitat use, maybe abundance, occupancy, things like that," says Turso, who adds he is enjoying spending time out in the field, as well as knowing he's contributing to research.

"It's a privilege to be able to learn here. And the landscape is beautiful," says Turso. "It's really been an awesome experience so far, and I'm looking forward to seeing what's next."

Roth says landowners are especially interested in conserving species like the rusty blackbird and Bicknell's thrush, not just because of their intrinsic value, but because they enable them to have more freedom over land management decisions. If a species receives endangered status, the state and U.S. Fish and Wildlife Service could impose management measures.

For example, Weyerhaeuser has an agreement with the Maine Department of Inland Fisheries and Wildlife (MDIFW) regarding rusty blackbirds and their management, so that's a species whose population the company is especially interested in maintaining.

Roth thinks of herself as a facilitator, and is responsible for orchestrating the collaboration on both projects, as there are many partners in the research.

"The landowners are really critical in helping us logistically, giving us access and helping us get around, and giving us information about their property," says Roth.

Weyerhaeuser and other large forest landowners, such as Wagner Forest Management and J.D. Irving, Limited, are part of the Cooperative Forestry Research Unit (CFRU), a stakeholder-driven research cooperative at UMaine that includes 33 organizations representing half of all forestland in Maine.

Through CFRU, Weyerhaeuser has identified relevant issues in forestry and answered questions through scientific research, according to Stabins.

"For those projects that occur on our land, we have a direct

connection, can be more involved, and more finely understand the details of the methods and results," he says.

"These CFRU projects are evidence of our efforts to protect biodiversity, contribute to forestry research, and continually improve our practices. We consider many factors during the planning and design of each individual timber harvest and use a host of remote-sensing, ground-based, and internal/external data sets," says Stabins. "The incorporation of environmental stewardship and sustainability into our management is not only the right approach, but makes business sense due to the long-term nature of growing forests."

Wilson says Weyerhaeuser personnel have been involved and helpful throughout the research process, scouting for stands occupied by Bicknell's thrush or rusty blackbird that could be data collection sites, providing GIS mapping data for their managed land, and more.

Working in a remote area like the mountains of western Maine means resources such as lodging and internet are scarce, and the research sites can be difficult to traverse and only accessible via pothole-filled logging roads. Even the birds are "secretive," Roth says, and it can be a challenge to find and follow one to catch for banding. The more help they have throughout the process, the better their chances of gathering enough data to contribute meaningful insights to inform landowners.

Roth also credits Foss and Stabins, as well as Adrienne Leppold, the nongame bird biologist at MDIFW and a UMaine alumna. Leppold was instrumental in connecting Roth and Foss to work together on the rusty blackbird project.

Funding for the projects comes from The Nature Conservancy, the U.S. Navy, New Hampshire Audubon, William P. Wharton Trust, Maine Outdoor Heritage Fund, UMaine's Cooperative Forestry Research Unit, and Maine Agricultural and Forest Experiment Station.

"For me, the most rewarding outcome would be if we can come up with a win-win scenario for landowners where they can continue to harvest the trees that they need in order to continue to make income, and at the same time have high-quality habitat for these birds," says Roth. "If we can continue to create the forest products that we want as a society, but also create habitat for these species that are in need of some help right now, I think that's the big win-win." ◆

Left: Researcher Amber Roth, an assistant professor of forest wildlife management, is a facilitator. She brings together the project teams focusing on two species, and coordinates with the landowners and other research partners. **Right:** A 6-day-old rusty blackbird nestling. The species is declining for unknown reasons and is a key research focus in western Maine.

The habitat is shrinking so these lower-elevation, commercially managed forests are going to become increasingly important to the species.

FRAMING MAINE

Fall exhibition in run-up to state's bicentennial focuses on artists' perspective on place

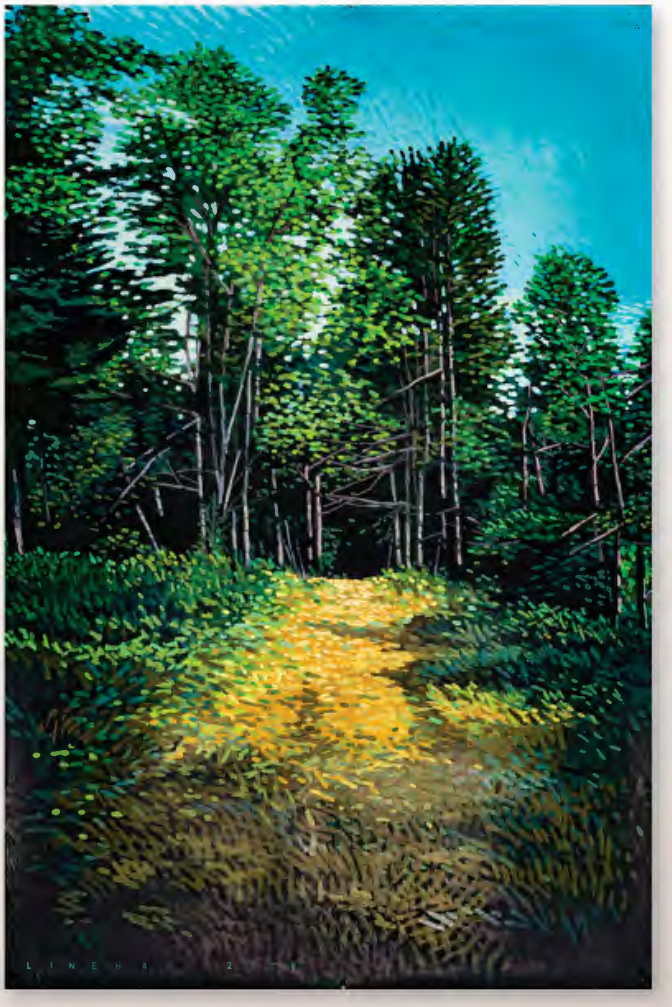
Maine has a legacy of inspiring diverse forms of visual art, with representations of varied landscapes and culture in paintings, drawings, prints, photographs, fibers and other media playing a significant role in how the state is viewed by the world. In many cases, artists have been responsible for shaping and maintaining Maine's historical and cultural identity.

That's why, in the run-up to Maine's bicentennial in 2020, considering some of the ways contemporary artists represent Maine in their art is a critical piece of celebrating the state's history.

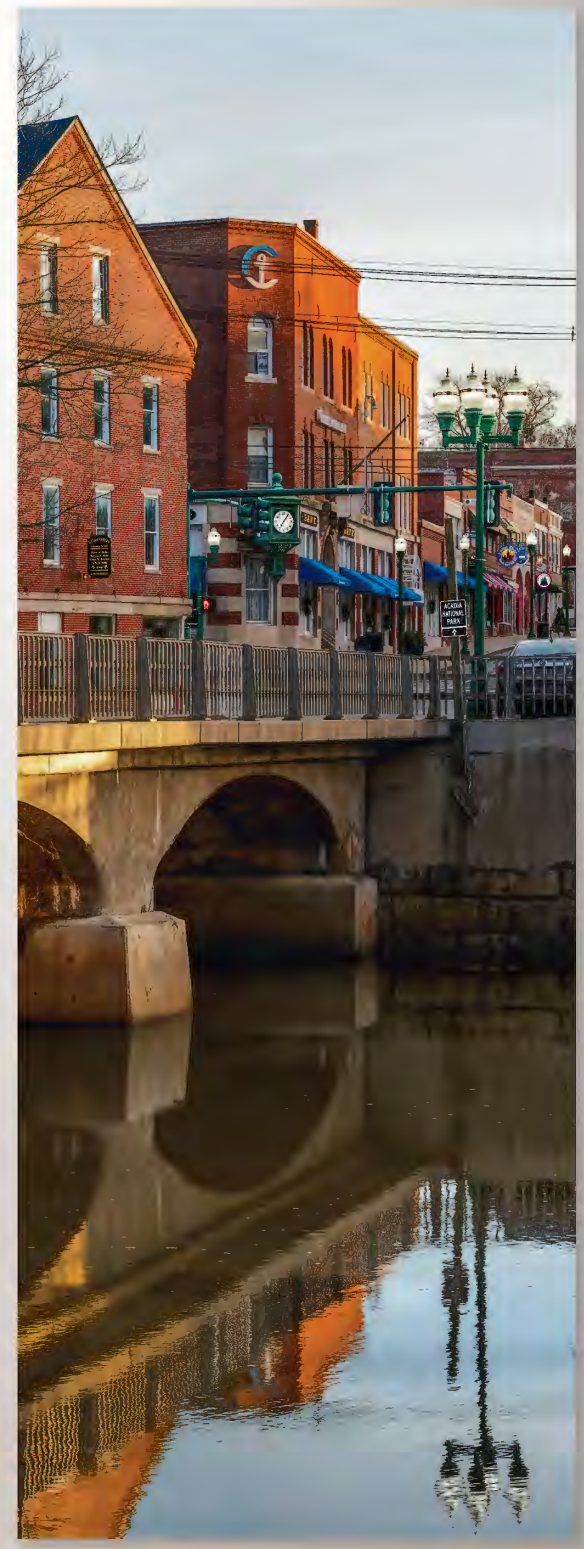
An exhibition, "Framing Maine: Artists' Perspective on Place," opened Oct. 4 and runs through Nov. 15 in Lord Hall Gallery at the University of Maine. The more than 50 works in wide-ranging media, formats and subject matter share a strong personal connection to, or vision of, Maine. As do the 34 artists from throughout the state, some of whom were on campus to share their perspectives in a panel discussion as part of the opening reception.

The panelists spoke with art historian, critic and author Carl Little about their art and experiences. The conversation focused on the importance of art in Maine's history and emerging cultural identity, as well as how the state has influenced the images and forms these artists create. The panel discussion was recorded and is available on the Framing Maine series website, framingmaine.com.

The exhibition co-curators are Laurie Hicks, UMaine professor of art and director of Lord Hall Gallery; Carl Little; and Kreg Ettenger, director of the Maine Folklife Center and Maine Studies Program at UMaine. ◆



Grass Path by James Linehan, acrylic on paper, 2012

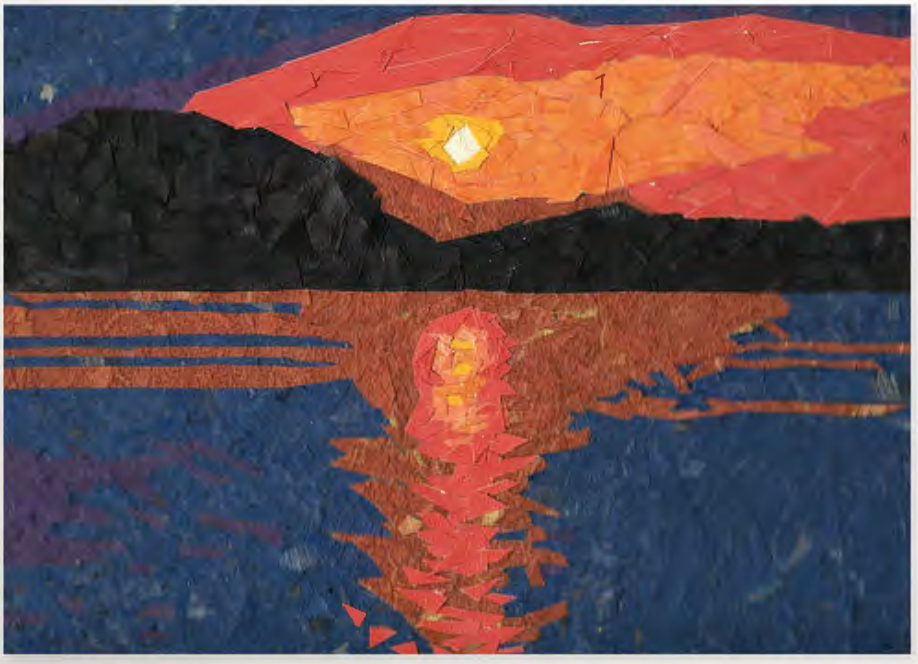


Downtown Sunrise by Heath Paley,
dye sublimation onto aluminum, 2017

The Stolen Cord by Ed Nadeau, oil on linen, 1988

Farm Pond, Maine by John Whalley, graphite on paper, 2019
Courtesy of Greenhut Galleries, Portland, Maine

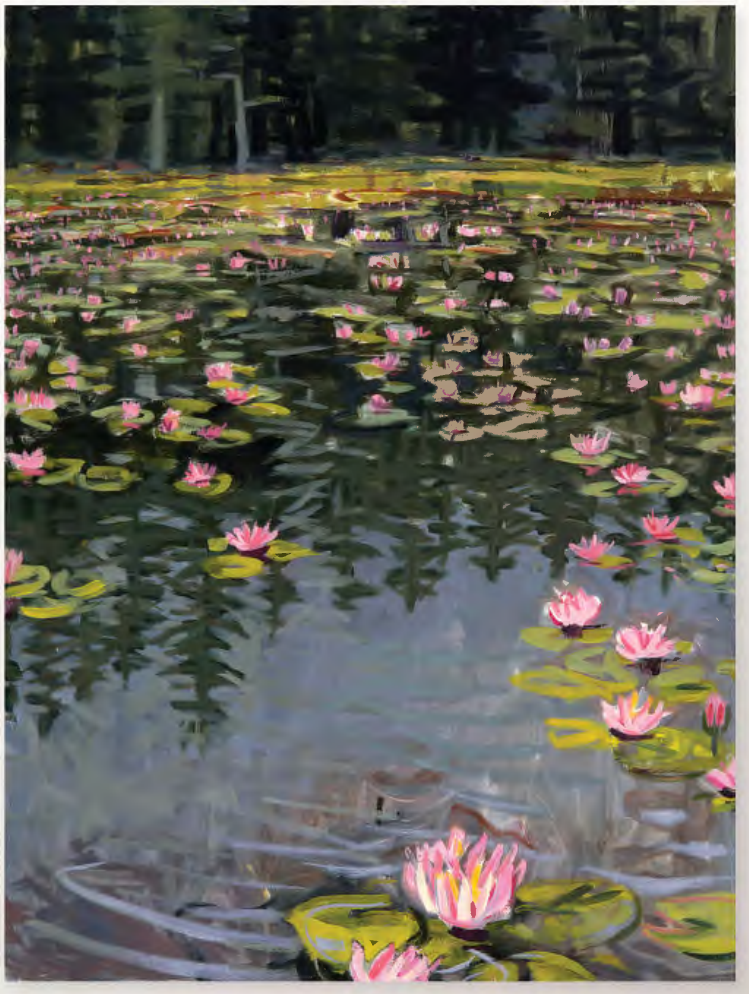
Old Portland from Amato's by Marsha Donahue, oil on canvas, 2014



Wocuhsisk/Pigeon Hill (A Passamaquoddy Place name where the chiefs would gather) by Stephanie Francis, collage, 2010

Boarstone Mountain from Onawa by Alan Bray, casein on wood panel, 1993

Inn by the River, The Forks, 129 Days
by Johanna Moore, solargraph, 2014



Ames Pond Lilies by Louise Bourne, oil on canvas, 2017

Misty Millinocket Lake by Mark Picard, fine art photograph on Premium Luster Archival paper, 2016

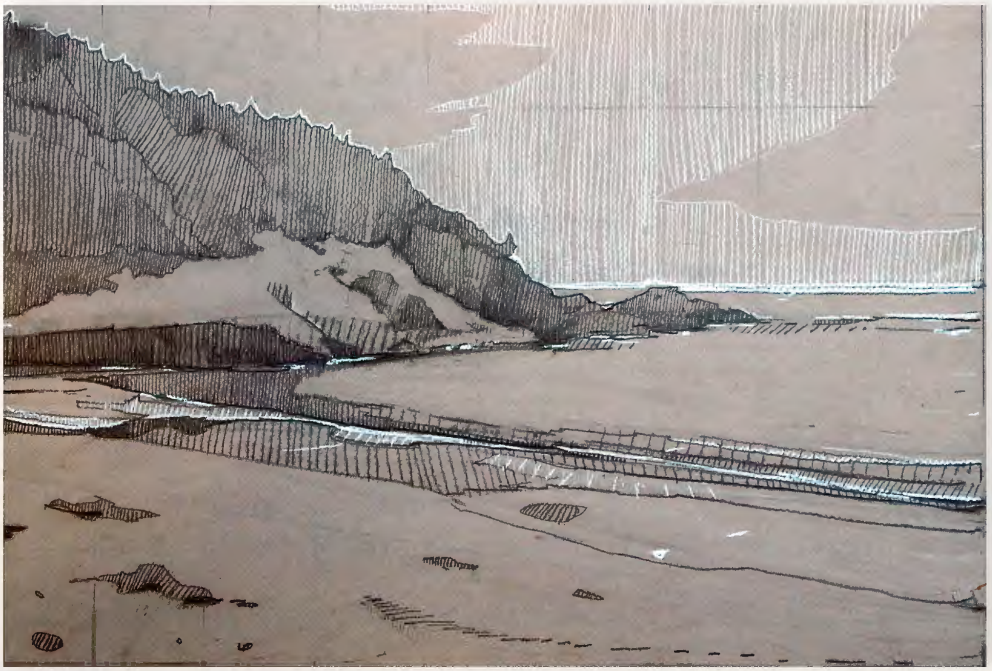
Hanging the Bedding by Siri Beckman, wood engraving, 1998

Winter Power 8, Illusion by Nina Jerome, oil on canvas, 2004

The Village by Rosemary Levin,
hand-dyed and hand-hooked wool rug, 2014

Cape Porpoise Truck by Kevin Beers, oil on canvas, 2010

Gary's Hand on the Wheel by Antonia Small,
black-and-white film negative, Epson print, 2012



Sand Beach, Acadia by Robert Pollien, graphite and chalk on toned board, 2014

Mountains of Maine by Deborah Heyden, intaglio print, 2017

Patrick Pittis Photo by Adam Küykendall

Action!

'Rubble' screenplay may lay groundwork for Pittis' Hollywood film career

After earning a graduate degree in writing and producing for TV at Loyola Marymount University, Patrick Pittis landed a job in the entertainment industry.

As an usher at a movie theater. The pay was good. And between cleaning seats and trash cans, he got to watch films for free.

In his off time, Pittis wrote movie scripts. And in spring 2019, Universal Pictures won the bidding for one of those scripts — "Rubble."

Pittis describes the film as a "contained thriller with a big sci-twist," similar to "10 Cloverfield Lane." Much of the action, he says, takes place in a collapsed staircase.

During his youth, the Bangor, Maine native made short films and attended theater camp with his so-called nerdy friends. The Stephen King fan continued to write scripts in his high school film class.

At the University of Maine, Pittis initially studied theater and secondary education. At the time, he considered a career as a high school drama teacher.

But along the way, he became more and more interested in writing — especially about pop culture — and he switched his major to communication.

Pittis says he was encouraged to explore screenwriting and directing in the supportive atmosphere of the UMaine School of Performing Arts. After he graduated magna cum laude in 2013, Pittis and Meghan Ballard headed to the Golden State.

"I had met my wife as an undergrad," Pittis says. "I had told her my goal was to move to California to try to be a writer. And she was naive enough to believe that I could do it."

Turns out she was right.

When they arrived on the West Coast, Pittis and Ballard worked multiple jobs to save money. Pittis tended bar, delivered pizza and drove for Lyft. And he applied to graduate school.

Two years later, he was accepted at Loyola Marymount, a top film school. Pittis found it thrilling to use state-of-the-art film equipment and collaborate with others who also were developing their writing voices. When he and friends formed a small student production company, they got hands-on experience — from designing set lighting to securing location permits.

Today, Pittis works as an accounting clerk at The Intellectual Property Corporation, an Emmy Award-winning television production company. He says learning about the business side of entertainment has been valuable and eye-opening.

During the two-hour, one-way commute to work in Van Nuys, Pittis brainstorms. He imagines a cool concept or character and a world in which they can exist. He figures out the story he wants to tell and where the emotional beats of the story are, then builds out each scene.

When he writes, Pittis sits on the couch, cranks '80s synth music, and types until his hands are cramped. He calls his initial script the vomit draft. By the third or fourth rewrite, he's ready to share it.

Right out of grad school, Pittis' screenplay "Foxhole" got optioned by an independent producer in Hollywood. The logline: A supernatural creature plagues two soldiers in a foxhole during World War II in France.

The independent producer hooked Pittis up with a management company. And a short time later, the managers showed his "Rubble" script to agents. After some tweaks, Universal bought the rights.

"What happened to me is ridiculously crazy. I was very lucky every step of the way," says Pittis. "It's important to not be discouraged if you don't have immediate success."

Rejections don't dissuade Pittis, anyway.

"If I don't have something to be writing, it's like a bug in my brain. I need to have something that I'm working on," he says.

"A good screenwriter is somebody who has to write. The people that can really push past all of the denials and rejections are the people that live and breathe writing." ◆

When he writes, Pittis sits on the couch, cranks '80s synth music, and types until his hands are cramped. **He calls his initial script the vomit draft. By the third or fourth rewrite, he's ready to share it.**

UMaine climate scientists participate in National Geographic and Rolex Perpetual Planet Extreme Expedition to Everest to better understand 'Earth's critical life-support systems'

HIGH ACHIEVERS

By Beth Staples

In May, Mariusz Potocki breathed the rarefied air near Everest's summit. So too, though, did hundreds of others.

Potocki was astounded by the view just below Mount Everest's Balcony at about 8,300 meters. Clusters of brightly outfitted climbers stood in a line, then moved, inch by inch, single file, toward the 8,850-meter-high (29,035-foot) peak.

"It was a little bit irrational," says Potocki, a University of Maine Climate Change Institute (CCI) glaciochemist who was working his way to the roof of Earth as part of the National Geographic and Rolex Perpetual Planet Extreme Expedition to Mount Everest.

A bit ironic, too. The goal of the two-month multinational, multidisciplinary endeavor was to document people's impacts on one of the planet's most severe environments.

Thankfully, Potocki, one of six CCI scientists who took part in *the* single most comprehensive scientific expedition to Everest, already had accomplished his mission. He had collected the highest ice core on the planet.

The National Geographic and Rolex Perpetual Planet Extreme Expedition team, including Climate Change Institute glaciochemist Mariusz Potocki, have a spectacular view near Yellow Band, the rock on Lhotse Face between Camps III and IV. Photo by Mariusz Potocki

Dreams do come true," Potocki says of conducting science on the 60-million-year-old mountain.

The researcher, cave explorer, mountaineer, underwater diver and photographer drilled the 10-meter ice core at 8,020 meters on South Col.

He did it with an off-the-shelf ice-coring instrument modified by UMaine's Advanced Manufacturing Center.

Potocki had hoped to drill another ice core May 23 just off the summit. But that was the day dozens of people attempting to reach the peak bottlenecked in Everest's "death zone." Climber Nirmal Purja snapped a widely circulated photo of the human traffic jam near the top of the world.

The death zone is so named because at 8,000 meters and higher, there's one-third of the oxygen there is at sea level. People's cells — deprived of oxygen — begin to die. Consequences include impaired judgment, altitude sickness, heart attacks, strokes and death.

For safety reasons, the expedition climbers — two other climate scientists, 15 Sherpas (including climbing leader Panuru Sherpa who has summited 17 times) and three filmmakers — decided not to continue climbing the 430 meters to the summit.

"The biggest fear was the crowd," Potocki says. "It was too dangerous to wait in line."

Potocki had steeled himself for the real possibility that he would see bodies on the mountain. And he did.

Earlier during the ascent, the doctoral candidate from Poland had to step over the body of a climber who had died adjacent to the safety rope a couple of days earlier.

At least 11 people perished during the 2019 season, for which Nepal reportedly issued a record 381 climbing permits. Sherpas aren't included in the number of permits issued.

Near Everest's peak, in addition to the dearth of oxygen and minus 30 degree Fahrenheit temperature, hurricane-force winds can rage at more than 100 mph.

The high-altitude expedition team drills the world's highest ice core sample at 8,020 meters above sea level during the National Geographic and Rolex Perpetual Planet Extreme Expedition to Mount Everest in spring 2019. Photo by Dirk Collins, National Geographic

Far left: On the Khumbu Icefall, which is described as a shifting river of ice, people wait in line to climb a ladder and continue the trek toward Camp I. **Above:** After securing the world's highest ice core, Mariusz Potocki and a another climber make their way to Base Camp just after sunrise. They arose at 3 a.m. to get through the Khumbu Icefall early in the day when there's less shifting of the ice. Photos by Mariusz Potocki

Paul Mayewski described the 10-meter-long ice core that Mariusz Potocki collected at 8,020 meters on South Col as a "buried weather station."

Near Everest's peak, in addition to the dearth of oxygen and minus 30 degree Fahrenheit temperature, hurricane-force winds can rage at more than 100 mph.

Sean Birkel closely watched the weather conditions on Mount Everest from more than 7,000 miles away in Orono.

Throughout May, and leading up to the summit push, the CCI research assistant professor processed and interpreted weather forecast data from NOAA and the European Centre for Medium-Range Weather Forecasts.

He relayed forecasts of wind speed, atmospheric pressure and temperature at Everest's peak to CCI director and expedition leader and lead scientist Paul Mayewski, and climbing leader and high-altitude mountaineer Peter Athans at Base Camp. They provided the up-to-date information to the climbing team.

Potocki says if the ice core — which could be 2,000 or more years old — yields good preliminary results, he wants to return to Nepal, brave the conditions, have another shot at the summit and drill additional ice cores.

"Everest is still an amazing place, even if it's so commercialized," he says. "It's a very charming mountain, so it was really amazing to be there, especially with a fantastic team."

Mayewski led the fantastic team. He communicated via satellite phone with Potocki and other climbers as they maneuvered through the treacherous Khumbu Icefall — a steep, shifting, jagged, narrow stretch of glacier — and ascended to Camp I (19,861 feet), Camp II (21,015 feet), Camp III (23,573 feet), Camp IV/High Camp (26,314 feet), South Col and beyond.

An Altitude Air helicopter pilot evacuates a sick person during a January training session on Mount Everest. Photo by Mariusz Potocki

AMC RETROFITS ICE CORERS FOR EXTREME EXPEDITION

When researchers conduct trailblazing exploration in punishing environments, off-the-shelf tools sometimes don't make the cut.

Climate Change Institute researchers preparing for the National Geographic and Rolex Perpetual Planet Extreme Expedition needed ice-coring equipment light enough to be carried up 29,000 feet on Mount Everest. It also had to be rugged enough to endure severe situations, and work in a variety of snow and ice conditions.

To get that equipment, Dan Dixon headed across campus to the Advanced Manufacturing Center.

The CCI research assistant professor knows AMC project managers Kyle Forsythe and Forest Wentworth well. They've retrofitted ice-coring systems before.

"I've never met a problem they couldn't fix," says Dixon. "(AMC) is a luxury. They're smart guys. I say, 'We need to do this, can you make it happen?'"

Forsythe and Wentworth can. And do. And did. They altered a drilling system that had been tested in Iceland. Then, based on the system's performance there, made additional tweaks. Among the changes — they made three off-the-shelf ice-coring systems lighter, altered the drill heads, and made holes in the barrels so ice chips can't get jammed.

One system was used at Base Camp, and the climbing team took two (one for backup) up the mountain. Each system — which weighs 33 pounds — included extensions, drills of various sizes and shapes, toolkits and batteries. Lots of batteries.

CCI glaciochemist Mariusz Potocki said the revamped equipment performed perfectly as he collected the highest ice core in the world on South Col at 8,020 meters (26,321 feet).

"It was a beautiful day. There was wonderful ice there," says Potocki, who had rehearsed the procedure over and over in his head, and talked about it with his tent mate from National Geographic's media team.

"The glacier is a perfect shape. The drilling was amazing, phenomenal."

As it turned out, even in the frigid, windy conditions, one battery powered the collection of the entire ice time capsule. Potocki now displays that battery on his desk.

Wentworth, who majored in mechanical engineering technology at UMaine, says the expedition's success reminded him of how special his job is.

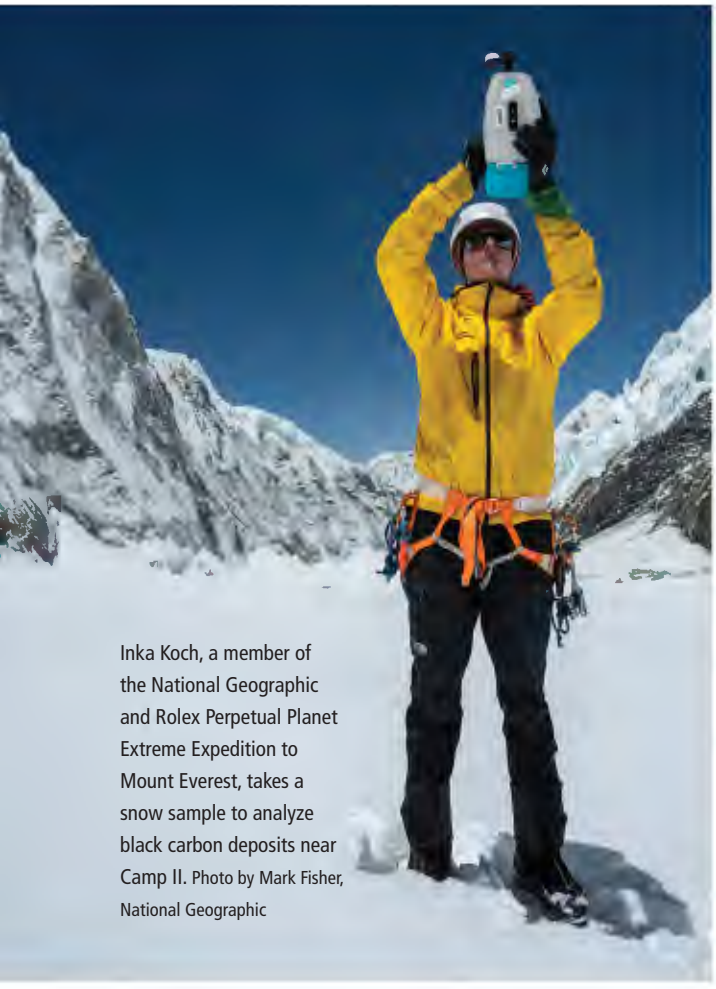
Forsythe, who earned a degree in engineering physics in Orono, says he's gratified to have had a hand in the consequential project. ◆

Top: Members of the National Geographic and Rolex Perpetual Planet Extreme Expedition to Mount Everest team work to drill an ice core at Everest Base Camp to better understand climate change on the glaciers of the Hindu-Kush Himalaya. Photo by Brittany Mumma, National Geographic

Above: Climate Change Institute explorer Mariusz Potocki collected the world's highest ice core from this Mount Everest glacier. Climbers appear speck-size on the glacier. Photo by Mariusz Potocki

Water flowing from Himalayan glaciers is a resource for energy, food and consumption for about 20% of the world's population.

Much of the water in the Imja Khola River is derived from melting glaciers, which is evident from the ethereal blue color that results from the suspension of fine glacial sediments. As the glaciers diminish in size, the amount of runoff from glacier melt also will diminish. Photo by Aaron Putnam



Inka Koch, a member of the National Geographic and Rolex Perpetual Planet Extreme Expedition to Mount Everest, takes a snow sample to analyze black carbon deposits near Camp II. Photo by Mark Fisher, National Geographic

Mayewski directed the biological, geological, glaciological, meteorological, mapping and multimedia enterprise from Base Camp, at an altitude of 17,514 feet.

"We believe the best way to do science on Everest isn't just to do one kind of science, but do many kinds of science," he told National Geographic.

The world-renowned climate scientist and explorer is grateful for his role in this pioneering project that National Geographic calls a "new model of exploration that expands understanding of the Earth's critical life support systems and delivers data to catalyze solutions for a Perpetual Planet."

Mayewski has long admired National Geographic's reputation, big-picture perspective and approach. Its stated vision is a planet in balance "through a unique combination of strong science, exploration, education and storytelling."

As a youth, Mayewski pored over issues of *National Geographic Magazine* and dreamed of expeditions to remote regions. Like Potocki, his dreams have come true.

This marked Mayewski's fourth scientific expedition on Everest, which Tibetans call Chomolungma and Nepalis call Sagarmatha for "mother of the sky."

He's led nearly 60 research expeditions around the globe, many in Antarctica, where he was the first person to explore large tracts of the continent. "Mayewski Peak," a summit in Antarctica's Saint Johns Range, is named in his honor.

The purpose of this expedition was to examine high mountain glaciers, which are water towers for people downstream. Two other critical systems that fuel Earth's engines — rainforests and the ocean — are on the docket for future National Geographic exploration.

Water flowing from Himalayan glaciers is a resource for energy, food and consumption for about 20% of the world's population. One billion people living in the watershed will be stressed due to the shrinking of the glaciers, Mayewski says. Initially from flooding and landslides, and later due to drought.

"Water is the new oil," he says. "You need clean water to live."

While little is known about climate change impacts on iconic Everest and water towers in the region, Mayewski says this comprehensive project — which he calls "a new window into the planet" — will change that.

PROGRESS TOWARD A PERPETUAL PLANET

The international team of scientists, Sherpa climbers and storytellers on the National Geographic and Rolex Perpetual Planet Extreme Expedition set out to collect data to provide real-time and historical information about factors affecting the ecosystem's health.

Here's a synopsis of what the explorers, including six scientists from the Climate Change Institute, accomplished during the two-month mission:

RECORDED

- The highest ice core at 8,020 meters, and obtained additional ice cores from lower elevations

COMPLETED

- A survey of biodiversity and wildlife in multiple high-elevation environments, including possible elevation records for at least two insect species — a centipede at 5,510 meters and a caddisfly at 5,610 meters
- The highest-elevation helicopter-based lidar scan at about 7,000 meters
- The most detailed lidar and photogrammetric imaging of Mount Everest Base Camp

COLLECTED

- Glacial lake sediment cores
- Rocks for glacial and geologic analysis
- Snow samples from each precipitation event over the study period
- Water samples from seven glacial lakes

CONDUCTED

- The highest-resolution scans of the Khumbu Glacier

INSTALLED

- Five automated weather stations on Everest — two of which are the world's highest operating stations — at South Col at 7,945 meters and on the Balcony at 8,430 meters.

STAY TUNED.

For updates and to explore historical and new data about Mount Everest's role as a water tower for the region, **visit natgeo.com/everest** ◆

Top: *Cortiella hookeri* — a plant that grows in the sparsely vegetated high alpine zone of the Himalaya — was found at an elevation of about 4,900 meters (16,076 feet) on a fresh lateral moraine ridge, likely less than a century old. University of Maine scientist Aaron Putnam identified the plant with the assistance of iNaturalist, a joint initiative of the California Academy of Sciences and the National Geographic Society. **Above:** University of Maine student Laura Mattas drills to collect a sample of a boulder dropped onto a moraine during the last ice age by what was then a much larger Khumbu Glacier. UMaine researcher Aaron Putnam will supervise the surface-exposure dating to determine how many years ago the Khumbu Glacier maintained its ice-age size. Photos by Aaron Putnam

Above: Paul Mayewski, Climate Change Institute director, and expedition leader and lead scientist, hikes to Base Camp. Photo by Eric Daft, National Geographic **Right:** University of Maine graduate student Peter Strand, left, and Tri-Chandra graduate student Lal Bahadur Thapa fly a drone to map glacial moraines and landslide deposits near the village of Khumjung. The glacial geology team seeks to gain insight into the history of glaciers and climate of the region. Photo by Aaron Putnam

"We believe the best way to do science on Everest isn't just to do one kind of science, but do many kinds of science."

Paul Mayewski

Climatologist Tom Matthews from Loughborough University and meteorologist Baker Perry from Appalachian State University installed five weather stations on Everest, including the two highest on Earth. The stations already are providing real-time data instrumental for climate scientists, meteorologists and climbers.

During the Fueling Earth's Engines discussion with other Perpetual Planet Extreme Expedition team members in Washington, D.C., Mayewski described the 10-meter-long ice core that Potocki collected at 8,020 meters on South Col as a "buried weather station." The buried treasure will allow people to go back in time — tens, hundreds and perhaps thousands of years.

"It will unlock a lot of secrets," says Mayewski, who lost 20 pounds during the two-month endeavor due to the flu and high elevation.

UMaine's laser technology that yields 10,000 samples per meter in ice cores will reveal first-ever details about the atmosphere above 8,000 meters. Scientists will glean facts about human-made pollutants, past temperatures, precipitation and snowfall amounts. They'll also learn where air masses over and around Everest hail from — which will be key to understanding the region's monsoon cycle.

The data will allow scientists to better understand the past climate and make more accurate predictions about future climate.

In addition to analysis of the ice core, Mayewski, Potocki and UMaine colleagues will analyze numerous other specimens they painstakingly gathered.

UMaine doctoral student Heather Clifford drilled an ice core with Mayewski at Base Camp, which in May becomes a hopping tent city, complete with an emergency room, helicopter pads and movie theater.

On campus in Orono, Clifford, with CCI research assistant professor Kimberley Miner, will analyze ice, sediment, snow and stream water for different chemical measurements, including persistent organic pollutants and microplastics.

"I came back with a sense of wanting to try new things and travel more," says Clifford, adding she was inspired by the experience, including meeting brave climbers and visionary scientists.

Above: UMaine-Tri Chandra glacial geology team members, from left, Bhuwan Awasthi, Laura Mattas, Lal Bahadur Thapa, Samir Dhungel and Peter Strand, sample a glacial boulder on a moraine constructed by the Khumbu Glacier during the last ice age. At the peak of the ice age, the Khumbu Glacier would have flowed down the central valley seen in the background to deposit this glacial landform. Photo by Aaron Putnam

Right: At 8,430 meters above sea level, the high-altitude expedition team celebrates after setting up the world's highest operating automated weather station during the National Geographic and Rolex Perpetual Planet Extreme Expedition to Mount Everest. Photo by Mark Fisher, National Geographic

From his tent, Climate Change Institute researcher Aaron Putnam had this view, which includes a portion of Mount Everest's Base Camp — the rock-covered surface of the Khumbu Glacier. Ice pinnacles in the background are the result of surface melt due to warm atmospheric temperatures. Large tents in the foreground served as the hub of field operations for the National Geographic scientific effort. Photo by Aaron Putnam

UMaine's laser technology that yields 10,000 samples per meter in ice cores will reveal first-ever details about the atmosphere above 8,000 meters.

To reach Everest, Clifford, Mayewski and Potocki flew to Kathmandu, then to Lukla (altitude 9,109 feet). From there, over about 10 days, they hiked to Base Camp to gradually acclimate to the 8,400-foot increase in elevation over 39 miles.

Base Camp also is where UMaine Earth and climate sciences assistant professor Aaron Putnam's team — which included scientists from Tribhuvan University — concluded its geology research. The group's goal was to document the Khumbu Glacier's chronological history from the last ice age to the present.

UMaine Ph.D. candidate Peter Strand and Laura Mattas, then an undergraduate and now a Quaternary and climate studies master's student, were part of the group that wound its way up the valley to Base Camp from Lukla.

They gathered rock samples along the way. The team also used drone-mapping technology to create 3D images of landforms — moraines and the modern-day terminus of the glacier — to establish a baseline for monitoring year-to-year changes in the glacier's retreat and volume of ice.

The scientists used a technique called cosmogenic surface-exposure dating to determine when the Khumbu Glacier retreated up the valley. They started lower in the valley, sampling older ridges of rubble left along the former glacier margins, or moraines, from the last ice age. They worked their way up the valley toward the youngest landforms exposed in recent years.

TOP STUDENTS

To graduate, Laura Mattas and Heather Clifford faced an uphill climb. Literally.

In May, as their peers celebrated Commencement at the University of Maine about 125 feet above sea level, Laura Mattas and Heather Clifford marked the occasion at Mount Everest's Base Camp — at 17,514 feet.

They were on the world's highest mountain conducting research for the National Geographic and Rolex Perpetual Planet Extreme Expedition.

Mattas, an undergraduate, and Clifford, a graduate student, didn't wear traditional caps and gowns for the May 11 ceremony. Other items had priority in their backpacks for the multiday hike to Base Camp.

So the explorers improvised. Trash bags became robes, cardboard and duct tape made sturdy mortarboards, and yellow electric tape turned into tassels. Clifford draped a yellow jacket over her shoulders to signify her graduate hood.

And when "Pomp and Circumstance" started playing on an iPhone, Clifford and Mattas stepped through the flap of an insulated yellow dining tent.

Among the distinguished guests were Sherpas; UMaine colleagues, including Mariusz Potocki who collected the world's highest-altitude ice core; and National Geographic science team members, including Tom Matthews and Baker Perry, who installed the two highest weather stations on Earth.

Guests had assembled for dinner around a table laden with insulated Hydro Flasks, ketchup bottles, hand sanitizer, instant coffee, a small lantern and bowls of soup.

And a congratulatory vanilla cake.

Paul Mayewski, director of the Climate Change Institute, and expedition leader and lead scientist, said the graduation ceremony on Everest was almost certainly a first for UMaine, maybe the world.

He also announced that Clifford and Mattas were valedictorians of their respective classes.

"We searched all over the Khumbu Glacier. We couldn't find anybody who had as high grades, was from the University of Maine and was on Mount Everest," he said during the ceremony.

Mattas, who studied Earth sciences with a concentration in climate sciences, has already conducted deglaciation research on Everest and in Antarctica, New Zealand and Iceland.

"I'm glad my eyes are bloodshot from altitude rather than studying for finals," she said after accepting her temporary diploma — a cloth bag used to collect rock samples.

She's now pursuing a master's degree in Quaternary and climate studies with the Climate Change Institute. And Mattas, a native of Glenville, New York, says she's always had her head in the clouds.

"I grew up playing in the great outdoors of the nearby Adirondack Mountains and was curious about the way storms traveled and passed through the mountains, how the mountains and valleys formed (and) what damages were being caused by acid rain."

After the ceremony, guests signed the diplomas, which Clifford called an incredible expedition souvenir.

Clifford earned her master's degree in Quaternary and climate studies, with a concentration in ice cores and data analysis. While at UMaine, the native of Sandwich, Massachusetts also has conducted research in the Peruvian Andes, Swiss Alps and Greenland.

For her doctorate at CCI, she'll examine snow and ice from these high mountain regions, and seek to solve problems related to pollution and climate change.

"These two valedictorians have raised the bar to new heights," said Aaron Putnam, assistant professor in CCI and the School of Earth and Climate Sciences, at the conclusion of the ceremony. "They're clearly our top students, in so many ways, and they are just pushing the field to new heights. And we couldn't be more proud of them." ◆

Left: Laura Mattas, left, and Heather Clifford don trash bag robes, cardboard and duct tape mortarboards, and yellow electric tape tassels for commencement. **Right:** Heather Clifford, front left, and Laura Mattas, front right, celebrate at Base Camp with the multinational National Geographic and Rolex Perpetual Planet Extreme Expedition team.
Photos by Peter Strand

The researchers followed the route pioneered by Sherpa Tenzing Norgay and Sir Edmund Percival Hillary, who are credited with being the first to summit Everest in May 1953.

Along the way, the team stayed in teahouses, similar to hostels. Strand — who took books, chocolate bars and beef jerky for sustenance — says porters were invaluable to the team charged with assessing the health of the glacier.

Mattas says every day brought a new landscape, new challenges and encounters with new and exciting people. She and Strand say this research just scratches the surface of what's possible.

Near the foot of the Khumbu Icefall at Base Camp, Putnam and Strand also did cosmogenic dating on recently exposed rocks to determine if they have any "memory of past times when it was warmer and the ice was smaller."

The results, says Putnam, will allow them to assess whether the current meltdown of Himalayan glaciers is unprecedented since Homo sapiens first roamed Earth.

Putnam says he cherishes the cultural experiences and the bonds he forged — which don't get captured in scientific papers — with Nepalese scientists and Sherpas. None of the incredible science would have been successful without them, he says.

Mayewski is eager to share those forthcoming scientific discoveries with people in Nepal so they can make informed decisions and strengthen their climate change resilience.

"Nepal opened up to us basically their heart, the most important thing they can offer us," he said during the Fueling Earth's Engines event at the National Geographic Explorers Festival.

"Our requirement, or our privilege, now is to try to put the science together and be able to talk about its impact on hydroelectric power, agriculture activities, quality of life, tourism and all of the things important to these people."

Time is of the essence, says Mayewski.

According to National Geographic, the 7.6 billion people inhabiting Earth are causing "unprecedented negative human impacts on the world's species and ecosystems."

"(W)e believe if people truly understand the natural world and its people, they will value and protect the planet and the diverse cultures that call it home," reads the website.

Putnam agrees. Seeing is believing, he says.

If global citizens with a grasp of climate history witness the impact of climate change on this iconic landscape and the people who live in its shadow, Putnam says some may be motivated to make a difference — when deciding which products to buy, when making investments and when stepping into the voting booth. ◆

> One billion people living in the watershed will be stressed due to the shrinking of the glaciers, Paul Mayewski says. Initially from flooding and landslides and later due to drought.

Above: Inka Koch and Laura Mattas cross a swing bridge over the Imja Khola River. The river is fed by monsoonal rainfall, as well as snow and glacier melt from the highest catchment on Earth. Photo by Aaron Putnam

Above: Mariusz Potocki took this night photograph from Pumori, just to the west of Everest. Climbers' headlamps light the way up the mountain. "It was hard to sleep," he laughs. **Left:** Panuru Sherpa leads a January training session/ reconnaissance trip for members of the National Geographic and Rolex Perpetual Planet Extreme Expedition to Mount Everest. The daytime temperature at Base Camp in January is about 4 degrees C, or 39 degrees F. At night, it's about minus 17 degrees C, or 1 degree F.

Photos by Mariusz Potocki

Three Fulbright finalists

Two students, one alumna take their research projects abroad

By Beth Staples

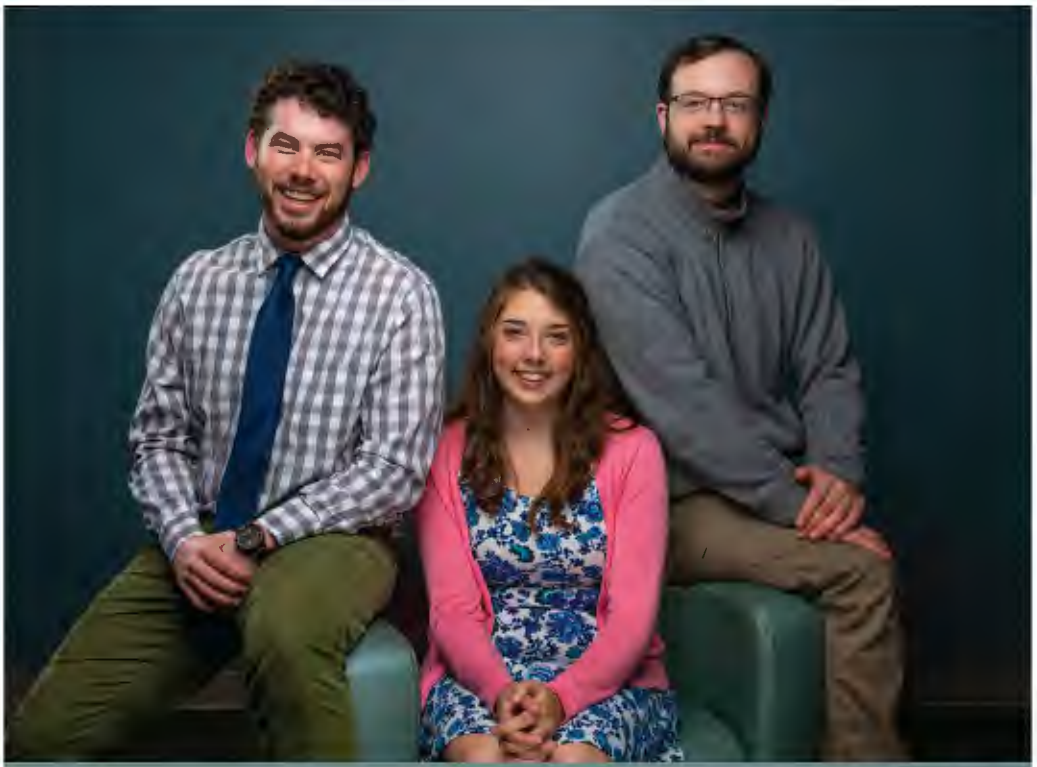
Emily Craig, Eric Miller and Jesse Walters were offered Fulbright grants for their research projects based on their academic achievement and demonstrated leadership potential.

Craig, a 2018 alumna from Stonington, Connecticut, expects to do research in Sri Lanka. She plans to explore environmental origins of chronic kidney disease of unknown etiology (CKDu) — one of the country's leading causes of death.

Miller, of Wausau, Wisconsin, is examining payments for environmental services (PES) to promote conservation and resource management in Lao People's Democratic Republic, or Laos.

And Walters, from Klickitat, Washington, is looking at how sulfur — an element critical to life, climate and the economy — is exchanged between the Earth's surface and interior. He is based in Frankfurt, Germany.

Craig plans to examine environmental sources of CKDu and work to develop a screening assay that quickly tests for well water contamination. In 2018, the member of the Honors College earned



Fulbright finalists from the University of Maine are, from left to right, Eric Miller, Emily Craig and Jesse Walters.
Photo by Adam Küykendall

a bachelor's in marine science, with a concentration in marine biology and a minor in chemistry. After graduating, she worked as an associate with the Honors College.

Growing up in a coastal town, Craig developed a lasting appreciation of the ocean and marine life. She's explored how people's devastation of the natural environment affects human health and well-being. At UMaine, environmental toxicology was a focus of her research.

Craig credits her independent Honors College research with advancing her as an academic. She calls the marine sciences program an exemplary learning environment. "All of a sudden, school wasn't just reciting information from a textbook, but realizing that there is a lot left to be researched and learned about," says Craig, who likes to snorkel, paint and do yoga, and is interested in a career as a professor of marine toxicology.

Miller's PES project brings together ecology, economics and global environmental policy — an ideal fit for his academic interests. The Eagle Scout is pursuing two master's degrees, an M.S. in resource economics and policy, and an M.A. in global policy, with a concentration in environmental policy.

The program operates in more than 140 countries. **Recipients of Fulbright grants are selected on the basis of academic achievement and demonstrated leadership potential in their fields.**

He describes payments for environmental services as market-based incentives — similar to subsidies — offered to forest owners, farmers and other landowners to encourage conservation of natural resources that provide essential broader ecological services.

"It's a flexible tool, as it can be applied to communicate the value of a resource that is difficult to quantify through traditional valuation techniques," says Miller, who snowboards, camps, canoes, cycles and bakes bread. "I'm excited and grateful for the opportunity to connect with so many different perspectives as well as finding out how I'll grow as an individual from this experience."

At UMaine, Miller has learned technical skills and gained wisdom from mentors. He's considering a career as a policy analyst at an environmental policy think tank, as a water resource economist for a federal agency, or as an employee at the U.S. Department of State.

Walters, an Earth science doctoral student, examines subduction zones — where two pieces of Earth's crust collide. When seafloor rock sinks into the inner Earth, he'll explore whether sulfur remains in it or if it's transferred to volcanoes that overlie subduction zones, then is returned to the surface.

As a youngster in the small logging town of Klickitat, where his high school graduating class totaled seven students, Walters hiked, camped, rafted and solved mysteries of the natural world. "When I was growing up, my father became interested in gold prospecting and we would travel around the country mining in remote areas," says Walters, who once fronted a heavy metal band and now plays guitar in the cover band Jesse and the Geodes. "I became drawn to how Earth's rock formations develop and the chemical processes that drive our planet."

The 2019 Chase Distinguished Research Assistant says at UMaine he's become a more capable researcher, gained expertise on world-class laboratory instrumentation, and grown as a scientific writer and presenter. He's interested in a career in academia and is passionate about sharing his research and excitement for science. ◆

Community FEAST

Microsoft and National 4-H Council empower Washington County teens to combat local food insecurity

By Elyse Catalina | Photographs by Holland Haverkamp

For two years, a group of juniors at Washington Academy in East Machias has used technology to combat food insecurity in their county.

The innovative project is part of a national program offered through a partnership between the National 4-H Council and Microsoft. The organizations help close the connectivity gap in rural areas by empowering teens to bring technology to their communities.

The 4-H Tech Changemakers program puts teens at the forefront of creating change, allowing them to serve as digital ambassadors by equipping them with tools, resources and technical partners. The project spans more than 90 communities in 15 states, including Maine's Washington County.

The program was created to get youth and adults to work together to solve a problem in their community, according to team member Paige Bell of Edmunds, Maine.

Washington County has one of the highest food insecurity rates in the state at 15%, according to Feeding America.

"Food insecurity was something we could see clearly all around us," says team member Forrest Perkins of Marshfield, Maine, noting that a lot of local children receive free or reduced-price lunch at school, and many adults, especially seniors, don't have access to or can't afford fresh, healthy food.

"Growing up on a family farm, I've known there is high demand for good food, and we have to not only know about good food, but also how to handle it (and) grow it, and what to do with it," Bell says.

The three-year project has received a grant, as well as Surface Pro tablets, from Microsoft and the National 4-H Council.

Six teen leaders have collaborated with UMaine Extension Master Gardener Volunteers, Healthy Acadia and local businesses to revitalize a 3,000-square-foot garden at their school. The improvements include installation of a fence and raised beds.

In addition to the core group of six, 28 other students have participated in the project. Through the support of youth volunteers and community partnerships, the garden grows produce for the Machias Food Pantry, which serves up to 400 people a month.

The group also has created a website, Community FEAST (Food, Education, Agriculture, Sustainability, Technology), where community members can connect to farms and food pantries to find locally grown food, as well as learn more about countywide efforts addressing food insecurity. The group's Instagram account, communityfeast4h, features photos and videos of its work in the garden and engagement in the community.

"The community has a resource it can use," Perkins says of the website.

The team also hosted several Hour of Code sessions in which they taught computer coding basics to elementary school students, as well as their parents and grandparents.

The students have learned more about the "heart" component of 4-H, says Jen Lobley, a UMaine Extension professor in 4-H and volunteer development, who is working with the youth on the project. They've also learned about gardening, nutrition, public speaking, interviewing, capturing video and creating a website.

"They have come to have a better understanding of the issue of hunger and how it affects people in their local community," Lobley says. "They have learned the power and joy of giving and doing for others."

Bell and Perkins say they enjoy making a difference.

Above: The 4-H Tech Changemakers program was created to get youth and adults to work together to solve a problem in their community, according to team member Paige Bell (bottom left). **Left:** Through the support of youth volunteers and community partnerships, the group's 3,000-square-foot garden grows produce for the Machias Food Pantry. The team also hosts sessions to teach computer coding basics to members of the community.

"I love being part of this project because I definitely feel like I'm helping. Especially now (that we're) getting the food that we've grown into the local food pantry," says Bell, who adds that food pantry clients seem to be enjoying the produce, as well.

"They can definitely see that we're creating something that will hopefully encourage other people to do the same thing and make a difference."

Bell, who lives on a ninth-generation farm, says the project has expanded her thoughts about growing food, as well as working with others toward a shared goal.

"Food has always been really important to me," she says. "I understand the importance of healthy food, and I feel like it's really important for other kids to be able to understand that, as well."

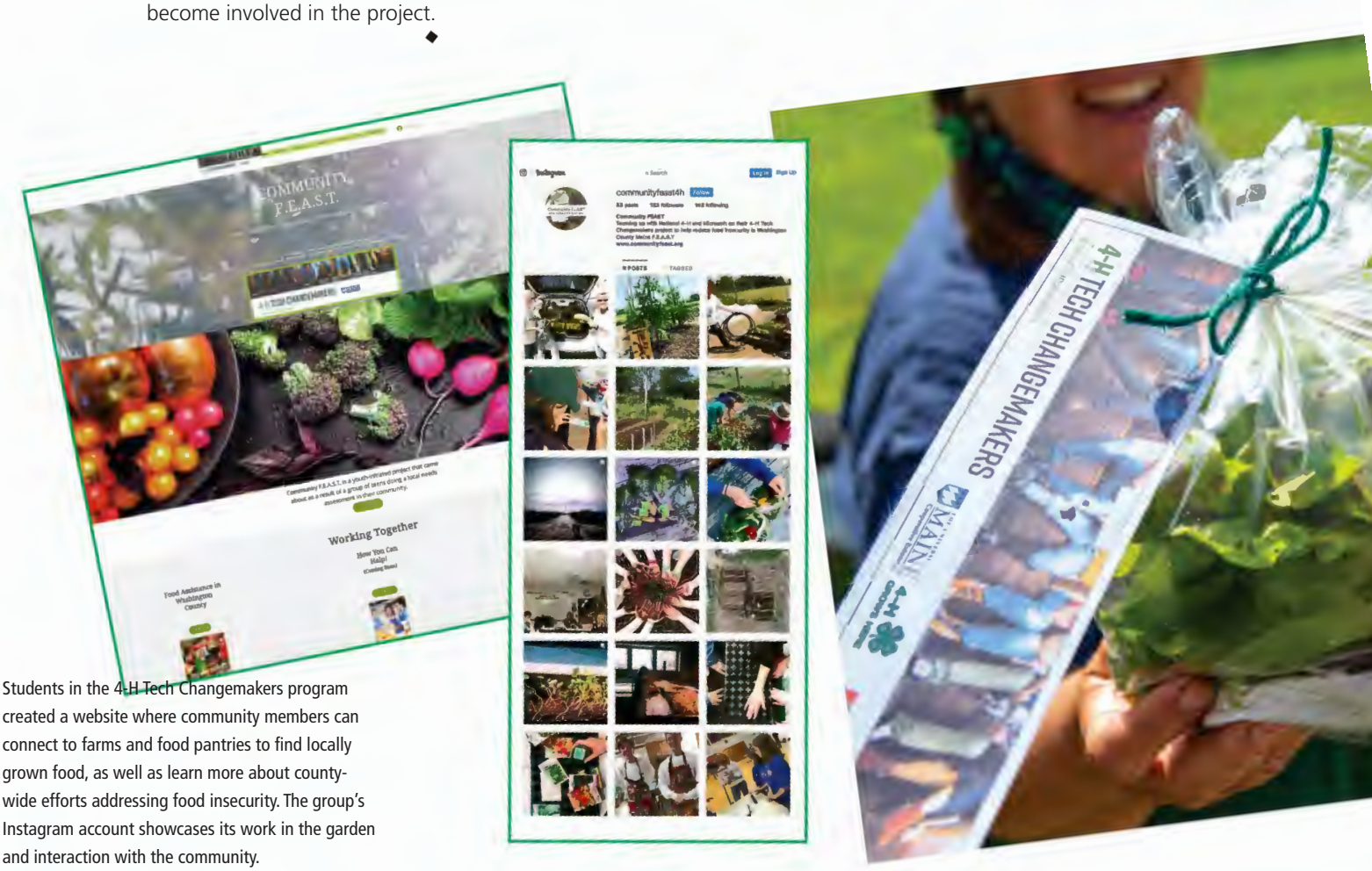
By creating a website and posting to Instagram, the students facilitate connections between farmers and customers, and offer a glimpse into their garden's progress, Bell says.

"It feels really good because you'll farm, collect all the produce, and then you'll go back and think, 'People are eating this. I'm helping to feed my community,'" Perkins says.

The students plan to add content to the website, including more local food resources and ways others can help combat food insecurity and become involved in the project.

◆

The innovative project is part of a national program offered through a partnership between the National 4-H Council and Microsoft. **The organizations help close the connectivity gap in rural areas by empowering teens to bring technology to their communities.**



Students in the 4-H Tech Changemakers program created a website where community members can connect to farms and food pantries to find locally grown food, as well as learn more about county-wide efforts addressing food insecurity. The group's Instagram account showcases its work in the garden and interaction with the community.

E. James "Jim" Ferland and Eileen P. Ferland Photo by Adam Küykendall

Transformative vision

New Engineering Education and Design Center named for Jim and Eileen Ferland

The University of Maine's new Engineering Education and Design Center will be named in honor of Skowhegan, Maine natives E. James "Jim" Ferland and Eileen P. Ferland, who donated $10 million to the project.

The announcement of the previously anonymous donors was made Sept. 12 during the UMaine Alumni Association 2019 Reunion, where Jim Ferland was celebrating his 55th class reunion.

The E. James and Eileen P. Ferland Engineering Education and Design Center (EEDC) will house the Biomedical Engineering Program and Department of Mechanical Engineering, as well as teaching laboratories for mechanical engineering technology, and provide space for all UMaine engineering majors to complete their senior capstone projects.

The Ferlands' gift in March 2018 helped the University of Maine Foundation set a record for giving totals — $17.4 million in private support from more than 350 individuals, corporations and foundations. They include the Gustavus and Louise Pfeiffer Research Foundation, which made a $1.5 million donation.

More than $66 million of the $75 million to $77 million project total now has been raised. Groundbreaking for the center is planned in early 2020, with anticipated completion in 2022.

Jim Ferland received a bachelor's degree in mechanical engineering at UMaine in 1964 and began his career as an engineer with the Hartford Electric Light Co., a subsidiary of Northeast Utilities in Connecticut. He became president of Northeast Utilities in 1983.

In 1986, Jim Ferland was recruited by Public Service Enterprise Group, where he served as chairman, president and CEO. He retired in 2007, making him the longest-serving CEO in the industry.

The EEDC project is part of UMaine's $200 million Vision for Tomorrow comprehensive campaign, which has raised over $182 million, led by the UMaine Foundation. ◆

AFTER THE STORM

Monitoring concentrations of dissolved organic carbon in Maine lakes before and after severe rainstorms could inform management strategies to help ensure consistent, high-quality drinking water, according to University of Maine researchers.

In their study, working with local drinking water districts, Kate Warner and Jasmine Saros, researchers in UMaine's Climate Change Institute and the School of Biology and Ecology, found that increasingly frequent and extreme rain events can contribute to short-term abrupt changes in the quantity and quality of lakes' dissolved organic carbon, which is derived from leaves, pine needles and other terrestrial debris in watershed runoff.

The goal was to better understand the effect of severe rainstorms on freshwater ecosystems and, in particular, how dissolved organic carbon is changing in Maine lakes that are used for drinking water. Dissolved carbon can interact with some of the drinking water treatment processes and form harmful byproducts.

By sampling dissolved organic carbon in six Maine lakes before and after five severe rainstorms, the researchers found three response patterns. Some lakes had an initial spike in dissolved organic carbon that returned to prestorm levels within days. The largest lakes sustained no changes in the concentrations of dissolved organic carbon. In other lakes, dissolved organic carbon levels increased and remained high. Such a sustained response is particularly important for water districts, which might have to modify treatment strategies following extreme storms.

Maine has 6,000 lakes, 45 of which are drinking water sources, say the researchers. ◆

In the field

University of Maine students spent four weeks in an archaeology field school in the Machias Bay area, directed by assistant professor of anthropology Bonnie Newsom. This is UMaine's seventh season of coastal archaeological fieldwork in the region.

In the field school, funded by the Maine Academic Prominence Initiative grant, students were immersed in experiential learning that blends fieldwork with cross-cultural community engagement. Students learn archaeological science techniques centered on systematic data collection from a site that spans roughly 3,000 years of Maine's pre- and post-contact history.

The fieldwork focuses on one of Maine's most fragile shell midden sites — an area of discarded shells that contains material remains of past peoples and long-term paleoenvironmental data. Shells preserve organic materials (animal bone, textiles, wood, plants, seeds, etc.) in Maine's acidic soil. The organics help archaeologists examine the cultural context and environmental aspects to learn what they can tell us about humans and climate change, including whether the climate was different throughout the occupation of the site.

The students actively contribute to **the preservation of irreplaceable data threatened by severe erosion** at a site that is an important cultural space to the Passamaquoddy people.

The students actively contribute to the preservation of irreplaceable data threatened by severe erosion at a site that is an important cultural space to the Passamaquoddy people.

Since its inception, the UMaine field school has been conducted in cooperation with the Passamaquoddy Tribal Historic Preservation Office. As part of this summer's field school, the students also worked on a community service project with Passamaquoddy Tribal members to assist with their language preservation efforts. ◆

Patented innovation

The University of Maine was recently issued a patent for a device that detects brain injury by measuring sleep movement patterns. This technology will be licensed by Activas Diagnostics, a UMaine spinoff company. The invention is a fitted mattress sheet equipped with more than a dozen sensors that gather information about sleep-wake and respiratory patterns while a person sleeps in their own home rather than in a sleep study facility. The SleepMove monitoring system has the potential to detect early symptoms of mild cognitive impairment and Alzheimer's disease. The UMaine inventors are Marie Hayes, professor of psychology, and Ali Abedi, assistant vice president for research, and professor of electrical and computer engineering. ◆

HUMAN-VEHICLE COLLABORATION

A $500,000 National Science Foundation research grant to the University of Maine to study self-driving vehicles aims to make the transportation of the future more accessible, usable and trustworthy.

The project, co-led by Nicholas Giudice and Richard Corey, who run and direct the UMaine Virtual Environment and Multimodal Interaction (VEMI) Lab, is designed to improve user trust of fully autonomous vehicles through a new study they call human-vehicle collaboration (HVC). The goal is to explore new ways of sharing how decisions are made and information is communicated between the human passenger and the artificial intelligence "driver," thereby addressing the key human factors of perceived loss of control over driving activities and fear of not "knowing" what the vehicle is doing during autonomous operation.

Although the autonomous vehicle market is predicted to reach $500 billion in the next five years, the majority of R&D has focused on the technical challenges of making these vehicles work well for roads, Giudice says. Far less is known about the challenges of making these vehicles work well for people. Indeed, an annual AAA survey released in March found that 71% of people are afraid to ride in fully self-driving vehicles.

HVC represents the science of identifying the best ways for people to interact and partner with the vehicles of the future. It is an essential step in the "trust race" to ensure that autonomous vehicles are still able to meet our needs, even when we're not at the wheel, Giudice says. ◆

SMARTPHONES AND SADNESS

What did you use your smartphone for today? For University of Maine clinical psychology doctoral student Colin Bosma, smartphones are a research tool. This fall, 110 volunteer participants in his study are filling out a series of questionnaire assessments and watching a video clip from a sad movie scene while attached to an electrocardiograph. Then they'll download an app developed in the Onnela Lab at the Harvard T.H. Chan School of Public Health to their smartphones that will collect data in real time for a week.

Bosma will analyze participants' digital footprints to assess whether people who struggle to regulate sadness in response to an event — as determined by the questionnaires and electrocardiograph — are less social and less mobile.

Emotion regulation is the ability to intentionally reduce the intensity of an emotion. For example, a person saddened about the death of a friend might purposefully recall funny memories of the friend to feel better. People who have difficulty regulating sadness are more vulnerable to mental health problems, including depression.

To completely understand emotion regulation, Bosma says an unobtrusive assessment of the construct — the person's responses to sadness, anger or fear — as it occurs in the environment is needed. Digital sensors in smartphones can provide that. ◆

Colin Bosma says the data-driven psychological assessments will lead to **a better understanding of individual mental health issues**, including depression, and accelerate personalized treatment.

Native plant loss

Caitlin McDonough MacKenzie, a postdoctoral researcher at the University of Maine, and her research team compared 19th century botanical records from Mount Desert Island — most of which is protected as Acadia National Park — to a recent survey of plants. They found approximately one of six plants documented in the late 1800s are now extinct on the island. Causes are likely a combination of habitat loss, climate change, damage from deer and pollution, she says.

Each of the 13 Northeast sites examined by the research team showed a drop in the proportion of native plant species in local flora. ◆

25% of local plant diversity across areas in the Northeast has been lost in the last 50–100 years.

16% of plants documented in the late 1800s are now extinct on Mount Desert Island.

43% of orchids and lilies recorded in 1894 on MDI are gone.

Another **33%** of the species declined in abundance on MDI.

Newsom awarded AAUW fellowship

Archaeological research focused on the World War II German prisoner of war (POW) camp that was located on Passamaquoddy land in eastern Maine has been recognized with a 2019–20 American Fellowship from the American Association of University Women (AAUW).

The fellowship provides a $6,000 grant to support the work of UMaine assistant professor of anthropology Bonnie Newsom with Passamaquoddy Tribal Historic Preservation Officer Donald Soctomah, leading to publication of the results of their archaeological study of the former site of the POW camp — one of seven in Maine. In 2013, Newsom collaborated with Soctomah and supervised an archaeological study of the site as part of a U.S. Department of Defense munitions clean-up effort.

Newsom will use the technical report from that study as the basis for a broader manuscript focused on the history of the POW camp in Passamaquoddy homeland, including results of the site excavations. The current community-based research expands on the social aspects of a World War II POW camp on Passamaquoddy land. ◆

IMPROVING RURAL HEALTH CARE

A nurse practitioner (NP) residency program will be reestablished next year with the help of a $1.7 million grant to Penobscot Community Health Care (PCHC), in partnership with the University of Maine School of Nursing, Harrington Family Health Center and Hometown Health Center in Newport.

The program, made possible by a U.S. Health Resources & Services Administration grant, has the potential to impact patients in at least five Maine counties — Penobscot, Somerset, Washington, Waldo and Piscataquis. PCHC last had a nurse practitioner residency program in 2014.

NPs are experienced registered nurses who receive intensive graduate didactic education and clinical training in preparation to provide safe, high-quality, patient-centered, evidence-based care across the lifespan, says UMaine assistant professor of nursing Kelley Strout. Patients who require care from NPs in Maine are more likely to be on Medicaid, uninsured or underinsured, live in poverty, experience multiple chronic conditions, and/or substance use disorders, compared to those in other geographic areas of the country. Currently, NPs are expected to assume the care of a full-panel of 700–1,200 complex patients with little to no on-the-job orientation or training.

The nurse practitioner residency program will provide an intensive clinical residency focused in primary care with robust, specialized didactic and clinical experiences aligned to meet the complex needs of Maine's patient population, says Strout. ◆

Photo by Sergi Pla-Rabes

RAPID RESPONSE

New evidence shows that Arctic ecosystems undergo rapid, strong and pervasive environmental changes in response to climate shifts, even those of moderate magnitude, according to an international research team led by the University of Maine.

Links between abrupt climate change and environmental response have long been considered delayed or dampened by internal ecosystem dynamics, or only strong in large magnitude climate shifts. The research team, led by Jasmine Saros, associate director of the UMaine Climate Change Institute, found evidence of a "surprisingly tight coupling" of environmental responses in an Arctic ecosystem experiencing rapid climate change.

Using more than 40 years of weather data and paleoecological reconstructions, the 20-member team quantified rapid environmental responses to recent abrupt climate change in West Greenland. It found that after 1994, mean June air temperatures were 2.2 degrees C higher and mean winter precipitation doubled to 40 millimeters. Since 2006, mean July air temperatures shifted 1.1 degree C higher.

The "nearly synchronous" environmental response to those high-latitude abrupt climate shifts included increased ice sheet discharge and dust, and advanced plant phenology. In lakes, there was earlier ice-out and greater diversity of algal functional traits. The new evidence underscores the highly responsive nature of Arctic ecosystems to abrupt transitions — and the strength of climate forcing, according to the team, which published its findings in the journal *Environmental Research Letters*.

> "We present evidence that climate shifts of even moderate magnitude can **rapidly force strong, pervasive environmental changes** across a high-latitude system."
>
> Jasmine Saros

Understanding how ecosystems respond to abrupt climate change is central to predicting and managing potentially disruptive environmental shifts, says Saros, one of seven UMaine professors who have been conducting research in the Arctic in recent years. ◆

AgingME

An initiative of the University of New England in collaboration with the University of Maine to improve the health and well-being of Maine's older adults through enhanced practitioner training has received a five-year award of nearly $3.75 million from the Department of Health and Human Services' Health Resources and Services Administration under its Geriatrics Workforce Enhancement Program.

The two universities will develop and lead a statewide collaborative called AgingME that will focus on training enhancements and practice transformation processes at the primary care level. In partnership with Maine's health systems leaders at MaineHealth and Northern Light Health and federally qualified health centers, as well as Area Agencies on Aging and other community agencies, AgingME will bring together practitioners, health professions students and educators statewide to improve primary care for older adults and their caregivers.

UMaine's Center on Aging will serve as the lead evaluator for the statewide geriatrics training initiative, documenting the impact of its work by collecting input and data from students, partners, older adults and caregivers reached in the program.

At UMaine, AgingME efforts will entail the integration of geriatrics and specialized clinical content into simulation lab training for students in the School of Nursing Family Nurse Practitioner program and gerontology courses in the Interprofessional Graduate Certificate program. The School of Social Work will develop a geriatrics field practicum unit, and the School of Food and Agriculture will incorporate a geriatrics nutrition practicum. UMaine's clinical psychology doctoral program will advance its training related to the health and well-being of older adults. ◆

INNOVATION FOR RURAL YOUTH

A $4 million fundraising campaign is underway to purchase the Magic Lantern, a theater and pub on Depot Street in Bridgton, Maine and expand the community engagement it offers with the development of an innovation lab and learning center for youth.

To date, the Maine 4-H Foundation has raised half of the $4 million needed to purchase the facility to create the Magic Lantern Innovation Lab and Learning Center. The center, which will be led by University of Maine Cooperative Extension, will provide a hub of creative activity for rural youth in the Maine Lakes Region. Under Maine 4-H Foundation ownership, the Magic Lantern will continue to operate a three-auditorium theater, a pub with upgraded movie projection capabilities, and a venue for community engagement.

The UMaine Extension 4-H youth development program will increase the educational offerings, and outreach to schools and educational nonprofit organizations. The goal is to have proceeds from the Magic Lantern fund local youth education, making the facility as self-sustaining as possible.

Magic Lantern opened in February 2008 as a community center with state-of-the-art technology, including high-definition projection and sound systems, and full stages. The facility was put up for sale in 2017. The following year, talks began with the co-owners of the Magic Lantern, community members and the Maine 4-H Foundation to explore the possibility of the philanthropic and educational venture. The planning team included Magic Lantern co-owner Frank Howell, Maine 4-H Foundation executive director Susan Jennings and community member Dan Cousins, and had input from school superintendents, headmasters, and nonprofit and foundation leaders and educators.

An app for monarchs

> “We are trying to create a model that predicts areas that have a **high suitability for monarchs for roosting during their fall migration to Mexico.”**
>
> Brandon Boxler

When spotting a butterfly, a common reaction may be to whip out a phone and snap a photo. A team of University of Maine researchers is hoping another response could be to use the phone to log details about areas where butterflies are likely to be found. Using a mobile app, anyone can become a citizen scientist by visiting potential monarch butterfly roosting sites from Maine to Georgia and answering questions based on their observations.

Brandon Boxler, a UMaine graduate student in ecology and environmental sciences, and Cynthia Loftin, associate professor of wildlife ecology and leader of the United States Geological Survey Maine Cooperative Fish and Wildlife Research Unit, plan to use data collected from the app to validate a model that predicts the location of monarch roosting sites.

The monarch butterfly conducts one of the most dramatic migrations in the world, according to the researchers. Every fall, the fourth generation of butterflies that came north from Mexico in the spring turn south and begin a 3,000-mile journey to their overwintering grounds. However, the number of monarchs completing the migration has fallen by 90% in the past two decades, the researchers say that’s due to multiple causes, including loss of overwintering habitat to logging, loss of breeding habitat — native milkweed — to herbicides, as well as exposure to pesticides, disease and parasites/parasitoids.

Researchers nationwide are learning more about the monarch and its behavior in an attempt to curb the population decline. Among them are Boxler and Loftin, who completed a model that seeks to determine where the roosts occur and what the sites have in common. Their model suggests the butterflies tend to roost in vegetation, often in trees or bushes in otherwise open areas. They are more likely to be found near open water, and in areas with fall blooming flowers from which they can feed. Learn more about accessing and using the app at the project’s web site: umaine.edu/mainecoopunit/monarch-model-validator.

FOREST HEALTH MONITORING WITH REMOTE SENSING

State-of-the-art geospatial data collection and modeling to assess, monitor and forecast the quality, health and value of Maine forestlands is the focus of a new NASA-funded project led by the University of Maine.

The three-year project, which received a nearly $750,000 grant, is led by Parinaz Rahimzadeh, assistant professor of remote sensing of natural resources in the UMaine School of Forest Resources. The research team will use remote sensing technology to develop comprehensive models with more detailed, accurate, higher resolution and near-real-time data on forest tree species identification, and forest tree decline detection and damage assessment.

> "Advances in remote sensing technology are **revolutionizing the way in which forests are continually measured and monitored."**
>
> Parinaz Rahimzadeh

The project will connect remote sensing information, such as NASA air- and space-borne hyperspectral and multispectral data, with traditional and ground-based data to address immediate needs for precise pest and pathogen control and early intervention, as well as preservation of economic, ecological and cultural assets of forest resources.

Ultimately, the remote sensing framework for geospatial data collection and modeling will provide information on forest composition, as well as damage caused by recent pest and pathogen outbreaks, such as spruce budworm, emerald ash borer and Caliciopsis pine canker.

Other members of the research team include UMaine faculty Aaron Weiskittel, Center for Research on Sustainable Forests; Daniel Hayes, School of Forest Resources; and Wilhelm Friess, Department of Mechanical Engineering. They are joined by Peter Nelson of the University of Maine at Fort Kent, and U.S. Forest Service and NASA scientists. ◆

BadgedToHire

The University of Maine is one of three higher education institutions nationwide selected to participate in a two-year microcredentialing initiative with employer partners statewide, made possible by a grant from Lumina Foundation to Education Design Lab.

Since last fall, UMaine has been one of seven colleges in a yearlong 21st Century Skills initiative of the Education Design Lab, a Washington, D.C.-based nonprofit dedicated to reenvisioning the school-to-work pipeline. The university partnered with Northern Light Health and Bangor Savings Bank in the project designed to identify, recognize and match the workforce skills that college students need and employers want.

As part of the new BadgedToHire program, UMaine will work with employer partners in Maine and the region to evaluate the value of 21st-century skills microcredentials as a hiring signal for career readiness, particularly for underserved learners.

"The 21st-century skills employers say they need in employees, including communication, creative problem-solving, empathy and critical thinking, are difficult to quantify and assess," says Claire Sullivan, who developed UMaine's Engaged Black Bear digital badging initiative in 2015. "A badge is a way to demonstrate that an employment candidate clearly has those skills. Through intentional practice and application, they are assessed, and badges are attached to the competencies."

In the two-year program, participating Maine employers will provide input into advancements in digital badging, and will be involved in mentoring and incentivizing students pursuing badging pathways. In the next two years, BadgedToHire participants will contribute to the understanding of how digital badging can impact hiring and whether it contributes to employee success on the job. ◆

Unsafe salsa

Homemade canned salsa recipes are abundant on food blogs, but the majority of them fail to follow USDA home canning guidelines and are a cause of food safety concern, according to a new University of Maine study. UMaine Cooperative Extension professor Kathy Savoie and Jen Perry, assistant professor of food microbiology, examined 56 recipes for home canning of salsa from 43 food blogs. They found that in 70% of the recipes, USDA home canning guidelines were not included in four categories: acidification, thermal processing, contaminants and vacuum sealing. Historically, home-canned vegetables have been the most common cause of botulism outbreaks in the United States. ◆

70% of the 56 recipes examined did not include USDA home canning guidelines

719 to 3.2 million
Facebook users follow these 43 food blogs

21% of recipes failed to meet the minimum USDA acidification guidelines

SOUTHERN HEMISPHERE CLIMATE CHANGE

To understand industrial-age glacier recession and climate warming in New Zealand, an international research team led by the University of Maine will document the past 10,000 years of natural variations by studying the moraines of retreating glaciers and rings of temperature-sensitive trees in the Southern Hemisphere.

The data will allow scientists to compare the Holocene-era glacier and climate changes in the Southern Alps of New Zealand and the European Alps — mountain ranges on opposite sides of the planet. The goal is to understand natural climate drivers, and whether documented climatic anomalies of the Northern Hemisphere were regional or global in scope.

Temperature reconstruction from the Southern Alps also will provide a key metric for evaluating **global climate and Earth-system models** developed by NOAA Geophysical Fluid Dynamics Laboratory.

The three-year collaborative research project, funded by a nearly $637,000 award from the National Science Foundation, is led by Aaron Putnam, UMaine assistant professor of Earth sciences. Putnam studies how interactions among Earth's surface, atmosphere, cryosphere and oceans produce glacial cycles and abrupt climate change.

In New Zealand's Southern Alps, the research team will use the latest in cosmogenic nuclide technology to date glacial landforms and recently deglaciated organic remains to establish accurate timelines of glacier changes. In addition, tree rings of South Island silver pines will be used to document climatic fluctuations on annual timescales.

Co-principal investigators on the project are George Denton, UMaine; Joellen Russell, University of Arizona; and Joerg Schaefer, Lamont-Doherty Earth Observatory of Columbia University.

Additional collaborators include David Barrell from GNS Science of Dunedin, New Zealand; Edward Cook of Lamont–Doherty Earth Observatory; Jonathan Palmer of the University of New South Wales; Andrew Mackintosh of Monash University; and Brian Anderson of University of Victoria Wellington.

Embedded with the team each field season will be a graduate student of science journalism from Northwestern University, and UMaine undergraduate and graduate student researchers. ◆

“We have been Black Bears since the fall of 1989. **Now, 30 years later, we remain committed to the future of our alma mater**. We made our legacy commitment after meeting our initial philanthropic goals. We are fortunate to have started early and **look forward to building upon our UMaine legacy**.”

Todd D. Saucier ‘93, ‘97G, ‘44H

Danielle Daigle Saucier ‘93, ‘96G

Everyone has a legacy. What is yours?

TODD AND DEE SAUCIER HAVE CHOSEN TO LEAVE A LEGACY by remembering the University of Maine Foundation in their wills. Your legacy can be shaped to support the aspects of the University of Maine that you care most about. When you write or review your will, please consider leaving a charitable bequest through the University of Maine Foundation for future generations of UMaine students. Our planned giving staff will be happy to help you.

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IN THE NEXT ISSUE

Profile of a living laboratory: The University of Maine and University of Maine Foundation manage more than 14,000 acres of land statewide, including the Dwight B. Demeritt Forest adjacent to the Orono campus. The 1,478-acre Demeritt Forest, comprised of mixed forest stands, fields and waterways, is used year-round for education, demonstrations, research and recreation.