spring2013

M | SNRE

Stewards

A magazine for alumni and friends of the School of Natural Resources and Environment

M-CUBED

FROM AFRICAN VIRUSES TO URBAN GARDENS, 19 SNRE FACULTY BENEFIT FROM UNIVERSITY'S NEW TEAM APPROACH TO RESEARCH

features:

THE DESERT OASIS

RESEARCH PROJECT EXAMINES FOOD ACCESS IN MICHIGAN

COPING WITH STRESS

MAPPING THE HEALTH OF THE GREAT LAKES

AQUAMAN

DON SCAVIA IS ALL THINGS WATER AT U-M

UNIVERSITY OF MICHIGAN

Photo by Dave Brenner

2013 π day

Top 3.14159 reasons to love SNRE

I often tell people how wonderful it is to be dean at SNRE. Mostly it's about having the chance to help create opportunities for our amazing students and faculty. But every now and then, it's about declaring something as if a potentate. And so recently, my great love of mathematics led me to declare: "There shall be pie on Pi Day." On March 14, at 1:59 p.m. (that's 3.14159 for the less nerdy amongst you), Ford Commons was filled with blueberry, apple, cherry, and raspberry pies, along with the biggest crowd we have ever had for our Coffee with the Dean social hour (visit flickr.com/photos/snre for more images).

SNRE has always been an intellectually vibrant community, but increasingly, it is defined by and known for its social vibrancy. I talked about this when addressing nearly 120 prospective students on Admitted Student Visit Day in March. I posited that doing the hard work of caring for the environment requires two things. First, an ability, in the face of any setback, to take 30 seconds to mourn, and then pick yourself up, take a deep breath, and work harder—the stakes are just too high to do anything else. And second, a tribe that will celebrate with you, encourage you, challenge you; a tribe that makes you bigger, stronger, better, faster.

We admit students to SNRE whom we believe already have the relentlessness required to do environmental work. And then SNRE is the tribe; a tribe that recommits to each other even as we recommit to the environment; a tribe working to do nothing less than change the world.

I believe this is why so many alumni volunteer their time, whether to review student portfolios, conduct mock interviews, critique job talks, propose master's project ideas, or attend career fairs. SNRE alumni are enriching the experience of current students on a daily basis. An ongoing commitment to our tribe also explains why dozens more alumni took part in get-togethers organized by current students (see related story, page 31).

In the weeks ahead, our tribe shifts again. The incoming class takes shape, and hundreds of undergraduate and graduate students will graduate. As these transitions occur, our bonds to each other will remain strong. And like pi, that's a constant worth remembering.

Go Blue!

mlm

P.S. I can recite many digits of pi from memory. Nobody was willing to challenge me at Pi Day. Are you?

MISSION: **The School of Natural Resources and Environment's overarching objective is to contribute to the protection of the Earth's resources and the achievement of a sustainable society.**

Stewards

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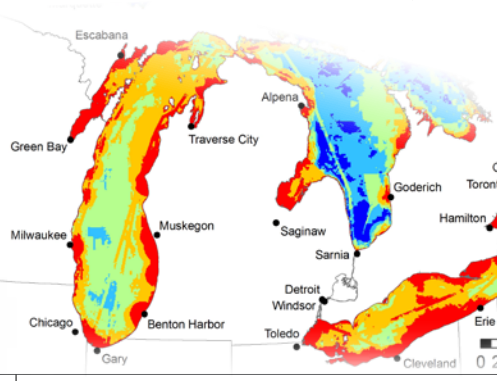

Stewards

Dean
Marie Lynn Miranda

Associate Dean for Academic Affairs
Don Zak

Associate Dean for Research
Michael Moore

Director of Communications/Editor
Kevin Merrill

Writers
Angela Fichera, Allie Goldstein

Photographer
Dave Brenner

Design CDM Communications

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Contact Information
School of Natural Resources and Environment
University of Michigan
440 Church Street | Ann Arbor, MI 48109
734.764.2550 | snre.umich.edu

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Photo by Dave Brenner

JUSTIFIED

Environmental Justice community celebrates Bryant, looks forward

To celebrate the career of Bunyan Bryant and a field they care passionately about, 150 environmental justice academics and activists convened in Ann Arbor Oct. 5-6 to reflect on the movement's past, present, and future. The conference gave tribute to Bryant, who retired after a 40-year career as an activist, researcher, and mentor at the School of Natural Resources and Environment.

"We need to think about how to move forward—not just about fighting a rear-guard action," said Bryant in addressing attendees on the final day. "We have to have a vision to move forward. If you do not have a vision, you cannot survive. We've got to have hope. Hope is the basic foundation for our vision."

Through plenary and breakout sessions, participants from across the country offered ideas on how to strengthen the academic and advocacy work of environmental justice.

"In my mind there is no doubt that Dr. Bryant has influenced the lives of thousands and thousands of students and people in many, many communities," said Lisa F. Garcia, the event's co-speaker and the U.S. Environmental Protection Agency's senior advisor to the administrator for environmental justice. Her own position within the EPA is the direct result of the 1990 Michigan Conference on Race and the Incidence of Environmental Hazards, which Bryant co-organized and which led to the formation of a "Michigan Coalition" that advised the EPA on environmental justice policies.

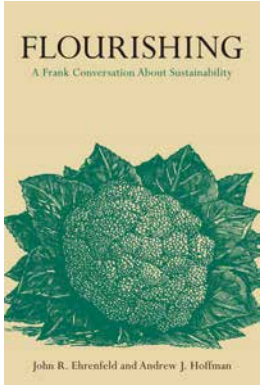
"The School of Natural Resources and Environment has no intention of relinquishing our prominence in the field of environmental justice," said Dean Marie Lynn Miranda. "We are fully committed to making sure that the good work Bunyan has been doing continues and that environmental justice remains a cornerstone and the essence of this school."

– **KEVIN MERRILL**

ENVIRONMENTAL JUSTICE LEADERS AT THE CONFERENCE INCLUDED (FROM LEFT) **DORCETA TAYLOR**, SNRE PROFESSOR; **LISA F. GARCIA**, U.S. ENVIRONMENTAL PROTECTION AGENCY'S SENIOR ADVISOR TO THE ADMINISTRATOR FOR ENVIRONMENTAL JUSTICE; **VERNICE MILLER-TRAVIS**, A SENIOR ASSOCIATE AT SKEO SOLUTIONS INC.; **DEEOHN FERRIS**, PRESIDENT AND FOUNDER OF SUSTAINABLE COMMUNITY DEVELOPMENT GROUP; **PEGGY SHEPARD**, EXECUTIVE DIRECTOR OF WE ACT FOR ENVIRONMENTAL JUSTICE; **JOSE BRAVO**, EXECUTIVE DIRECTOR OF JUST TRANSITION ALLIANCE; **CHARLES LEE**, DEPUTY ASSOCIATE ASSISTANT ADMINISTRATOR FOR ENVIRONMENTAL JUSTICE, U.S. EPA; **JIM CROWFOOT**, EMERITUS SNRE DEAN; **DONELE WILKINS**, PRESIDENT AND CHIEF EXECUTIVE OFFICER OF THE GREEN DOOR INITIATIVE; **PAUL MOHAI**, SNRE PROFESSOR; **MICHELE ROBERTS**, CO-DIRECTOR OF ENVIRONMENTAL JUSTICE AND HEALTH ALLIANCE; **BEVERLY WRIGHT**, DIRECTOR OF THE DEEP SOUTH CENTER FOR ENVIRONMENTAL JUSTICE AT DILLARD UNIVERSITY; (SEATED) **GRACE LEE BOGGS**, FOUNDER OF THE DETROIT-BASED BOGGS CENTER; **DAVID PELLOW**, PROFESSOR, UNIVERSITY OF MINNESOTA; **BUNYAN BRYANT**, SNRE PROFESSOR; **MARIE LYNN MIRANDA**, SNRE DEAN; **MICHEL GELOBTER**, FOUNDER AND CHAIRMAN OF COOLER INC.; AND **ROBERT BULLARD**, PROFESSOR AND DEAN OF THE BARBARA JORDAN-MICKEY LELAND SCHOOL OF PUBLIC AFFAIRS AT TEXAS SOUTHERN UNIVERSITY.

BOOKS

Latest works from SNRE faculty



Flourishing: A Frank Conversation About Sustainability

John R. Ehrenfeld and Andrew J. Hoffman
Stanford University Press (2013)

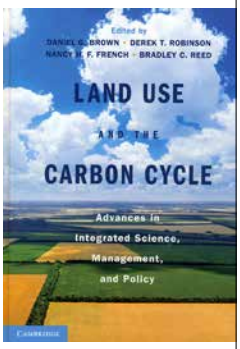
Flourishing: A Frank Conversation about Sustainability invites readers into a conversation between a teacher, Ehrenfeld, and a former student, Hoffman, as they discuss how to create a sustainable world. This book goes beyond the typical stories about repairing the environmental damages of human progress. Through their dialogue and essays, they uncover two core facets that drive what they describe as unsustainable, unsatisfying, and unfair social and economic machines dominating lives. First, the collective model of the way the world works cannot cope with the inherent complexity of today's highly connected, high-speed reality. Second, understanding of human behavior is rooted in this outdated model. Driven by the old guard, sustainability has become little more than a fashionable idea. As a result, both business and government are following the wrong path—at best applying temporary, less unsustainable solutions that will fail to leave future generations in better shape. To shift the paradigm, this book tells a new story, arguing for a transformative cultural shift based on our collective wisdom and lived experiences. There is no middle ground; without a sea change at the most basic level, society will continue down a faulty path.

Hoffman is an SNRE professor and director of the Erb Institute for Global Sustainable Enterprise; Ehrenfeld is an influential voice in the sustainability debate and former director of the MIT Program on Technology, Business, and Environment.

Land Use and the Carbon Cycle: Advances in Integrated Science, Management, and Policy

Dan Brown, Derek T. Robinson, Nancy H. F. French and Bradley C. Reed
Cambridge University Press (2013)

As governments and institutions work to ameliorate the effects of anthropogenic CO2 emissions on global climate, there is an increasing need to understand how land-use and land-cover change is coupled with the carbon cycle, and how land management can be used to mitigate the effects of climate change. This book brings together an interdisciplinary team of 58 international researchers to share knowledge on land use and the carbon cycle. It discusses contemporary theories and approaches combined with state-of-the-art technologies. The central theme is that land use and land management are tightly integrated with the carbon cycle and it is necessary to study these processes as a single natural-human system to improve carbon accounting and mitigate climate change. The book is a valuable resource for advanced students, researchers, land-use planners, and policy makers in natural resources, geography, forestry, agricultural science, ecology, atmospheric science, and environmental economics.



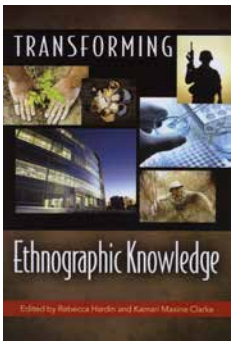
Brown is an SNRE professor; Robinson teaches at the University of Waterloo, Ontario; French, at Michigan Technological University; and Reed is with the U.S. Geological Survey.

Transforming Ethnographic Knowledge

Rebecca Hardin and Kamari Maxine Clarke
University of Wisconsin Press (2012)

Transforming Ethnographic Knowledge is an engaging, reflective, and deeply personal book that prompts a rethinking of both the limits and possibilities of ethnography. It explores the ethnographic methods that anthropologists first developed to study other cultures—fieldwork, participant observation, dialogue—and how they are now being adapted for a broad array of applications, such as business, conflict resolution and demobilization, wildlife conservation, education, and biomedicine. The book traces the changes the authors have seen in ethnography as a method and as an intellectual approach, and they offer examples of ethnography's role in social change and its capacity to transform its practitioners. Though Clarke and Hardin edited the volume, each also writes a chapter. Clarke looks at ethnographers' involvement (or non-involvement) in military conflict; Hardin takes her own anthropological training into rainforests where wildlife conservation and research meet changing subsistence practices and gendered politics of social difference.

Hardin is an SNRE associate professor; Clarke is a professor at Yale University.



Wege

Steiner urges action, activism

Achim Steiner, the executive director of the United Nations Environment Programme, urged his audience to embrace action and sustainability to move societies forward in delivering the 12th Annual Wege Lecture March 11. "We are still struggling with those who believe that these transitions will be too disruptive, who want to go slower, even though environmental change is accelerating," Steiner told an audience of 500 at Rackham Auditorium. "Our greatest challenge today is to develop the confidence among our fellow citizens that the cost of inaction is in fact so much higher than the cost of acting now."

ACHIM STEINER CAME FROM NAIROBI, KENYA, HEADQUARTERS OF UNEP, TO MEET WITH SNRE STUDENTS AND FACULTY.

Inset photo by Dave Brenner

Steiner, who also serves as Under-Secretary-General at the UN, spent the day interacting with SNRE students and faculty. He held a question-and-answer session with students in Room 1040 to start the day, which was capped by a tribute dinner honoring him and Peter M. Wege.

"Given everything we know today, given everything that is at our disposal in terms of technology and finance and human ingenuity, there simply will not be an excuse 100 years down the line when a historian looks at the decisions that were not made today, to rationalize them in the way we have for the last 100, 150 years," Steiner said. "Our role as environmentalists at the beginning of the 21st century is to give people confidence that the future is not only a derivative of the past."

READ MORE ABOUT HIS LECTURE, Q&A SESSION WITH STUDENTS AND VIEW IMAGES:
snre.umich.edu/wege

Lecture photo by Martin Vloet, Michigan Photography

17 SNRE students among 40 in inaugural Dow Fellows cohort

Forty master's and professional-degree students from eight schools and colleges at the University of Michigan, including 17 from the School of Natural Resources and Environment, are beginning the Dow Sustainability Fellows Program. The students become the the first cohort of fellows for the $10 million program launched last spring. In addition to receiving a stipend, each fellow participates in monthly seminars and workshops, team projects, co-curricular activities, and other exercises designed to foster interdisciplinary collaboration among scholars. The 17 SNRE recipients are: Sundeep Ramachandran, Jessica Wall, Berry Kennedy, Emily Taylor, Ursula Jessee, Makely Lyon, Nancy Gephart, Therese Miranda, Sabrina Sullivan, Betsy Riley, Lukas Strickland, Jenny Cooper, Ryan Gourley, Michelle Fournier, Nolan Sandberg, Wesley Allred, and Liz Och.

Sustainability Report features SNRE faculty, students

Faculty Don Scavia, Dorceta Taylor, and Andy Hoffman and many SNRE students were featured in the new U-M Sustainability Report. The interactive digital 2012 Sustainability Progress Report combines video, animation, and data to show the university's efforts to tackle some of the world's most pressing sustainability challenges. Using environmental metrics, the university tracks the impact of its operations and measures progress toward long-range goals focused on climate, waste prevention, healthy environments, and community awareness. As announced by President Mary Sue Coleman in 2011, the 2025 goals support the university's broader overall commitment to sustainability, known as Planet Blue.

READ THE REPORT:
sustainability.umich.edu

Former EPA Administrator Jackson talks sustainability

Lisa Jackson, the former administrator of the U.S. Environmental Protection Agency, chose SNRE as one of the first locations to speak since leaving the Obama administration. Jackson's April 11 visit capped a Sustainability Summit across campus, which focused efforts by the university to create a more sustainable campus. Jackson answered questions from SNRE students in an open session during her visit.

SUSTAINABILITY ROUNDUP

Blesh joins SNRE

Jennifer Blesh, a post-doctoral researcher in agronomy at the Federal University of Mato Grosso in Cuiabá, Mato Grosso, Brazil, will join SNRE in January 2014 as its newest assistant professor. Blesh was selected to fill a new position for a researcher/teacher focused on sustainability and food systems. She earned her Ph.D. in soil and crop sciences and a master of science degree in soil science, both from Cornell University. She has a bachelor of science degree in ecology from the University of Georgia. Through her work, she seeks to increase scientific understanding of the potential for agroecological management to improve the sustainability of food production.

Case competition

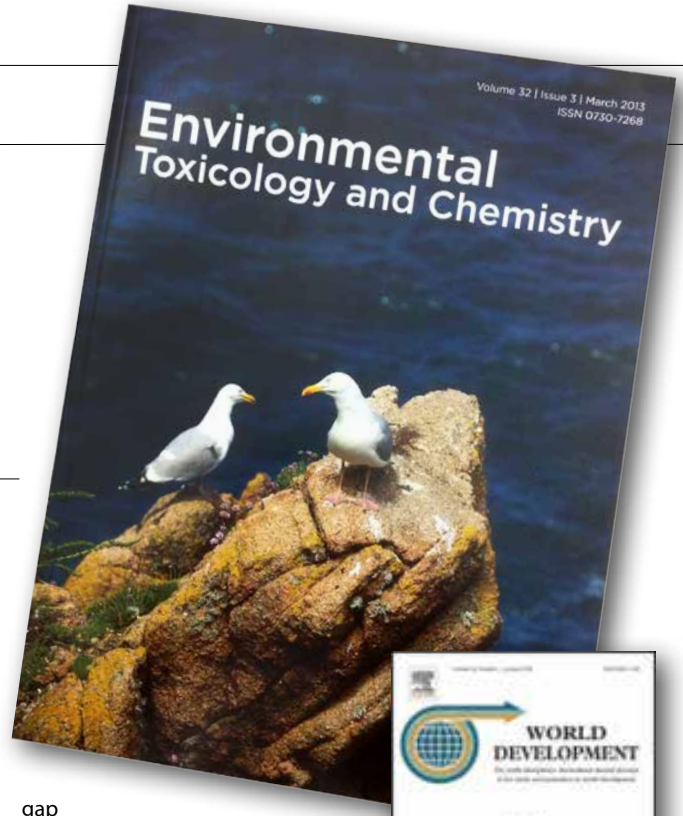
The Erb Institute for Global Sustainable Enterprise launched a prize for the best sustainable enterprise-teaching cases published annually by the William Davidson Institute's Globalens division. The competition promotes the creation of key teaching materials on topics of global sustainability and social impact. "The Erb Sustainability Case Competition exemplifies the University of Michigan's commitment to interdisciplinary teaching and research," said Marie Lynn Miranda, SNRE dean. "SNRE is delighted to showcase the commitment of our faculty and students to developing innovative curricula addressing our world's complex sustainability challenges."

Sustainable development

The Erb Institute and the World Environment Center formed a partnership to engage M.B.A/M.S. students in planning and implementing sustainable development initiatives with leading global companies. The Erb-WEC Fellows Program will be supported by IBM Corp. as part of its commitment to environmental sustainability and developing next-generation skills for the 21st century workforce. The Erb-WEC partnership provides cross-disciplinary curriculum and training for eight graduate student fellows during 2013. WEC will provide students access to senior-level sustainability executives; students also will obtain information on how companies evaluate and apply sustainability-related data and formulate decisions.

JOURNALING

Academic journals find new (temporary) home at SNRE



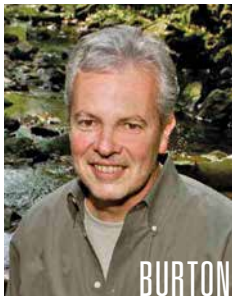
In the last year, two prestigious academic journals have found a home in the Dana building under the editorship of two School of Natural Resources and Environment professors.

World Development is edited by Arun Agrawal, whose own research focuses on indigenous knowledge, community-based conservation, common property, population and resources, and environmental identities. He also directs the SNRE-based International Forestry Resources and Institutions network.

Environmental Toxicology and Chemistry is edited by Allen Burton, whose research on aquatic ecosystem stressors and ecological risk assessment has taken him to all seven continents. He also directs the NOAA-sponsored Cooperative Institute of Limnology and Ecosystems Research, housed at SNRE.

In the academic world, journals often travel to the home institution of their current editor. Though both journals have recently found new homes in the Dana Building, each has been publishing research at the top of their respective fields for decades: *World Development* is in its 40th year while *Environmental Toxicology and Chemistry* is turning 31.


AGRAWAL


BURTON

For both Agrawal and Burton, the editorship puts them at the helm of a very ambitious endeavor. Each manages a team of dozens of editors from around the world who in turn direct the anonymous peer-review process through which articles are selected for publication. *World Development* receives about 1,300 submissions a year; *Environmental Toxicology and Chemistry* pulls in almost 900. These submissions have to be read, whittled down, sent out for peer review, whittled down again, revised, and edited for international readerships—and each journal comes out 12 times a year. The hardest part? "Having to say no to the vast majority of articles," Agrawal said in an email.

But the work is worthwhile. *World Development*, according to its website, publishes development "lessons learned" from across the globe and examines potential solutions to problems such as poverty, unemployment, malnutrition, environmental degradation, civil conflict, and gender and ethnic discrimination. The most recent issue included articles on the rice value chain in Bangladesh, adult literacy and child mortality in Ghana, emigration from Kazakhstan to Russia, expenditure on girls' education in India, and public support for aid in the United Kingdom. Its authors asked difficult, vital questions—questions such as Is social spending procyclical?; Is there a disability gap in employment rates in developing countries?; Do microloan officers want to lend to the less advantaged?—and these are just the ones posed in the article titles.

"Our readership is very broad," Agrawal said. "It includes both practitioners—particularly those in international development organizations—and researchers interested in different facets of international development."

Environmental Toxicology and Chemistry is equally interdisciplinary, publishing experimental and theoretical work from ecology, biochemistry, epidemiology, physiology, and more, with a focus on hazard and risk assessment. Current "hot topics" are the environmental toxicology of nanomaterials; endocrine disrupting chemicals and intersex; contaminated sediments; and food-chain bioaccumulation of mercury, flame retardants, and fabric protectors.

"We are trying to publish more papers now that look at multiple stressors—such as habitat, climate, and invasives—along with the chemical ones," Burton wrote in an email.

When *Environmental Toxicology and Chemistry* was founded more than three decades ago, there were no good venues for publishing environmental toxicology and chemistry research. Now, the journal not only fills that niche but has expanded it, creating room for competing publications in the field. More than 6,000 members of the Society of Environmental Toxicology and Chemistry—environmental toxicologists and chemists from academia, government, businesses, and not-for-profits—in more than 100 countries receive *Environmental Toxicology and Chemistry*, and almost half a million articles from its pages were downloaded last year. Though Burton tracks these readership numbers, it is what appears within the journal's pages that gets him most jazzed.

"The most exciting part [of editing the journal] is publishing cutting-edge research in the field that I love," he said.

– ALLIE GOLDSTEIN

briefs

New website spotlights lessons for sustainable ocean management

Recognizing the declining health of the world's oceans, policymakers, managers, and scientists have called for expanded efforts at ecosystem-based management in marine and coastal systems. To provide guidance for these efforts, an interdisciplinary team led by SNRE researchers developed case studies to highlight lessons learned from global marine ecosystem-based management (MEBM) projects. Produced over a four-year period, the cases examine how MEBM works in the real world and how it can be effective in different geographic and political settings. "It's the largest set of MEBM case studies ever put together, featuring more than 20 comprehensive case studies along with an additional 45 case snapshots," said SNRE Professor Steven Yaffee. The cases will provide a benchmark to assess the current state of marine ecosystem-based management practices, from which policymakers can continue to assess progress and learn additional lessons. In addition to Yaffee, SNRE Associate Professor Julia Wondolleck, Heather Leslie and Leila Sievanen (Brown University), and Lisa Campbell (Duke University) headed the research teams. The David and Lucile Packard Foundation provided funding for the project.

MORE ONLINE:
snre.umich.edu/emi/mebm

Professors contribute to new National Climate Assessment

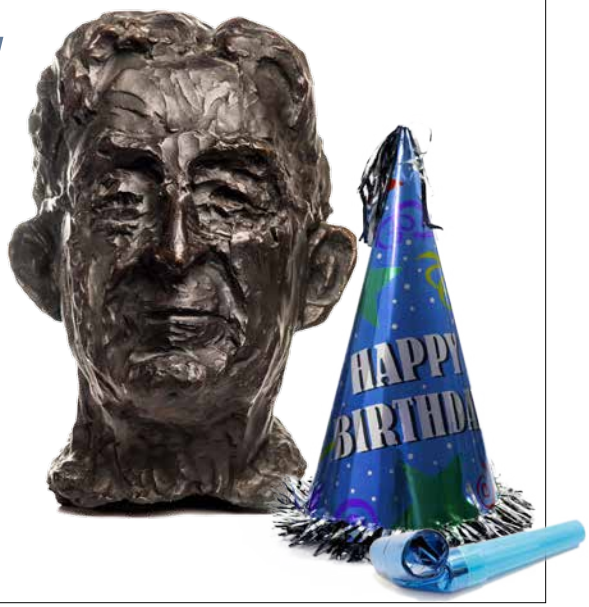
Three SNRE professors were lead convening authors of chapters in the National Climate Assessment, released in January with contributions from 240 of the nation's top scientistis. Don Scavia was a lead convening author of the Midwest chapter; Dan Brown of the chapter regarding changes in land use and land cover; and Rosina M. Bierbaum of the chapter on climate change adaptation. Professor Maria Carmen Lemos was an outside reviewer of the assessment. In addition, Bierbaum served on the 60-person advisory committee that oversaw development of the draft report, which is the third federal climate assessment report since 2000. The report stresses that climate change is already affecting Americans, that many of its impacts are expected to intensify in coming decades, and that the changes are primarily driven by human activity.

Munn, Sturges named Wyss Scholars

Liz Munn and Frank Sturges were named as Wyss Scholars for 2012-14. The Wyss Foundation supports two students each year at four universities nationwide to recognize future leaders in nonprofit and public sector conservation, with a focus on the western United States. After five years of hosting scholars (10 students so far), SNRE's funding was renewed this past summer to enable it to support five more cohorts. SNRE students are chosen during the first year of their master's program based upon dedication, need, and merit. Munn is a Behavior, Education and Communication and Environmental Policy and Planning student, with interests in land conservation and management with an emphasis on water resources and community engagement. Sturges is an Environmental Policy and Planning student pursuing a dual degree with the Ford School of Public Policy, with interests in public land management and policy.

HAPPY 40TH BIRTHDAY dana building

Built in 1903 for the university's Medical School, the building that houses today's SNRE celebrated an anniversary of sorts in April. At its April 1973 meeting, the U-M Board of Regents changed the building's name to honor Samuel Trask Dana, the school's first dean. From its opening, the West Medical Building housed departments affiliated with the medical school. When the medical school moved in June of 1961 to its new campus, the building took on a new occupant—the School of Natural Resources—and a new name, the Natural Resources Building. Dana (whose bust at right is a fixture in the Dean's Conference Room) was named dean in 1927 of the newly established School of Forestry. In addition to being a professor of forestry and forest economics, he was a prominent conservationist, chairman of the U.S. Timber Conservation Boards, and president of the Society of American Foresters.



inquiry

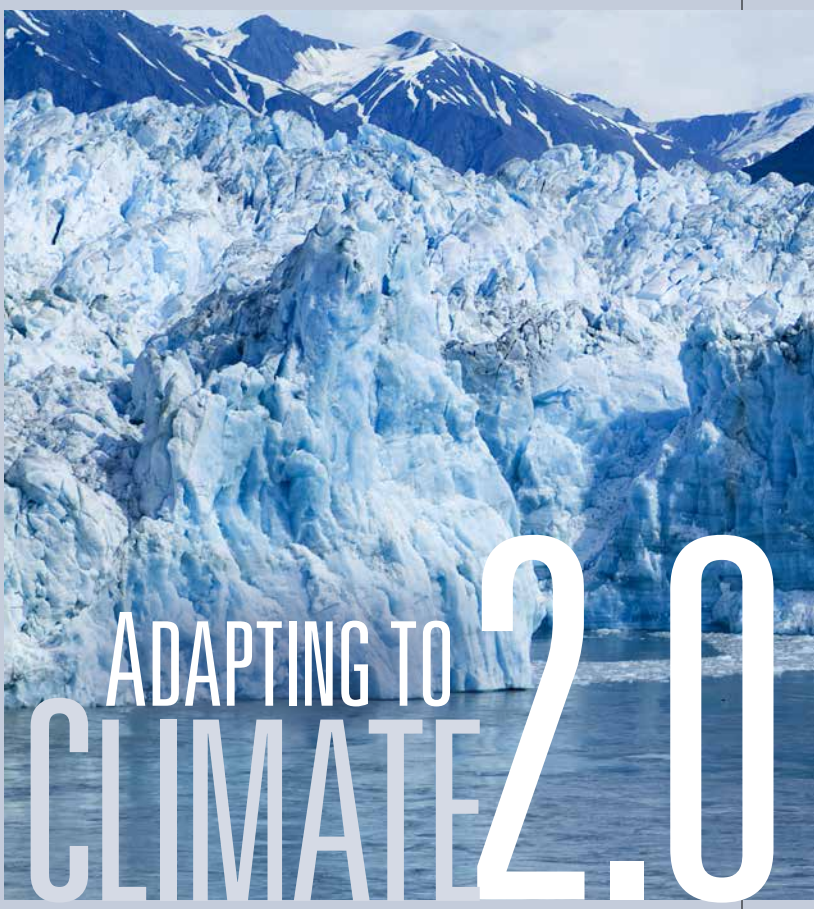
The rule-followers among us

How can you get people to follow rules? This question has long been the chagrin of natural resource managers that compete with social networks to control human behavior. SNRE Professors Arun Agrawal and Dan Brown, along with four other collaborators, created a computational model to get at this conundrum. The model included a forest, its users (firewood-extracting households), and two types of institutions: a formal rule-setting organization and informal social networks. From these institutions, two competing signals coursed through the system: one was a "rule" signal on the sustainable level of fuelwood extraction, sent by the rule-setting organization, and the other was a "norm" signal regarding extraction preferences that flowed freely among households with social ties. Under these parameters, the authors were able to test which signal prevailed as stronger under various experimental conditions—and what the outcomes were in terms of forests still standing after the 50-year simulation.

What they found has fascinating implications for natural resource management. The first finding of the model was essentially that social networks are important. Varying the levels of social mixing and the proportion of "high-consumption" forest users, the model demonstrated that a modest number of over-extractors could influence the behavior of the entire group. The converse is true for "rule-adherents": forest users that placed high importance on the signal coming from the formal institution were able to normalize rule-following among their peers. The idea that relationships among people influence their behavior toward their shared environmental resources is widely accepted and apparent in the real world. What was perhaps more interesting about the model, then, was the emergence of a "tipping point" beyond which the effect of social networks diminishes and household behavior is more strongly influenced by organizational rules. This is "good news" for natural resource organizations, the authors point out, since it suggests that they may have to "win over" only a fraction of community members to influence the entire group. Rather than viewing their mandates as existing in competition with informal social norms, formal rule-setting organizations may actually use social networks to their advantage—as long as they can influence some critical mass out of the crowd.

Another co-author was Rick Riolo of the Center for the Study of Complex Systems at the University of Michigan.

Agrawal, A., Brown, D. G., Rao, G., Riolo, R., Robinson, D. T., & Bommarito II, M. (2013). Interactions between organizations and networks in common-pool resource governance. *Environmental Science & Policy*, 25, 138-146.



Adapting to Climate 2.0

"More than before, but less than needed," is the subtitle of Rosina M. Bierbaum and colleagues' recent article on climate adaptation in the United States. The researchers used material submitted for review for the adaptation chapter of the 2013 U.S. National Climate Assessment (see related story, page 9), of which Bierbaum is lead author, to take the temperature (pun intended) of adaptation activities occurring across the nation. The effort was momentous considering the relatively little information available on climate adaptation, particularly compared to the robust body of research on mitigation.

"People aren't finding these stories from the practitioner world," Bierbaum said.

The heart of the article is a series of tables that document adaptation activities across the country. These are broken down by scale, from federal agencies to states to local nongovernmental organizations to private corporations. The lists include some unlikely contenders, such as the U.S. Navy, which is looking at maritime security and readiness in a rapidly thawing Arctic, and Keene, New Hampshire (population 23,000), which began installing larger stormwater pipes after intense flooding last spring. On the corporate side, Pacific Gas and Electric is tracking how the melting Sierra Nevada snowpack will affect hydroelectric energy production, and ConAgra Foods is identifying alternate suppliers for their ingredients, realizing that oddities such as the late tomato harvest that recently affected production will become more commonplace.

Yet despite many fascinating examples, the article's subtitle stands true: "Although substantial adaptation planning is occurring in various sectors, levels of government, and the private sector, few measures have

BLUE ALERT: A RAPIDLY THAWING ARCTIC HAS EVEN THE U.S. NAVY LOOKING AT CHANGES IN MARITIME SECURITY AND READINESS.

been implemented and even fewer have been evaluated," the authors find. (Another co-author was Missy Stults, an incoming SNRE doctoral student.)

Common barriers to adaptation action include a barely trickling flow of financial resources, a lack of usable information about local climate effects, inflexible laws and regulations, uncoordinated institutions, cultural conflicts, and general inertia. Despite these challenges, several "best practice" examples illustrate that the adaptation hurdles are not too high to clear. Although Bierbaum and her coauthors note that there is no "one-size-fits all" approach to adaptation, the practices of "mainstreaming," or integrating climate considerations into existing policies and plans, and of adopting no- or low-regrets strategies, or making changes that would be attractive even in the absence of a warming climate, have been successful in many cases. Overall, the article indicates the need for more information-sharing across scales.

"There is a big role for federal and regional entities to help aggregate best practices," Bierbaum said. "Otherwise you're having many, many groups reinventing the wheel."

By its nature, "adaptation" is a highly iterative process—one that requires high degrees of stakeholder engagement and information-sharing, and surely many revisions. "A comprehensive review of climate adaptation in the United States" is thus a kind of State of the Union address on adaptation, with plenty of celebration of what's been accomplished as well as a sober picture of the work that lies ahead.

– ALLIE GOLDSTEIN

Bierbaum, R., Smith, J. B., Lee, A., Blair, M., Carter, L., Chapin III, F. S., & Verduzco, L. (2013). A comprehensive review of climate adaptation in the United States: more than before, but less than needed. *Mitigation and Adaptation Strategies for Global Change*, 18(3), 361-406.

Identifying a 'solution space' for climate change debate

"Too much of the debate is dominated by the physical sciences in defining the problem and by economics in defining the solutions," writes Andrew J. Hoffman on climate change. It is a bit of an odd statement for the director of the Erb Institute, whose joint professorship at SNRE and Ross School of Business gives him a firm stake in each field.

Yet a conversation with a climate skeptic a few years ago led Hoffman to examine the role of the social sciences in explaining what he sees as a culture war in which "cultural communities" on one side of the debate perceive their way of life to be threatened by change while those on the other feel their values are undermined by the status quo.

Barring a technological loophole or continued stalemate, the only way forward, Hoffman argues, is a reasoned societal debate that brings us to some form of consensus. Is (climate) peace possible? Drawing on psychology, communications, and sociology research, Hoffman identifies a "solution space."

Hoffman, A. (2012) "Climate science as culture war," *Stanford Social Innovation Review*, 10(4): 30-37.

Shared sprawl

In her recent article in *Landscape and Urban Planning*, Landscape Architecture Professor Joan Nassauer urges landscape architects to focus on the "vernacular," or "places that do not bear the stamp of professional designers"—places that in fact "occupy the largest part of the terrestrial planet." Nassauer has long advocated for landscape as a way to bring various stakeholders to the table (or better yet, out in the landscape in question) to talk about the shared space. She's seen first-hand how having scientists and policymakers and neighborhood residents look together at a specific place can mitigate misunderstandings and inspire innovation.

In "Landscape as medium and method for synthesis in urban ecological design," she presents a framework for integrating an obvious but often invisible "landscape law"—the fact that landscapes integrate environmental processes—with participatory design methods. This approach can help to "align what is visible and may have immediately apparent value for some, with what is invisible or not widely understood, the ecosystem services supported by landscape," Nassauer writes.

In a world where suburban and exurban areas are the fastest growing land use, such an approach may be critical to preserving the services nature provides to people.

Nassauer, J. I. 2012. Landscape as medium and method for synthesis in urban ecological design. *Landscape and Urban Planning.* 106:221-229.

– COMPILED BY ALLIE GOLDSTEIN

THE DESERT OASIS:

Redefining Food Access in Michigan

What's for dinner? Or *not* for dinner?

A huge team of researchers, students, and farmers look to improve food access in Michigan

BY **ALLIE GOLDSTEIN (M.S. '13)**

Even in the dead of February, the garden is very much alive. I enter the hoop house which, at first glance, is as white-washed as the snowy landscape outside. But when we lift up the plastic covering draped over the raised garden beds, there is spinach to feed a village—row upon row.

I'm at Growing Hope, a farm in Ypsilanti, Michigan, and one of six community partners involved in a five-year, $4 million U.S. Department of Agriculture-funded grant that will study food access across the state. Professor Dorceta Taylor of the University of Michigan's School of Natural Resources and Environment is the lead investigator, and she's assembled a huge team of researchers, students, and farmers to answer the age-old question of 'What's for dinner?' Well…not exactly. It's more about what's not for dinner, and what could be.

These questions are being asked in the context of a nation in which 49 million people live in food-insecure homes and within a state where one in six people worry about what will be on their dinner plate. They are also being asked in a different way than ever before.

From farm to table. . . and everywhere in between

Detroit has often been typecast as a "food desert," with major media outlets reporting that there are no large grocery stores remaining in the city. This is no longer true: tax breaks lured a Meijer and a Whole Foods back within the city limits, and both stores broke ground last summer. But, as many Detroiters and others have pointed out, while "food desert" is a catchy phrase, it doesn't do much except conjure up a sense of pity for people who live in a barren place. Taylor, a leading Environmental Justice scholar who also happens to be a black woman who grew up on a farm, has never been interested in stereotypes or simplifications—except, of course, to debunk them.

"When you look at a space that might seem like a desert or seem empty, there is something going on in that space," Taylor said, speaking to a full house as SNRE's MLK Day Lecturer. "Most food access studies in the past have looked at large supermarkets or not. We're looking at gas stations, restaurants, liquor stores—you name it. Anywhere people buy food."

The research is a collaboration among six universities—University of Michigan-Ann Arbor, University of Michigan-Flint, Michigan State University, Grand Valley State University, Wayne State University, and Lake Superior State University—each working with a community partner: Growing Hope (Ypsilanti), Allen Street Neighborhood Center (Lansing), Baxter Community Center (Grand Rapids), Edible Flint, the City of Sault Ste. Marie, and the Detroit Black Community Food Security Network. It will be the first study to consider food access across an entire state.

Beyond access

Michigan in particular stands out as a state that epitomizes some of the most entrenched problems with our nation's food system. The Great Lakes State houses 55,000 farms covering more than 10 million acres—about a sixth of the land area of the state—and yet thousands of Michiganders still struggle with food insecurity. Somewhere from farm to table, the system is breaking down. Finding out where and how will require looking deeper into the means of food production and consumption than anyone has before. The researchers will interview key informants at every link in the food chain, from farmers to corner store retailers to grocer giants to eaters. They will ask not just if food is available but what kind of food. Is it quality, healthy food? Is it culturally appropriate food—the kind people know how to prepare and want to eat?

"When we think of sustainability, we think of locally grown. Sometimes I say, locally grown for whom?" Taylor said in her lecture. She cited UpSouth Foods, a food truck that travels to farmers' markets on the east side of Detroit, selling produce both from a local Michigan farm and from black farmers on the other side of the Mason-Dixon line. UpSouth Foods offers sustenance not just in the form of healthy calories but also in economic support to Southern black farmers who for decades have been systematically disenfranchised by the nation's agricultural system and—ironically—the USDA loans program.

The Desert Oasis

"From black people's perspective, people who have lost so much control over their food supply, it is critical to help their people in the South," Taylor told the audience.

Rather than reiterate the food access situation in Detroit, however, the study will instead focus on 18 small- and medium-sized cities across Michigan: Sault Ste. Marie, Brimley/Bay Mills, and St. Ignace in the Upper Peninsula; Holland, Muskegon, Benton Harbor, and Grand Rapids in the west; Flint, Saginaw, Lansing, and Kalamazoo towards the center; and Ypsilanti, Taylor, Southfield, Warren, Pontiac, Inkster, and Dearborn in the southeast. Each of these cities has a large population of at least one racial or ethnic group—blacks, Latinos, Native Americas, Asians, and Arabs—within a state that is overall 80 percent white. These demographic variables are important because of the way food access often chasms along racial lines. Of the nearly 49 million Americans experiencing food insecurity, a quarter are black and another quarter are Latino. The focus on smaller cities and the intentional exclusion of Detroit will help get beyond the black-white dichotomy that Taylor says has befallen previous food access research.

"We're looking at a much more dynamic range of cities in terms of ethnic and racial composition," Taylor told me in an interview. "There are all sorts of stores that are serving cultural purposes, such as Arab stores that serve everything the Arab community needs and desires. Not every small store is a store that's selling bad food."

Ways and means

This is the kind of study in which the interdisciplinary "skills toolbox" becomes more than a metaphor. The research combines a range of quantitative and qualitative methods, from spatial analysis of food outlets to interviews with growers to surveys of grocery store shelves. This outreach has already begun and will involve dozens of students from the six universities involved, including members of a current SNRE master's project.

"We won't appreciate the policy and structural barriers to accessing food until we talk to people who exist in those systems," explained Maren Spolum, the project coordinator for the USDA grant and a recent graduate of Michigan's School of Public Health and Ford School of Public Policy.

Greg Rybarczyk, the lead investigator from the University of Michigan-Flint, and Shannon Brines, the manager of the Environmental Spatial Analysis Lab at SNRE, are heading up much of the geographic information systems (GIS) work. They are overlaying census data on demographics with the point locations of corner stores, food pantries, gas stations, and farms of all sizes. All of the survey data collected will be geocoded so that the qualitative responses will have a spatial component—a massive effort to ground human experiences in place.

Though they are still figuring out the specifics, Brines is optimistic that GIS will be able to serve as a meeting place for many different types of data that might not otherwise be considered together. Outside of the lab, Brines is a farmer who owns an 82-acre plot of land by Whitmore Lake (north of Ann Arbor) where he grows vegetables and (soon) fruit. While analyzing data on a computer screen and planting seeds in soil may seem like irreconcilable interests, Brines has been waiting for food to intersect with his "day job" for a long time. GIS, after all, has the potential to reveal the spatial aspects of Michigan's food system that allow Brines' tomatoes to end up on some dinner plates and not others.

"It's one thing to grow stuff, but distributing it and getting it to people who want it is the big thing," he said. "A lot of past studies have looked at straight-line distance to the supermarket, but that doesn't capture transportation. Is it walkable? Is there mass transit?"

Danielle Gartner (M.S. '08), who is now the program manager at Growing Hope, also finds the approach to the research refreshing—and in line with the philosophy she has adhered to for a long time. Growing Hope is a farm and makeshift food policy think tank started by another Dana Building graduate, Amanda Edmonds (B.A. '00, M.S. '05). Since 2003, the nonprofit has been bringing gardening to Ypsilanti-area residents through a raised garden-bed program and two local famers markets that bring healthy foods to low-income people. For Growing Hope, the idea of food access as encompassing not just availability of food but also its quality and cultural appropriateness is nothing new.

"At Growing Hope, that is our definition of food access," Gartner said.

Market Watch

The study is the first to consider food access across an entire state and to adopt broader definitions of both food and access. Researchers are identifying convenience stories, full-line grocery stores and supercenters, and bars and liquor stores. Geographic information systems mapping (below) shows the density of each in the greater Detroit Area.

SOURCE: Multicultural Environmental Leadership Development Initiative Lab

photo by Dave Brenner

PROFESSOR DORCETA TAYLOR REVIEWED THE PRELIMINARY WORK ON THE PROJECT DURING HER JAN. 21 MLK LECTURE IN THE DANA BUILDING.

Growing Hope has taken a data-driven approach to its food outreach work from the beginning, requiring recipients of the raised garden beds to weigh and report every vegetable and fruit they harvest. The USDA grant represents an opportunity for them to share best practices with food organizations across the state, many of whom they wouldn't otherwise connect with. Last year's participants in Growing Hope's program harvested an average of 95 servings of fresh produce from their gardens over the summer, Gartner said, saving a median of $32 on their grocery bills for the season. Though the direct economic impact was less than the organization had hoped, interviews revealed some of the unquantifiable health and happiness impacts program participants experienced.

"For some people this seems to be a lifestyle thing," Gartner said. "Maybe they only save $30, but would they have ever purchased an eggplant in the first place?"

Deborah Lown, an assistant professor and lead investigator at Grand Valley State University, is planning to add a nutrition and exercise component to the study to examine how gardening may spill over into other aspects of people's health and well-being. This is the point at which the word "study" becomes a bit misleading, at least in terms of its connotations of a lone researcher sitting at a desk. Rather than observe food insecurity at a distance, the many researchers and community partners aim to intervene in the system as they are studying it, tinkering with its parts to figure out how it works and how it might work better.

"We are the only one of these food studies that has actually attacked the problem at the level of access," Taylor said. "We're looking at barriers to see if we can start either reducing these barriers, or at least get people in conversation."

Building cities that feed us

It takes a visionary to embark on a five-year research project involving hundreds of people, and Taylor certainly qualifies. Her vision is not just for a food system that offers better access to better food, but for a new conception of cities as living, calorie-producing places.

"Over the last century and a half, we have thought of cities as places that are devoid of agriculture, and laws have developed accordingly," she said. "There are some residents of cities who don't want to live besides chickens and cows and goats. But also in many cities it's simply illegal to have them."

Some policy barriers to urban agriculture are obvious. Getting water to a city garden plot is often a problem, and some people resort to illegally opening fire hydrants to irrigate their crops. In many parts of the state, hoop houses—which in Michigan can expand the growing season by seven months—are illegal. Other policy barriers are less easily observed. Until it was lifted last year, an antiquated food cottage law in Michigan prevented micro-scale farmers from selling products like raspberries and honey at local markets.

However, as Gartner pointed out, much of the food policy reform that is needed involves not just lifting barriers to producing and distributing good food but also creating incentives to do so. Whole Foods and Meijer received a combined $7.5 million tax credit to set up shop in Detroit, but what about support for smaller vendors who have been there all along? For convenient and corner stores, the obstacles to selling fresh produce are often more than financial. A distribution system must be in place to deliver fruits and vegetables before they are wilted, and customers must then buy that produce before it goes bad. Policies around where Electronic Benefit Transfer and Bridge Cards (types of food assistance payment systems) are accepted often govern where low-income people can shop and what they eat. To this end, the study's focus on 18 small- and medium-sized cities will help to illuminate some of the barriers and incentives that define the issue of food access across the state.

"What laws and policies can we work on now that we're rethinking cities?" Taylor asked.

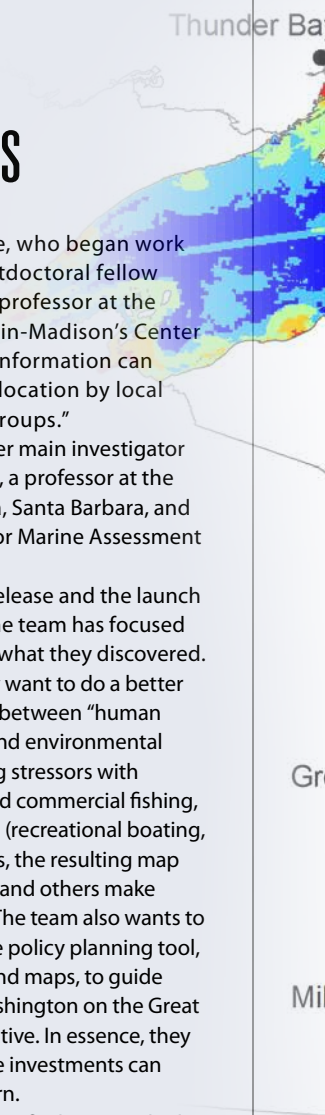
This question was ringing in my head as I left the Growing Hope center in Ypsilanti and its lush winter garden. Next door to the Center is a windowless liquor store, and next door to that is Family Fried Chicken, which was offering a Wednesday special for $4.69. A little down the street I found Dos Hermanos, a Mexican grocer that sold spices in plastic pouches and labeled its produce in Spanish, and a little down the street from that was a tiny Afro-Caribbean food outlet where about a dozen people were gathered, chatting among the shelves. The closest major grocery stores to Ypsilanti center is the Kroger south of I-94, Gartner told me, but I couldn't easily get there by foot or public transit. Is this cityscape a food desert or oasis? The answer, of course, depends on who you are and how you access food. It is—as Taylor realized a long time ago—maddeningly and fascinatingly complicated.

When it comes to interest in food access, though, Michigan is very straightforwardly a land of plenty. Taylor receives emails almost every day from people who want to be involved in the grant work, and she was recently interviewed on Michigan Public Radio about the study. By the end of five years, the researchers plan to publish dozens of research briefs and press releases, implement two university courses on food access, expand raised-bed gardening programs for low-income residents, promote healthy foods policies, and, perhaps most importantly, create enhanced dialogue among eaters, growers, and other stakeholders across the state. So far, the conversation has already grown larger than Taylor ever imagined. The level of interest is an "embarrassment of blessings," she said.

COPING WITH STRESS

BY **KEVIN MERRILL**

Allan, fellow researchers map the health of the Great Lakes



After three-plus years of collecting and analyzing data and building scientific consensus, a team led by University of Michigan researchers has released the most comprehensive map ever of environmental stress facing the Great Lakes.

Unfortunately, the areas colored red—representing the super-stressed regions—often had more than a dozen stressors co-occurring.

The overarching stress map represents the combined influence of nearly three dozen individual stressors and is incredibly detailed for a region spanning nearly 900 miles.

The map and its underlying findings, unveiled in January in the *Proceedings of the National Academy of Sciences*, generated headlines across the United States and Canada, including articles by The Detroit Free Press, Christian Science Monitor, Chicago Tribune, and Toronto Star. In many cases, journalists and policymakers were especially interested in which of the 34 stressors mapped was most to blame or fear. Researchers were prepared for the question.

"You have to be careful that you do not fall into the trap of looking at one or two [stressors] because they're easily visible, or the ones people already have in their minds because of what's currently in the newspapers," said Dave Allan, an aquatic ecologist at the School of Natural Resources and Environment and the project's principal investigator. "Our message is, you want to have a comprehensive look at all the environmental stressors going on."

For purposes of the study, the researchers defined "stress" as human impacts such as physical, chemical or biological disruptions that potentially have adverse effects on people, plants, and animals. The stress map is giving federal and regional officials an unprecedented scientific foundation upon which to sustainably manage the Great Lakes. A bi-national team of researchers from academia and environmental organizations known as the Great Lakes Environmental Assessment and Mapping (GLEAM) project coordinated the data collection. The project is based in SNRE, and the work has been accomplished with help from two SNRE graduates, Christine (Geddes) Joseph (M.S. '03) and Adrienne Marino (M.S. '09), SNRE postdoctoral researcher Sigrid Smith, and several Program in the Environment undergraduate and SNRE students.

"Basically, our work itemizes the laundry list of things that need to be fixed and where they occur," said co-author Peter McIntyre, who began work on the study as a postdoctoral fellow in SNRE and is now a professor at the University of Wisconsin-Madison's Center for Limnology. "This information can be used in any given location by local officials and citizen groups."

The project's other main investigator was Benjamin Halpern, a professor at the University of California, Santa Barbara, and director of its Center for Marine Assessment and Planning.

Since the data's release and the launch of a related website, the team has focused on new ways to apply what they discovered.

For example, they want to do a better job at prioritizing links between "human benefits" of the lakes and environmental stressors. By overlaying stressors with economic (shipping and commercial fishing, for example) and social (recreational boating, bird-watching) benefits, the resulting map can help policymakers and others make smarter public policy. The team also wants to develop a collaborative policy planning tool, based upon the data and maps, to guide decision making in Washington on the Great Lakes Restoration Initiative. In essence, they are investigating where investments can produce the most return.

The research and its findings sparked a flurry of inquiries. Agencies such as the U.S. Army Corps of Engineers wanted to obtain the data; others, such as the U.S. Coast Guard, wanted to share new data in hopes of making future maps and analysis more complete. The Nature Conservancy

is incorporating the data as part of its conservation planning for the Great Lakes. "The interest in the images, and from people wanting to work with the underlying data, has been really quite impressive," Allan said.

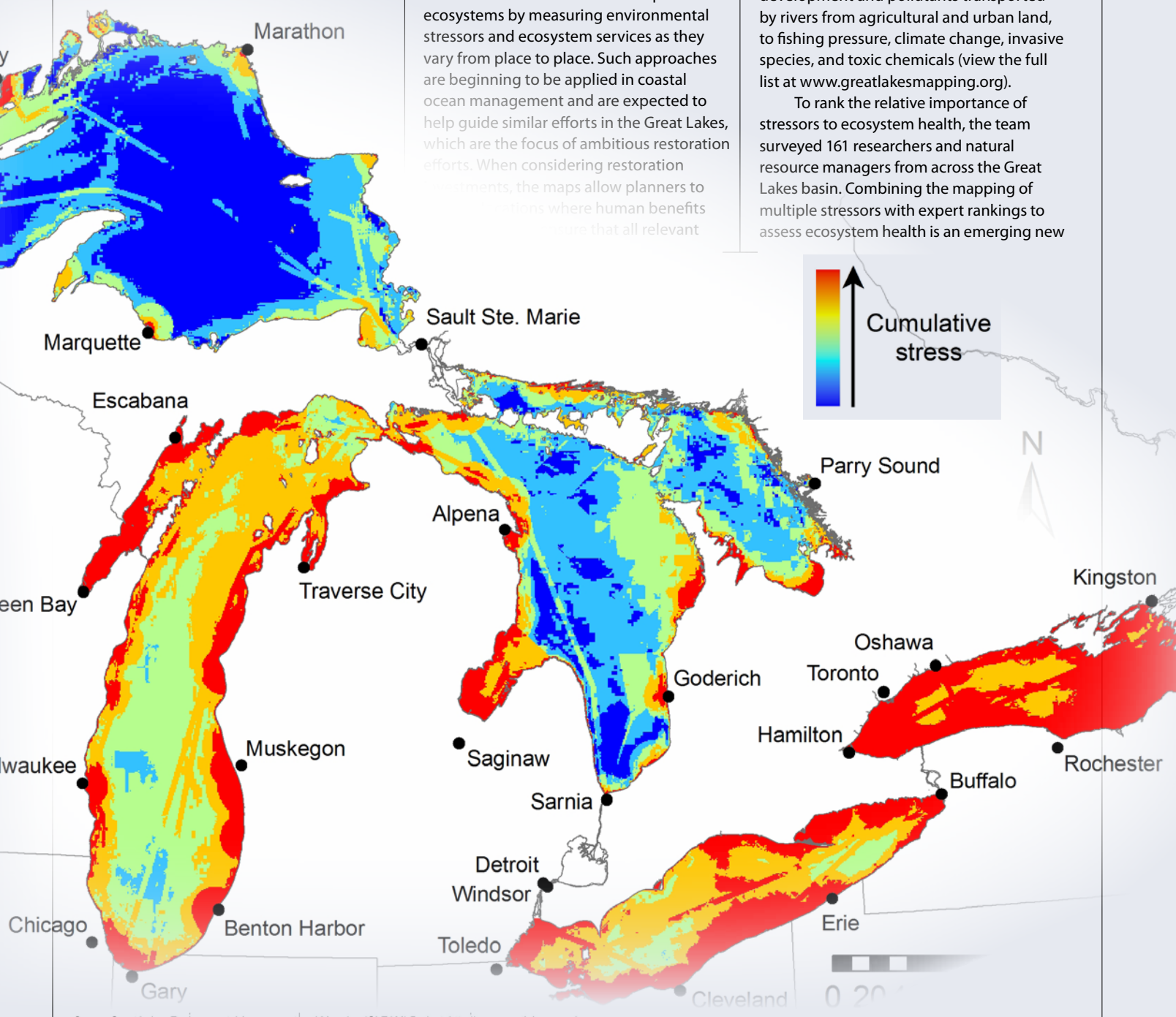
Researchers now are seeking new funding to test more theories. (The group has received funding from the new Michigan Water Center, housed within the Graham Sustainability Institute, to continue its research efforts.) They are also looking to partner with non-ecology scientists (planners, demographers, and political scientists) to study why some communities are able to act on the data and make improvements and others are not.

Stressors 101

Technically, the maps (each of the 34 stressors has its own) are known as high-resolution spatial data. The maps allow researchers to assess humans' impact on ecosystems by measuring environmental stressors and ecosystem services as they vary from place to place. Such approaches are beginning to be applied in coastal ocean management and are expected to help guide similar efforts in the Great Lakes, which are the focus of ambitious restoration efforts. When considering restoration investments, the maps allow planners to [illegible] locations where human benefits [illegible] sure that all relevant stressors are considered.

The team drew upon the latest data from federal and state agencies as well as non-governmental organizations and individual researchers. The overarching stress map represents the combined influence of nearly three dozen individual stressors and is incredibly detailed for a region spanning nearly 900 miles, showing impacts at the scale of half a mile. The stressors examined ranged from coastal development and pollutants transported by rivers from agricultural and urban land, to fishing pressure, climate change, invasive species, and toxic chemicals (view the full list at www.greatlakesmapping.org).

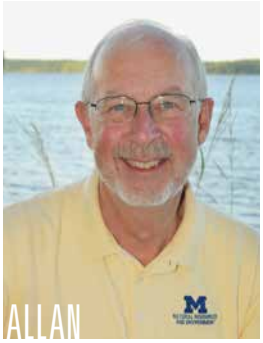
To rank the relative importance of stressors to ecosystem health, the team surveyed 161 researchers and natural resource managers from across the Great Lakes basin. Combining the mapping of multiple stressors with expert rankings to assess ecosystem health is an emerging new



Source:Great Lakes Environmental Assessment and Mapping (GLEAM) Project, http://www.greatlakesmapping.org

approach among scientists.

As they began the project, researchers faced the initial challenge of narrowing the large number of available stressors to a manageable handful. Those decisions were made in part on which had data available and could therefore be mapped. Some stressors were then ranked by severity to help determine which to keep; others were grouped into categories, with a one or a few representative stressors chosen.


ALLAN

For example, there are more than 180 invasive species in the Great Lakes. GLEAM researchers narrowed it to six. There are thousands of chemicals found in measurable amounts, of which several hundred were identified as worthy of concern. Those were then sorted into five categories, of which only three could be included in the mapping project.

That approach produced some criticism when the data were released, but the researchers found the results to not change much with changes to the list. "In our study, we did a whole raft of sensitivity analyses, where you say, does it matter how we scale the data?" Allan said. "Does it matter if we throw away one or more of the stressors? And when you do those sensitivity analyses, the short answer is, no, it doesn't matter."

In the end, the team's work found high and low "stress"—defined as human impacts like physical, chemical, or biological disruptions that potentially have adverse effects on people, plants and animals—in all five lakes. Ecosystem stress is highest closer to shores, but also extends into the lakes in some areas. Large sub-regions of moderate to high cumulative stress were found in lakes Erie and Ontario as well as in Saginaw and Green bays, and along Lake Michigan's shorelines. In contrast, extensive offshore areas of lakes Superior and Huron, where the coasts are less populated and developed, experience relatively low stress.

"Our maps are not the be all and end all; you can't just turn a crank and make all the right decisions," Allan said. "But they really provide an unprecedented opportunity to think comprehensively about what's important in each location. I wouldn't stop with our list, but I'd certainly look at our list."

Because the data were not all collected from the same year, the maps actually represent a snapshot from 2000-2009, and in some cases, an averaging of 10 or 20 years of data—or only a few years. That limitation—the inability to capture temporal variation, or changes year to year—is one that researchers acknowledge. A second is the limited number of stressors examined. A third involves its limitations as a predictive tool.

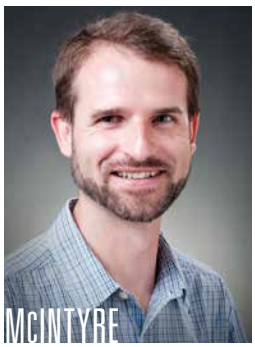

McINTYRE

Photo by Bryce Richter/University of Wisconsin-Madison

"I think it's more useful to try to add stressors that we weren't able to find data for initially than to think about updating individual stressors on a short-term basis because they represent a kind of average snapshot in time," Allan said. "It's important to recognize that that's actually a limitation of this kind of spatial approach; it doesn't capture the time dynamics of the lake well. And we know that the lakes are changing all the time."


HALPERN

With other ideas and opportunities to pursue, there are no plans to do a new round of maps soon. But if new ones were to be attempted, Allan said the team probably would include a nuisance algae called *Cladophora*, as well as harmful algal blooms, to the list of stressors mapped.

Aiding restoration planning

One of the goals behind the research was to help lawmakers and natural resource managers better plan Great Lakes-area investments, such as those under the Great Lakes Restoration Initiative, a federal effort that began in 2009 and which is funding hundreds of projects at sites where ecosystem stress is very high. The initiative is the largest investment in the Great Lakes in two decades. Eleven federal agencies developed an action plan to implement the initiative through 2014.


SMITH

"We're primarily a scientific research team and so our motivation is to try to advance the science and application of these marine spatial planning approaches to Great Lakes' restoration issues. We've certainly gotten the attention of people who are doing and funding the restoration work," Allan said.

To advance the science behind and application of their work, GLEAM researchers are trying to identify the characteristics for selecting restoration sites. The ideal location would be at least moderately "strssed", with relatively few stressors identified as dominant. It also would have to be conceivable to reverse those stressors through intervention, planning, or improved management, and there would have to be a clear human benefit to doing so.

They are in the early stages of developing a model or formula to do just that. "We're trying to systematize an approach that would be based on the number of threats that need to be reversed, their reversibility and the benefits that come from that location. And that would be our approach to putting together a tool—a decision-support tool — that would help people do restoration planning in a more systematic way than they do now," Allan said. "And that's not to say that what they do now isn't working, but this is where research and academia, I think, have a contribution to make."

Finding new uses

In addition to sharing the data as widely as possible, the researchers are spending more time looking at how the data can help planners make the lakes more beneficial. The Great Lakes

provide a host of human benefits, often defined as "ecosystem services," from recreational and commercial fishing to boating, beach use, and birding, with economic values estimated in the tens of billions of dollars annually. Comparing maps of ecosystem services to maps of stress, the researchers found that locations providing human benefits were often disproportionately stressed.

"Part of this study was to look at the spatial location of human benefits in the Great Lakes. Where do people swim, fish, boat? We're primarily looking at recreational benefits. And we are trying to do a better and more comprehensive job of describing the spatial pattern of human benefits throughout the basin. What we did in this study was sort of a first cut—and we'd like to do more. How do these stressors match up with the places where people are seeing uses—human uses, human values? We're working to improve our ability to do that."

Another idea is to see how well their maps match up with lake water quality and biological monitoring data collected by the U.S. Environmental Protection Agency and other groups. In other words, can the maps be used as a predictive tool of water quality?

"Spatial data are powerful, and most of the threats or stressors that we talk about vary from place to place," Allan said. "We need to understand how they vary from place to place just as much as we need to understand how they vary from year to year if we're going to do a good job of lake management."

READ MORE ON THE PROJECT
greatlakesmapping.org

GLEAM'S APPROACH

The Great Lakes Environmental Assessment and Mapping Project (GLEAM) evaluated multiple stressors affecting the Great Lakes ecosystem. Researchers merged spatial data layers representing all major categories of stressors, from climate change and land-based pollution to invasive species, into a single map of cumulative stress. The synthesis of this information enhances the ability to manage and restore the Great Lakes ecosystem. The final map can be used to assess stressor impacts at locations with significant human benefits and to evaluate conservation and restoration opportunities.

The methodology:

The project included four main steps.

1. Mapping the intensity of stressors across the Great Lakes at a resolution of one-square kilometer. The project team obtained or generated data to map 34 of an original list of 50 stressors that its core working group identified as potentially mappable and currently impacting the Great Lakes.

2. Weighting the relative impacts of each stressor by habitat type, based on a survey of Great Lakes experts.

3. Creation of a cumulative stress map by summing all the stressors.

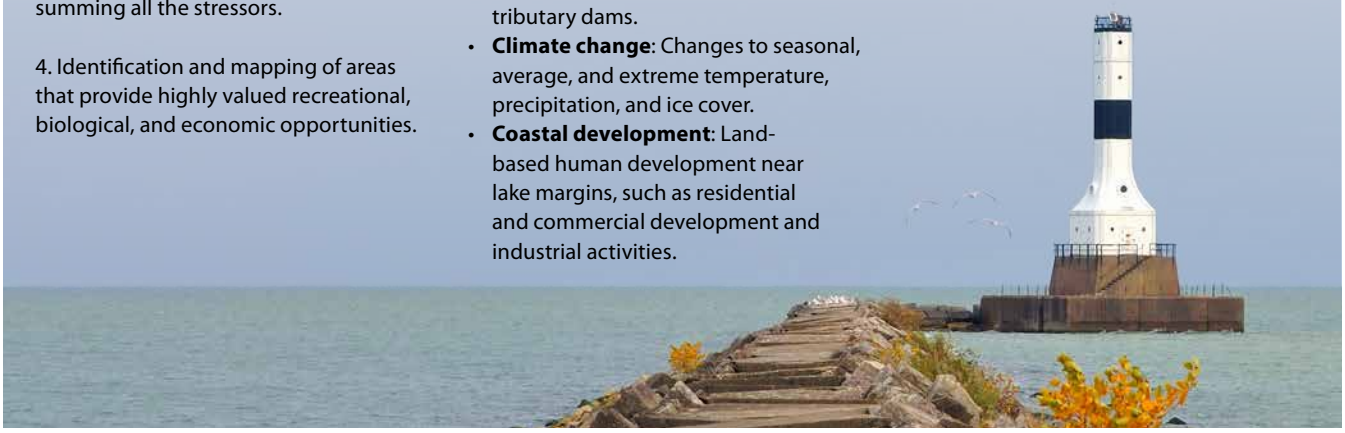
4. Identification and mapping of areas that provide highly valued recreational, biological, and economic opportunities.

What is a stressor?

A stressor is any substance, condition, flux, or organism that alters the characteristics of the lakes, including their biology, from natural or desired conditions. A stressor may be currently operating on the lakes or may be considered likely to do so in the future. Stressors may be physical, chemical, or biological.

Seven categories of stressors:

- **Aquatic habitat alterations**: Changes to aquatic habitat from diverse causes, such as shoreline hardening and erosion control structures, port and marina development, and tributary dams.
- **Climate change**: Changes to seasonal, average, and extreme temperature, precipitation, and ice cover.
- **Coastal development**: Land-based human development near lake margins, such as residential and commercial development and industrial activities.
- **Fisheries management**: Changes to Great Lakes ecosystems resulting from fishing pressure, stocking activities, and aquaculture.
- **Invasive species**: Changes to Great Lakes ecosystems from invasive and nuisance species in abundances not previously seen.
- **Nonpoint source pollution**: Nutrients, sediments, and waterborne contaminants transported from watersheds to the Great Lakes by streams and rivers and atmospheric deposition.
- **Toxic chemical pollution**: Chemical pollutants from industrial and agricultural sources.



THREE'S COMPANY

SNRE, Public Health researchers share expertise to study health systems in Kenya

BY **KEVIN MERRILL**

Q-FEVER TEAM MEMBERS ARE (FROM LEFT) JOSEPH EISENBERG (PUBLIC HEALTH), REBECCA HARDIN (SNRE) AND JOHANNES FOUFOPOULOS (SNRE).

It's the kind of scientific question tailor-made for interdisciplinary research. How does Q-fever, a highly contagious and still largely untracked disease, move among people, livestock, and wild animals, and what are the long-term effects of its presence on human health and economic systems?

Answers may be closer to emerging because of M-Cubed, a new University of Michigan program that is awarding nearly 200 grants to jumpstart interdisciplinary work. The two-year, $15 million effort encourages faculty to explore major issues facing the planet, from climate change and poverty to health and energy.

To qualify, three researchers from different disciplines come up with an idea and agree to work together. The teams get $60,000 to test their theory or carry out research. The Q-fever project, one of 16 funded so far involving at least one SNRE faculty member, resulted from a proposal submitted by Joseph Eisenberg at the School of Public Health and Johannes Foufopoulos and Rebecca Hardin at the School of Natural Resources and Environment. Using their respective expertise in public health, animal ecology, and social science, they want to better understand the impact of rapid social and ecological change on disease ecology in Africa's drylands, specifically the Laikipia District in Kenya. Their research is examining land and animal management issues and their effect on the transmission of Q-fever, a sometimes fatal disease, among wild and domesticated animals, residents, and visitors.

"If you look at the literature on zoonotic pathogen research, you don't have a lot of interdisciplinary work," said Eisenberg, an associate professor in the Department of Epidemiology and the project's leader. "You've got lab people looking at the virus in order to understand its virulence properties. You've got epidemiologists doing risk factors to see if it is drinking the milk, for example, that's causing the outbreak. And you've got ecologists looking at the animals. There isn't a single person that can actually do it all. You have to have a team of researchers working together. And it's hard to find funding sources that will fund an anthropologist, an ecologist, and an epidemiologist."

M-Cubed was created to help address that shortcoming. The program is part of the Third Century Initiative, a $50 million, five-year initiative announced in October 2011 by President Mary Sue Coleman to develop new multi-disciplinary teaching and scholarship approaches as U-M prepares to celebrate its bicentennial in 2017.

"The Third Century Initiative is a powerful testament to our belief in the excellence and creativity of the human capital that is the University of Michigan," President Coleman said in announcing the initiative. "This multi-year investment will deliver new leaders and new ideas for an unpredictable, changing world, and will be a critical, relevant contribution to society."

The Q-fever team

It sounds like the start of a bad joke: Did you hear the one about the epidemiologist, ecologist, and anthropologist who walk onto a savanna …?

Eisenberg, Foufopoulos, and Hardin acknowledge they are an unlikely trio. Each earned doctoral degrees in different disciplines, pursue different research questions, and focus their field and data collection efforts on different continents. But M-Cubed is giving the three professors a chance to take their professional collegiality to another level.

Hardin, the anthropologist, and Foufopoulos, the ecologist, have been SNRE colleagues since 2003. In the summer of 2010, they co-taught an undergraduate course funded by the Graham Sustainability Institute. The location was the Mpala Reserve, a privately owned research property in Laikipia, one of 71 districts in Kenya. That experience, and the relationships forged with college professors, health practitioners, and municipal leaders living and working there, laid the groundwork for the Q-fever proposal. Also aiding the effort was financial support from the Graham Sustainability Institute.

"When we returned to the Dana Building, we had several meetings to think about what kinds of research proposals would create institutional partnerships between SNRE and universities in Africa and undo some of the academic silos," Hardin said. "People were learning about wildlife and human interactions, or about human health, or cattle management. But this intersecting set of issues—that was really on people's minds. And bringing those things together wasn't being done very effectively there or here," Hardin added.

SNRE provided a natural setting for the collaborative effort. "SNRE increasingly is a home for this kind of collaboration, even with other units internally (at U-M), but also with colleagues internationally," said Hardin.

Kenya is an ideal laboratory to study the issue of disease transmission because of the interactions among species, both wild and domestic. "Here, dairy cattle pretty much hang out with other dairy cattle. There, it's a whole different thing," Hardin said. "So being able to start building an understanding of how the interspecies mix might matter to transmission and to responses to the disease, that's a nice contribution in terms of thinking about diversity and resilience on a broader scale."

As important as the cross-species interaction is, the presence of humans and their daily interactions with the natural environment is also a key study component, Foufopoulos said.

"If you go to Africa, it's very easy just to get locked into focusing on wildlife because it's so present and impressive. But the truth is, humans are super important. As a matter of fact, wildlife is retreating almost everywhere, even within national parks," he said. "And so you really have to consider humans."

"People realize that if you want to preserve intact ecosystems, you need to look outside just strictly protected areas and see whether you can find solutions that avoid the conflict between nature and humans and find ways to achieve a sustainable presence of humans in this landscape," Foufopoulos added.

photo by Dave Brenner

THREE'S COMPANY

"So Mpala, the place where we taught the course, is particularly good in that regard because it's actually private property. It's a ranch, but they are also committed in trying to protect wildlife. So it's a great setting to start addressing these kinds of questions. The idea was not just to do ecology, looking at wildlife, but to also look at humans," Foufopoulos said. "What are humans doing in the landscape, how can you ensure they have a living? Are there ways of promoting both? It turns out that pathogen transmission between wildlife, livestock, and humans is one of the flash points of this interaction, so understanding and managing pathogen infection is an excellent way to reduce these tensions."

On the ground in Laikipia

The project builds on social and ecological background research from six SNRE master's thesis projects carried out in the past two years in Kenya; this summer's master's thesis research will be conducted by Public Health student Annie Wang, who will work in conjunction with a post-doctoral fellow currently being hired with M-Cubed funds to coordinate summer research in Kenya. Once the initial data are collected, the team will analyze the results, looking for patterns and systems that could provide a framework for understanding the Q-fever transmission and how it is impacting social and economic functions in the community. Ideally, the post-doctoral researcher not only will help with data collection and analysis, but in putting together ideas on how to model the disease, they said. As they do, they will share the results with health officials in Laikipia.

"For a region like this, which is heavily touristic—and the tourism economy in Kenya is extremely important to the national economy—fear of something like Q-fever can keep tourists away because it is so easily transmitted, not only through drinking, but through breathing dust," Hardin said. "So we want to keep it from hobbling food economies, tourist economies, the local health of pastoralists and professionals working in these landscapes."

For Eisenberg, the issue of disease ecology raised in the proposal fits his research interest, which focuses on understanding disease through a systems perspective. Q-fever, he said, is a good model for thinking about zoonotic pathogen transmission and zoonotic disease risk. The appreciation of the importance of this particular disease has been increasing as the number of cases grows, and questions are now being asked about its effect on health systems and local economies.

"You need data to know what's going on, especially when we're looking at a pathogen like Q-fever where there's not a lot of information about it in the literature," Eisenberg said. "So getting that preliminary data in humans, getting preliminary data in livestock and, to what extent we can, in wildlife, is pretty critical. But the other big piece is setting up the framework for how you think about a problem like this, where you're dealing with humans, wildlife and livestock."

As they implement the proposal, the researchers acknowledge that the work is taking place amid major societal change sweeping Kenya. "That's one reason why we all feel committed to being engaged. There is a real strong need for constructive collaborative partnerships in a country that's rewritten its constitution," Hardin said. "They are really triumphing over some violent, divisive forces and trying to emerge as a modern democracy that manages its resources well. And we would like to be helpful in that struggle."

THE Q-FEVER TEAM

Joseph Eisenberg

Position: Associate Professor, Department of Epidemiology, School of Public Health
Research focus: Infectious disease epidemiology with a focus on waterborne and vector-borne diseases. Research interests integrate theoretical work in developing disease transmission models and empirical work in designing and conducting epidemiology studies
Doctoral degree: Ph.D. in Bioengineering, University of California, Berkeley (1992)

Johannes Foufopoulos

Position: Associate Professor, Conservation Ecology field of study, School of Natural Resources and Environment
Research: Disease ecology, host-parasite interactions, ecological immunology, emerging wildlife diseases, conservation biology, habitat fragmentation and extinction, impacts of global climate change on biotic communities, vertebrate ecology
Doctoral degree: Ph.D. in Zoology, University of Wisconsin-Madison (1999)

Rebecca Hardin

Position: Associate Professor, Environmental Justice field of study, School of Natural Resources and Environment
Research: Human and wildlife interactions, and social and environmental change related to tourism, logging, conservation, and hunting in Central Africa forests. Historical and ethnographic aspects of concessionary politics involving corporations, NGOs, and local communities, particularly in Africa
Doctoral degree: Ph.D. in Anthropology, Yale University (2000)

M-CUBED AND SNRE

Of the 160 projects announced since November 2012, 16 have at least one SNRE faculty member (19 total faculty). In addition to the Q-fever project, here are titles, project summaries and faculty role (with field of study) in the other 15 projects.

Faculty: Bilal Butt (project lead), assistant professor, Conservation Ecology
Title: Unintended consequences of technology in development: A cross-sectional analysis
Summary: Investigates three questions: How prevalent is the use of technology in rural and urban livelihood strategies among the poor in low- and middle-income countries; what are the political, economic, and social contexts associated with the use of these technologies in these livelihood strategies; and in what ways and under which contexts does the use of technologies reinforce, erode, or maintain pre-existing social relations of production and exchange?

Faculty: Dan Brown (project member), professor, Environmental Informatics
Title: Environments and activity: GPS-based collection of real-time perception and behavioral data to support modeling
Summary: Examines role of the built and social environment on physical-activity behavior using novel data and methodology to study why obesity levels have increased dramatically over the past three decades. The project will refine and test a methodology to capture survey data on mobile phones where surveys are triggered based on a sensor (e.g., GPS, accelerometer data).

Faculty: Allen Burton (project member), professor, Conservation Ecology
Title: Tracking water and biodiversity resources in the Great Lakes
Summary: Explores impacts of climate change, invasive species, and toxicants on key water and biodiversity resources in the Great Lakes. Investigates how changing environmental factors influence microbial mats in the Thunder Bay National Marine Sanctuary, and impacts from metals and synthetic organic chemicals in sediments.

Faculty: Brad Cardinale (project member), associate professor, Conservation Ecology
Title: Algal biofuel and biodiversity
Project summary: Examines mixed algae cultures for biofuel production by integrating methods spanning from engineering and ecology and genomics.

Faculty: Bill Currie (project lead), associate professor, Conservation Ecology; Arun Agrawal (team member), professor, Environmental Policy and Planning
Title: Linking people, forests, and the atmosphere to model landscape sustainability
Summary: Seeks to develop an innovative, new proof-of-concept computer model that links human use and alteration of forests, landscape ecological function, and surface-atmospheric exchange of carbon, energy, water, and aerosols.

Faculty: Raymond De Young (project lead), associate professor, Behavior, Education and Communication; Tom Princen (team member), associate professor, Environmental Policy and Planning
Title: Urgent transitions: Responding to emerging biophysical limits
Project summary: Explores transitions, related processes that need to occur in response to the growing consensus positing a biophysical limit to perpetual growth. Project grounded in biophysical trends and human capabilities, and pays special attention to local sources and impacts.

Faculty: MaryCarol Hunter (project lead), associate professor, Landscape Architecture
Title: A "nature pill" for healthy ageing in urban areas
Summary: Articulates a "nature prescription" that supports healthy ageing in urban areas. While many studies show a positive influence of the nature experience on human health and well-being, there is little understanding about how much or in what form the nature experience should be.

Faculty: Inez Ibanez (project member), assistant professor, Conservation Ecology
Title: Digital humanities approaches to popular periodicals: Quantifying reading trends with time series analysis
Summary: Uses distant reading and digital humanities techniques to study mainstream German periodicals between 1850 and 1918. Computer-based techniques range from the generation of index databases and the digitization of texts to programming, statistical analysis, and dynamic visualization of the data.

Faculty: Bobbi Low (project member), professor, Conservation Ecology
Title: Complex systems approaches to comparing and contrasting life histories of Rhesuses and humans
Summary: Constructs, analyzes models of the life histories of Rhesus monkeys and humans, using classical life history techniques and more recent complex systems techniques. Models will explore causes and effects of varying parental, nepotistic, and social scenarios and different environments, backgrounds, and social structures.

Faculty: Gregory A. Keoleian (project member), professor, Sustainable Systems
Title: Learning how to make liquid fuels from algae oil under water
Summary: Seeks to develop a better understanding of the chemistry of hydrothermal catalytic deoxygenation of fatty acids over early transition metal carbide-based catalysts.

Faculty: Shelie Miller (project member), assistant professor, Sustainable Systems
Title: Hydraulic fracturing of shales: Water contamination risks, treatment options, and fate of fracking fluids
Summary: Seeks to study contaminant release and transport mechanisms, treatment options, and lifecycle assessment of the environmental impacts of fracking fluids in comparison to other oil and gas extraction techniques.

Faculty: Paul Mohai (project member), professor, Environmental Justice
Title: School siting: Environmental justice, health, and law
Summary: There are more than 53 million schoolchildren and 135,000 public and private schools in the United States. Are these schools safe and healthy places for children to grow, play, and learn? Or are we exposing children to unhealthy pollution?

Faculty: Joan Nassauer (project lead), professor, Landscape Architecture
Title: The physical environment of post-industrial cities & well-being of their inhabitants
Summary: Synthesizing team members' existing data, results, and experiences to identify overarching actionable findings and principles about how the physical environment of post-industrial cities can further support the well-being of their inhabitants; identify research gaps that should be explored.

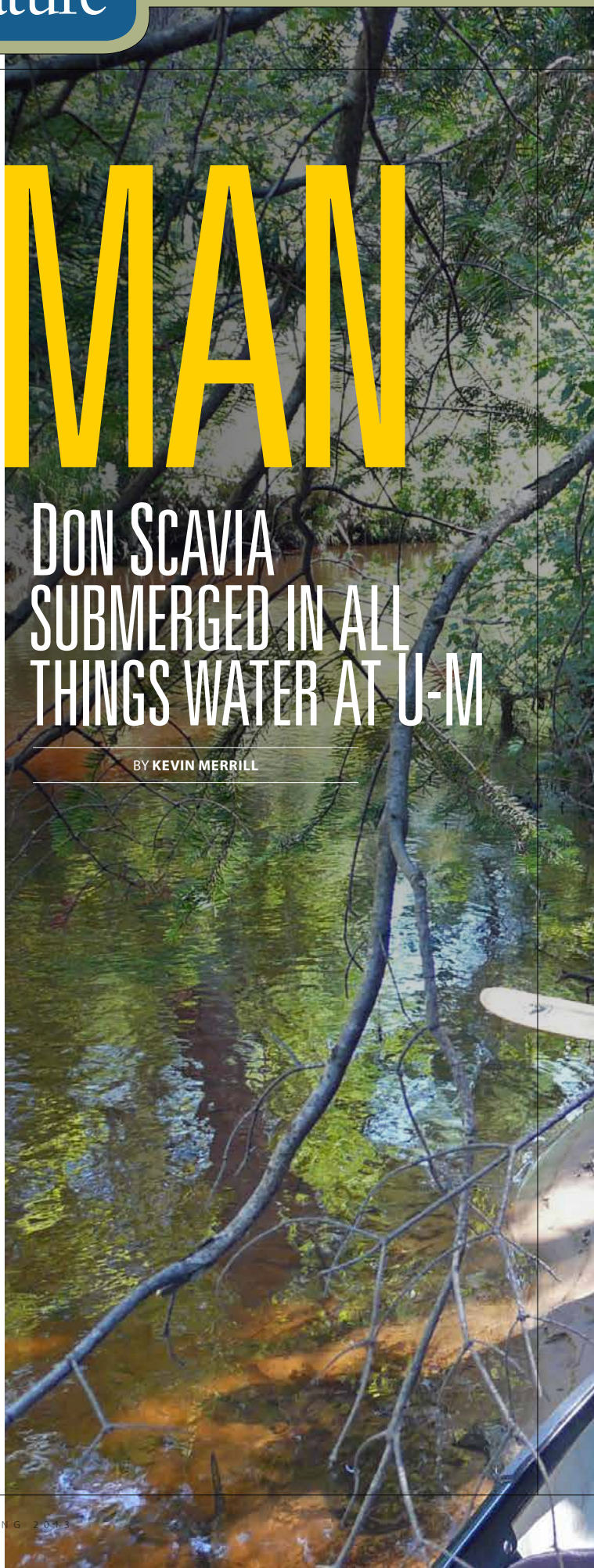
Faculty: Josh Newell (project lead), assistant professor, Sustainable Systems
Title: Innovatively planning for technological innovation: Water, infrastructure, and sustainability
Summary: Seeks to understand the broad, complex, and potentially unanticipated impacts on humans and the environment that could emerge from the deployment of emerging innovative technologies being designed to address the compelling water, wastewater, stormwater, and related sustainability problems of today.

Faculty: Ivette Perfecto (project lead), professor, Conservation Ecology
Title: Urban gardens: Constrained auto-generation of spatial pattern and consequences for ecosystem services
Summary: Seeks to determine the underlying ecological, sociological, and economic dynamics that generate spatial patterns of urban farms; examine the ecological dynamics that determine the dynamics of pest species in the gardens; and examine the consequences of this pattern and these dynamics for ecosystem function.
For a full description of the projects and team members, visit mcubed.umich.edu

AQUA MAN

Don Scavia submerged in all things water at U-M

BY **KEVIN MERRILL**



It's hard to find another researcher at the University of Michigan or perhaps in the entire Great Lakes region more focused on issues facing the lakes than Don Scavia. Whether helping launch the new $9 million Michigan Water Center, administering a $4.2 million grant on Great Lakes climate, co-authoring the Midwest chapter of the National Climate Assessment, or convening bi-national lakes-focused researchers this fall, Scavia is submerged in all things water at U-M.

He came to the world of academia and U-M in 2004 after a nearly 30-year career as a federal scientist, during which he held many top positions at the National Oceanic and Atmospheric Administration (NOAA). He served as chief scientist of NOAA's National Ocean Service, director of its National Centers for Coastal Ocean Science, and director of its Coastal Ocean Program Office. He was recruited to be a professor at the School of Natural Resources and Environment and to re-establish U-M as a force in Great Lakes research. And with the fall announcement of the Water Center, Michigan is "once again in a strong position to provide scientific support, evaluation, and synthesis," Scavia said.

The center is being administered by the Graham Sustainability Institute, a U-M Provost unit that Scavia has directed for four years in addition to his teaching and research roles. Day-to-day operation of the Water Center belongs to SNRE Professor Allen Burton. The center's mission is to guide efforts to protect and restore the world's largest group of freshwater lakes by reducing toxic contamination, combating invasive species, protecting wildlife habitat, and promoting coastal health.

"U of M is in a really good position to provide sound scientific input on Great Lakes issues. We can provide leadership and convening power among our colleagues across the region," said Scavia. "The center is conceived as a consortium. So not only are we going to be supporting our own students and faculty, but we're going to be providing support for students and faculty at places like the University of Wisconsin, University of Minnesota, and maybe even Ohio State. It's recognition that U of M can provide that leadership."

The center already has hired three Great Lakes experts from NOAA's Great Lakes Environmental Research Laboratory (GLERL) in Ann Arbor and solicited funding proposals from researchers in both the United States and Canada. Making this all possible was a decision by the Erb Family Foundation, longtime supporters of SNRE and U-M, to support the center with a $4.5 million grant over three years, which the university is matching.

As a first step in shaping the new center's mission and

SCAVIA, HIS KAYAK AND THE TWO HEARTED RIVER IN MICHIGAN'S UPPER PENINSULA.

photo by Ellen Scavia

demonstrating the strength of the consortium, the Graham Institute convened a group of more than 20 directors of U.S. and Canadian academic Great Lakes centers and institutes to discuss and develop science recommendations for the next phase of the federal Great Lakes Restoration Initiative. The group concluded that sound science must be an integral part of restoration projects.

"The first three years of center funding is to focus on the Great Lakes. So it's got a very strong Great Lakes focus in the beginning," said Scavia. "It was intentionally named the Water Center because we're hoping to grow a broader focus, looking at water issues across the globe. Whether it's water quantity issues in drought-stricken parts of the world or helping develop or deliver potable water in developing countries, it's going to be much, much broader than the Great Lakes over time."

Establishing roots at U-M

From 1975 to 1990, Scavia was a GLERL research scientist, where he also held an adjunct faculty position in what is now U-M's Department of Ecology and Evolutionary Biology. He later served as director of three of NOAA's top research units before leaving the Beltway for Ann Arbor. While in federal service, he focused on the links between agricultural runoff and the formation of coastal "dead zones" in places like the Gulf of Mexico and the Chesapeake Bay. He led the first federal integrated assessment of the Gulf dead zone on behalf of the Clinton White House in 2000 and was one of the first scientists to warn that increased demand for corn-based ethanol fuel will likely worsen hypoxia in the Gulf.

When asked to come to the University of Michigan, "the opportunity and challenge was too great to pass up," Scavia said. "U-M's Great Lakes research enterprise and our partnerships with several Ann Arbor-based state, federal, bi-national, and NGO organizations made this place a potential hotbed for the growth of Great Lakes research and policy development."

Since joining SNRE (he also holds an appointment as a professor in the U-M College of Engineering), he has held multiple water-based leadership positions on campus, including directing both Michigan Sea Grant (now directed by Professor Jim Diana) and the Cooperative Institute for Limnology and Ecosystems Research (CILER), both funded through NOAA. Burton is the current CILER director.

The Water Center is the latest sustainability-focused effort to fall under Scavia's purview (see his U-M portfolio on page 27). It was his administrative and broad research experience that led President Mary Sue Coleman to tap him in 2009 to lead the Graham Sustainability Institute and, a few months later, to be her Special Counsel for Sustainability and the senior staff for her Environmental Sustainability Executive Council. One of the first efforts he championed was an 18-month integrated assessment of campus sustainability that provided a detailed analysis of where the university was and how it could set and reach operational sustainability goals.

"Setting the campus operational sustainability goals—for example, the greenhouse gas emission reduction and water use reduction targets—was really important. Establishing those goals for the first time, committing to and finding

funding for them was a really important first step because you couldn't really have credibility in the rest if you weren't taking care of your backyard first," he said.

In education and research, "the Graham Scholars and the Dow Fellowships programs are really pushing the envelope and providing many more opportunities for our students, who are passionate about sustainability," Scavia said. "But I think the most important thing the University of Michigan is doing, that few other places can, is work at a scale that's hard for a small liberal arts school or others to attempt. The issue of scale is the critical one."

He cited as an example the Planet Blue Ambassadors program, which launched earlier this year. The certification consists of five online training modules connected to U-M's sustainability goals in energy, food, waste, water, and community. "We announced that on a Friday morning and by the middle of the next week, we had almost 23,000 pledges, 10,000 of which have been completed, and now we have over 1,000 certified Ambassadors. It would not have happened without a sustainability initiative," he said. "And other universities, other places that have similar sustainability things going on, can't work at that scale."

Despite the wide-ranging set of research and administrative duties, Scavia still finds time to co-teach NRE 580, the integrated assessment course he originally designed and which is required of nearly all first-year SNRE graduate students as part of the school's core curriculum. He also continues to publish scientific articles (more than 100 to date in such journals as the *Proceedings of the National Academy of Science*, *Science* and *BioScience*). He also serves on the board of directors of the Great Lakes Observing System; board of trustees of the Mpala Research Center, and on the advisory boards for the North American Nitrogen Center, the Environmental Law and Policy Center, and the National Wildlife Federation's Great Lakes Leaders Council; and as science advisor to the Healing our Waters Great Lakes Coalition. At U-M, he is on executive committees for the U-M Energy Institute, the Erb Institute for Global Sustainable Enterprise, the Risk Science Center, and the Center for Advancing Research and Solutions for Society.

Many of his published papers result from his research involving hypoxia in the Gulf of Mexico and Chesapeake Bay. Since 2002, Scavia has modeled the projected size of "dead zones" in these areas based on nutrient outflow from rivers that feed those basins. Now, he wants to add a third body of water to his projections: Lake Erie.

"Our forecasts are focusing on two problems. One is toxic algae in the western part of Lake Erie and the other is hypoxia in the central part of the lake," he said. "We will be forecasting whether or not it's going to be a good or bad year for toxic algae, as well as predicting the size of the dead zone." Like with the Gulf and the Chesapeake, these forecast tools are also being used to help set new nutrient loading targets for the lake.

Great Lakes and Climate

Since 2010, Scavia has been the co-director of GLISA, a $4.2 million NOAA-funded Regional Integrated Sciences and Assessments center (RISA) for the Great Lakes region. Each of the 12 national RISA centers focuses on adapting to climate change by bridging the gap between what local decision makers need and what climate and other scientists can provide.

"When we first started down this path, talking to city, water resource, and wildlife managers, they said they wanted downscaled climate projections: what's the climate going to look like, in my backyard, in 50 years?" Scavia said. "That's what everybody thought they needed and wanted."

The more he and the other GLISA scientists listened, the more they realized something more practical was required.

"As our scientists talked with them, the dialogue changed. We discovered that most of the decision makers actually wanted sound scientifically-based narratives of what to expect in the future. They want to be able to go to their policymakers and say, 'This is something we need to pay attention to and start working in that direction,'" Scavia said. "It's changed the perspective on what managers can expect and how they would use the information, as well as what climate scientists need to provide."

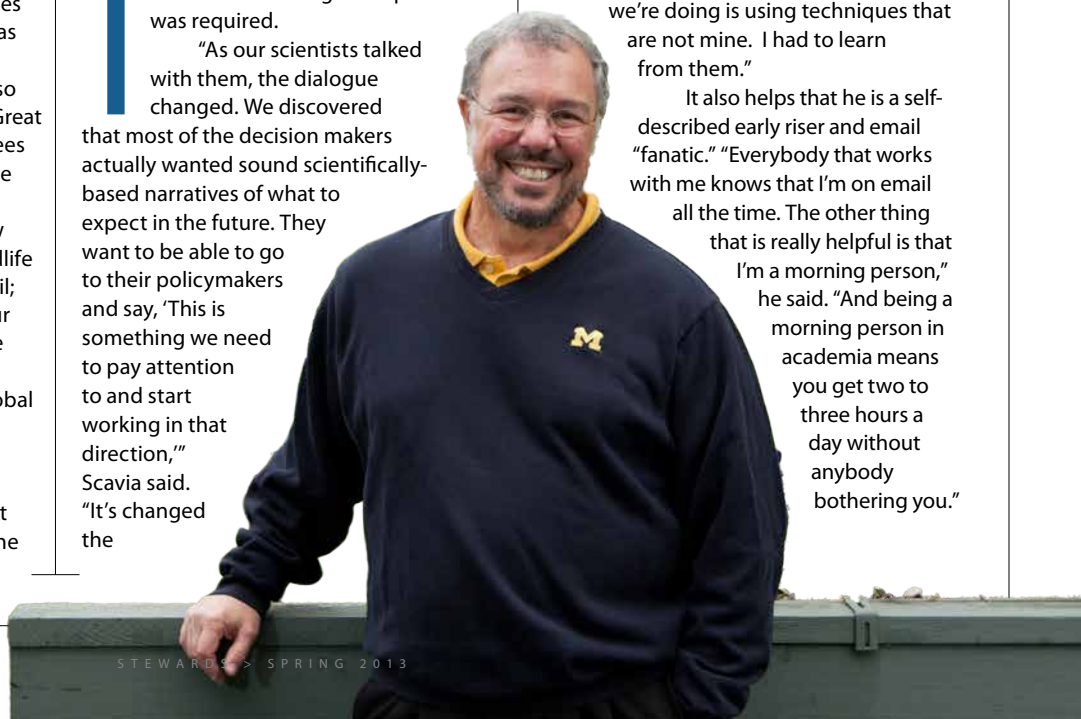
Another innovation undertaken by GLISA is to step away from trying to be a "boundary organization to all" and instead fund those groups closer to decision makers. A boundary organization is one that has a foot in both the decision maker and scientist camp; in many cases, a non-governmental organization already working with other NGOs, scientists, and agencies. "We realized that there are way too many decision makers for us to be playing that role," he said. "We're now supporting six boundary organizations to do what we were trying to do essentially for the region, but they're doing it at a much finer scale."

GLISA also played a role in the recently published draft of the National Climate Assessment. It commissioned 10 peer-reviewed white papers on the effects of climate change in the Midwest as input into the assessment; Scavia later served as lead co-author on that chapter.

Managing such a wide portfolio of responsibilities is a challenge but Scavia said he succeeds by building strong teams.

"Nobody can do this much by themself. So I hire great people, delegate a lot to them, and I trust them to do good stuff … and they deliver," he said. "And then I really work hard at bringing in motivated, smart students and post-docs that work on the fringes of what I know so that I learn from them. A lot of the new modeling we're doing is using techniques that are not mine. I had to learn from them."

It also helps that he is a self-described early riser and email "fanatic." "Everybody that works with me knows that I'm on email all the time. The other thing that is really helpful is that I'm a morning person," he said. "And being a morning person in academia means you get two to three hours a day without anybody bothering you."



Graham as the Glue

The Graham Sustainability Institute was a natural location for the Water Center. Since its founding in 2007, it has served as a collaborative partnership of schools, colleges and units across U-M, and has fostered cross-disciplinary collaboration. The Institute oversees projects from the Water Center and GLISA to most aspects of U-M's sustainability efforts, including the $10 million Dow Fellows program.

"We believe the Institute is a primary facilitator and innovator for sustainability at U of M," Scavia said. "It doesn't mean we are the ones doing it or the only ones doing it. But we are trying to drive it and shape it, and help make the whole greater than the sum of the parts, which is difficult at a decentralized place like the U of M."

The Institute's role as a convener and facilitator can be seen in the Great Lakes Futures Project. This year, it hosted a range of U.S. and Canadian representatives from NGOs, public agencies, businesses, and academia to propose long-term research and policy priorities to help protect and restore the Great Lakes and train the next generation of scientists, attorneys, planners, and policy specialists. The project is supported by 21 Canadian and U.S. research organizations. It will assess past and potential states of the Great Lakes and St. Lawrence River Basin, inform strategic policy formulation, frame research priorities, and help train the next generation of Great Lakes leaders.

"We thought this was a perfect time to bring together academics, agencies, NGOs, and industry, step back and ask, where is all of this heading? Are we heading in a direction we want to go?" Scavia said. "What do we want the future to look like? And are all these great programs that are busy doing things heading us in the direction we want to go?"

As for the future of the Graham Sustainability Institute, it will adhere to a core guiding principle.

"The strength of the Institute lies in its ability to engage, support, and integrate the good work of students and faculty across the 19 schools and colleges," Scavia said. "We're not there to supplant them or compete with them; we're kind of like the BASF commercial. We don't make sustainability at U-M; we make sustainability at U-M better."

"As long as the university maintains sustainability as a priority and recognizes that it's so broad and complex a topic that no one unit can do it all, they're going to want to have an organization help bring the pieces together and take advantage of opportunities," he said. "And I've got every reason to believe they're going to continue to want that."

THE WORLD OF SCAVIA

Great Lakes Regional Integrated Sciences and Assessments Center

As co-director, Scavia leads a team looking at climate change adaptation in the Great Lakes region. The interdisciplinary effort, begun in 2010, is funded by an initial five-year, $4.2 million grant from the National Oceanic and Atmospheric Administration. It is a collaboration of U-M and Michigan State University, with participation by Ohio State University and Michigan Sea Grant. Its core management team is comprised of leading climatologists, social scientists, and outreach specialists. GLISA is housed in the Graham Sustainability Institute; its co-director, Thomas Dietz, is a sociology professor at Michigan State University. The two overarching goals of the program are to contribute to the long-term sustainability of the region in the face of a changing climate and to facilitate smart decision-making backed by scientific knowledge.

www.glisa.umich.edu

National Climate Assessment

Scavia was a co-lead convening author of the Midwest chapter (covering eight states, including Michigan) of the National Climate Assessment (NCA), released nationally in January. The chapter was one of eight regional chapters; each examined the unique challenges and adaptation strategies facing different sections of the country. The NCA is a climate status report required every four years under the Global Change Research Act of 1990. The 1,100-plus-page assessment was written by a team of more than 240 scientists. The other co-lead author for the Midwest chapter was Professor Sara C. Pryor of Indiana University.

www.ncadac.globalchange.gov

Graham Sustainability Institute

Named in January 2009 to direct the Institute, Scavia manages an operation with 26 employees and an annual budget of more than $9 million. Reporting to the Provost, the Institute is a collaborative partnership of schools, colleges, and units across U-M, and fosters cross-disciplinary collaboration to create and disseminate knowledge. It launched in July 2007 with a $5.25 million gift from the Graham Foundation, a philanthropic organization established by Donald Graham and his wife Ingrid; the Office of the Provost provided an additional $5.25 million. The institute supports efforts from the $9 million Michigan Water Center and $4.2 million GLISA project to most aspects of U-M's sustainability efforts, including the Dow Fellows program.

www.graham.umich.edu

Michigan Water Center

The $9 million center, unveiled in October, is supported by the Graham Sustainability Institute. The center's mission is to guide efforts to protect and restore the world's largest group of freshwater lakes by reducing toxic contamination, combating invasive species, protecting wildlife habitat, and promoting coastal health. As a first step in shaping the center's mission, it convened more than 20 directors of U.S. and Canadian academic Great Lakes centers and institutes to discuss and develop science recommendations for the next phase of the Great Lakes Restoration Initiative. The Water Center is directed by Allen Burton, an SNRE professor who also serves as director of the Cooperative Institute for Limnology and Ecosystems Research.

www.graham.umich.edu/centers/water.php

Hypoxia Forecasts and Management Scenarios

Scavia's longest-running scientific work, and the one he is most widely quoted on, is on hypoxia, or "dead zones." Hypoxia refers to the loss of oxygen in water, which leads to conditions unsustainable for aquatic life. He has developed models to estimate the nitrogen-load reductions needed to reach particular hypoxia reduction goals. He later discovered the model could forecast the dead zone size for an upcoming season, based on the average spring nitrogen loads for the Chesapeake Bay and the Gulf of Mexico. The 2013 predictions for the Gulf of Mexico and Chesapeake Bay will be released in June. He's now developing models to predict dead zones and toxic algae for Lake Erie. His work on the Gulf of Mexico and Lake Erie are being used by the National Research Council, federal agencies, and the International Joint Commission to review federal nutrient loading goals.

www.snre.umich.edu/scavia/hypoxia-forecasts/
www.snre.umich.edu/scavia/ecofore/
www.miseagrant.umich.edu/nsf/
www.ijc.org/boards/leep/

Special Counsel to the President for Sustainability

In this role, Scavia is charged with coordinating existing efforts and inspiring new initiatives by students, faculty, and staff across campus in education, research, and operations. The position reports to President Mary Sue Coleman, and is overseen by the seven U-M vice presidents as members of the Environmental Sustainability Executive Council. He was appointed to the role in October 2009.

www.sustainability.umich.edu

classnotes

Giving Back

The School of Natural Resources and Environment sends a special thanks to alumni who returned to campus or participated virtually at events in support of today's students. The three events—SNRE's Alumni Speed Networking (Oct. 11), Graduate Career Fair (Jan. 15), and Master's Project Client Fair (Jan. 28 and Jan. 29)—brought back nearly 70 alumni to offer insights and guidance to current students. If you are interested in getting involved these or other annual events, please contact the SNRE Career Service staff at snre.careers@umich.edu.

Photo by Dave Brenner

CLAIRE SANTORO (M.S. '11), AN ASSOCIATE AT ENVIRONMENTAL CONSULTING FIRM INDUSTRIAL ECONOMICS, MET WITH STUDENTS IN THE DANA BUILDING VIA SKYPE AS PART OF THE GRADUATE CAREER FAIR.

Alumni Speed Networking participants:

Jim Mitchell (M.S.F. '68): Director of pricing, Edwards Brothers Malloy

Seth Phillips (B.S. '74): Retired, environmental coordinator, state of Michigan DNR, DEQ, and MDOT

Carolyn Poissant (M.L.A. '87): Principal/owner of Sadoka Designs, LLC

Eric Herzog (M.S. '89): Environmental scientist, U.S. Environmental Protection Agency

Amy Kuras (M.L.A. '89): Landscape architect/park planner, City of Ann Arbor

Lisa Yee-Litzenberg (B.S. '92): Coordinator of Student Career Services, SNRE

Michael Levine (B.S. '95): Co-owner, Nature and Nurture, Inc.

Elizabeth Riggs (M.S. '99): Deputy director, Huron River Watershed Council

John Cunningham (M.B.A./M.S. '00): Independent technology consultant

Amanda Maria Edmonds (M.S. '05): Executive director, Growing Hope

Rakhi Kasat (M.S. '06): Southeast Asia program manager, U.S. Environmental Protection Agency

David Hobstetter (M.S. '07): Staff attorney, Center for Biological Diversity

Bethany Hellmann (M.S. '08): Natural areas stewardship assistant, Washtenaw County Parks and Recreation Commission

Ari Kahan (M.S. '08): Environmental protection specialist, U.S. Environmental Protection Agency

Kathy Kohm (M.S. '88): Editor, *Conservation Magazine*, University of Washington, Seattle

Chris Theriot (M.S. '08): Manager of conservation programs, Ducks Unlimited, Inc.

Jennifer Young (M.S. '08): Energy program director, Michigan Suburbs Alliance

Ashley Burtner (M.S. '09): Researcher, Cooperative Institute for Limnology and Ecosystems Research

Erika Hasle (M.S. '09): Conservation ecologist, The Field Museum

Kyle Kwaiser (M.S. '09): Information manager, University of Michigan Biological Center

Jesse Worker (M.S. '09): Solutions fellow, Climate Reality Project

Rachel Chadderdon Bair (M.P.H./M.S. '10): Program director, Fair Food Network

Justin Adams (M.B.A./M.S. '11): Ambassador of WOW, Innovatrium Institute for Innovation/Competing Values

Coming Home

Joane Slusky

Landscape Architecture student Jake Hamilton (below, left) meets with Joane Slusky (M.L.A. '09) of Juno Solutions during the Feb. 2 MLA Portfolio Day. Practicing landscape architects, including many alumni, gave feedback on students' work. Slusky owns Juno Solutions, a landscape design services company in southeast Michigan serving private and corporate clients seeking practical planning and creative solutions.

Sarah Cashman

Sarah Cashman (M.S. '09) came back Jan. 11 as part of the Sustainable Systems Forum to deliver a talk on her work as a lifecycle analyst with Franklin Associates, a prominent lifecycle analysis consulting firm.

Alissa Kendall

Alissa Kendall (Ph.D. '97) spoke Feb. 8 as part of the Sustainable Systems Forum. Her talk was titled "Conducting Policy-Relevant LCA Research and Navigating an Academic Career in an Emerging Discipline." Kendall is an assistant professor of civil and environmental engineering in the Department of Civil and Environmental Engineering at the University of California, Davis. She also is an affiliate of the Institute of Transportation Studies, Energy Institute, and a fellow of the Agricultural Sustainability Institute.

Rebecca Williams

Rebecca Williams (M.S. '05), a reporter/producer at Michigan Radio's "The Environment Report," talked about storytelling and communicating science with Program in the Environment students Feb. 8. Using samples of her own work, Williams (below, far right) guided students through the creative process, and presented elements of effective journalism, and how

THE SECOND ANNUAL SPEED NETWORKING EVENT BROUGHT TOGETHER DOZENS OF ALUMNI WITH CURRENT STUDENTS. THE EVENT TOOK PLACE BOTH IN PERSON AND VIRTUALLY.

Photo by Heather Leszczynski

Caitlin Boon (M.S. '11): Geographic information systems contractor, Ducks Unlimited, Inc.

Hunt Briggs (M.B.A./M.S. '11): Consultant, Corporate Sustainability Practice, Resource Recycling Systems

Amrita Kumar (M.B.A./M.S. '11): Director of conservation finance, Ecotrust Forest Management

Shoshannah Lenski (M.S. '11): Associate, DTE Energy

Nagapooja Seeba (M.S. '11): Life cycle analyst, Steelcase

Frank Szollosi (M.S. '11): Regional outreach coordinator, National Wildlife Federation

Ajay Varadharajan (M.S.E./M.S. '11): Business analyst, Ford Motor Company

Graduate Career Fair participants:

Philip Huber (B.S.F. '81): Wildlife Biologist, USDA Forest Service

Jennifer Day (M.S. '10), Great Lakes regional coordinator, NOAA Great Lakes Environmental Research Laboratory

Rebecca Held (M.S. '11), Great Lakes Restoration Initiative coordinator, NOAA Great Lakes Environmental Research Laboratory

Karen Marzonie (B.S. '83, M.L.A '87): Landscape manager, Henry Ford Estate, Fair Lane

Amy Kuras (M.L.A. '89): Landscape architect, City of Ann Arbor

Micheal Levine (B.S. '95): Co-owner, Nature and Nurture, LLC

Mindy Milos-Dale (M.L.A. '95): Director, Oakland Township Parks

Lauren Hoffman (B.S. '06, M.L.A./M.S. '09): Landscape ecologist, Environmental Consulting and Technology

these stories motivate people to feel different emotions, think critically about the issue, and even modify their behavior. Students used their laptops to construct stories, using sound bites Williams provided. They also took a studio tour.

ANDREW FAHLUND

Andrew Fahlund (M.S. '97) returned to campus March 20 to talk about climate change and the ability of Western U.S. cities to cope with it. The talk, "Managing the Unavoidable: How Western Cities are Preparing for a More Volatile and Extreme Climate," was organized by current SNRE Wyss Fellows. Fahlund is executive director of Water in the West, where he fosters interdisciplinary research and convenes leaders from a broad spectrum of interests to address one of the American West's greatest challenges.

WILLIAM C. SULLIVAN

William C. Sullivan (Ph.D. '91) provided today's students with tips on making their research and professional lives more meaningful. Sullivan, a professor of landscape architecture at the University of Illinois at Urbana-Champaign, was invited to give SNRE's Rackham Centennial Alumni Lecture Oct. 25. The lecture was funded in part by the Horace H. Rackham School of Graduate Studies, which organized the Rackham Centennial Alumni Lectures as part of its 100th anniversary celebration.

Julie Mida Hinderer (B.S. '07, M.S. '10): Fishery research program associate, Great Lakes Fishery Commission

Sarah Hines (M.B.A./M.S. '07): Science application and integration specialist, USDA Forest Service

Sierra Patterson (B.S. '07, M.S. '10): Botanist, USDA Forest Service

Amy Braun (B.S. '08, M.S. '11): Manager, Sustainability, Kellogg Company

Jennifer Janssen (M.S. '08): Online advocacy and outreach senior manager, National Wildlife Federation

Bethany Hellman (M.S. '11): Natural areas stewardship assistant, Washtenaw County Parks and Recreation Commission

Claire Santoro (M.S. '11): Associate, Industrial Economics

Devi Glick (M.P.P./M.S. '12): Analyst, The Rocky Mountain Institute

Naomi Hamermesh (M.S. '12): Assistant research scientist, Michigan Tech Research Institute

Neal Billetdeaux (B.S. '82, M.L.A. '87), Principal, SmithGroupJJR

Laura Palombi (M.B.A./M.S. '11): Project manager, Clean Energy Coalition

Master's Project Client Fair participants:

Carl Weimer (B.S. '76): Executive director, Pipeline Safety Trust

Barbara Nelson (B.S. '77, M.S. '84): Michigan program director, National Park Service - Rivers, Trails, and Conservation Assistance Program

Neal Billetdeaux: Participated as vice-chair, USGBC Sustainable Sites Technical Advisory Group

Sue Bonfield (M.S. '86): Director, Environment for the Americas

Lauren Wenzel (M.S. '91): Acting director, NOAA National Marine Protected Areas Center

Elizabeth Riggs (M.S. '99): Deputy director, Huron River Watershed Council

David Gard (M.B.A./M.S. '01): Energy program director, Michigan Environmental Council

Barbara Lucas (M.S. '05): Environmental media consultant, "Michigan Motor Smart" Idling Reduction Task Force

Eric Wingfield (M.B.A./M.S. '05): Mobility strategist, Ford Motor Company

Emily Wilke (M.S. '06): Director of land protection, Southwest Michigan Land Conservancy

Morgan Crutcher (M.S. '11): Technical and policy analyst, Coalition to Restore Coastal Louisiana

James Mulligan (M.A./M.S. '11): Executive director, Green Community Ventures on behalf of the World Resources Institute

Laura Palombi (M.B.A./M.S. '11): Project manager, Clean Energy Coalition

Jeremy Taub (M.B.A./M.S. '11): Director of sustainability, Banorte Financial Group

Marcos Mancini (M.B.A./M.S. '12): Director of sustainable banking, Banorte Financial Group

Christine (Diana) Chrissman (M.S. '06), Conservation director, Grand Traverse Conservation District

John Willard (M.S. '12), Energy analyst-biosystems, Quantalux, LLC

Photo by Dave Brenner

MEMBERS OF THE CLASS OF 1962 RETURNED TO CAMPUS AS PART OF HOMECOMING ACTIVITIES THIS FALL. AMONG THOSE ATTENDING THE ANNUAL CAMPFIRE WERE (FROM LEFT) GENE (B.S. '62) LASCH, CYNTHIA LASCH, SANDY BARTH, NICHOLAS BARTH (B.S. '62), JOYCE WEIZENICKER AND DAVID WEIZENICKER (B.S. '62).

Save the Date: Homecoming 2013

Mark your calendars for Homecoming Weekend 2013. Events across campus are Thursday through Sunday, October 3-6. SNRE events will be Friday, Oct. 4, and include the annual Saginaw Forest campfire. If you have any questions about the event, please contact snre.alumni@umich.edu.

TAYLOR

Jason Taylor (M.S. '04, Ph.D. '08) has been hired as chief of natural resource management at Cape Cod National Seashore, a National Park Service site in Wellfleet, Mass. Taylor was a landscape ecologist with the U.S. Department of the Interior's Bureau of Land Management National Operations Center in Denver.

Robert J. Gibbs (M.L.A. '84) was honored by the Clinton Presidential Library's School of Public Service for his career contributions in urban planning and development. He was asked to speak as a William J. Clinton Distinguished Lecturer where he presented "How Great Communities are Conceived and Built", based on his new book *Principles for Urban Retail Planning and Development*. Gibbs is a Michigan landscape architect and urban planner who founded Birmingham-Mich.-based Gibbs Planning Group in 1988.

Wendy Silverman Gordon (M.S. '90) struck out on her own in 2012 under the auspices of Ecologia Consulting. She is leading an initiative on adaptation planning for sea-level rise along the Texas Gulf Coast. She is also the face and voice of water conservation in the Permian Basin, writing a guest column for *The Odessa American* and providing water conservation know-how on the CBS affiliate. She facilitates a LinkedIn group on Texas Water. She continues to reside in Austin, Tex., with her husband and two children. Learn more at www.ecologiaconsulting.com.

Michael J. Simsik (M.F. '92) was named chief of operations for the Africa Region with the U.S. Peace Corps. He assists in the management of more than 3,400 Peace Corps Volunteers in 24 countries in Sub-Saharan Africa, as well as a budget of more than $100 million. In 2012, he published his first book, *Lemurs, Landscapes, and Livelihoods*, based on his dissertation research on the highlands of central Madagascar (Lambert Academic Publishing).

SIMSIK

Dean Hay (B.S. '00, M.L.A. '02) is director of green infrastructure for Greening of Detroit. The group recently received $300,000 in grants that should enable the nonprofit to plant more than 2,000 trees and create about 600 jobs for young people in the Motor City. The reforestation grants will help combat storm water runoff and other environmental hazards that can harm the Great Lakes basin. The Greening of Detroit expects the new trees to restore about 42 acres of tree canopy, intercept more than 1 million gallons of rainfall in the first two years and sequester 3,000 pounds of carbon dioxide per year. Volunteers and urban youth employees will help plant and maintain the trees through 2015.

Baku Takahashi (M.S. '03) co-wrote a research paper for the Food and Agriculture Organization (FAO) of the United Nations. The publication is titled "Operationalizing fisheries co-management: Lessons learned from lagoon fisheries co-management in Thua Thien Hue Province, Viet Nam." Takahashi is a technical adviser at the FAO Regional Fisheries Livelihoods Programme in Viet Nam. He previously served as an operations coordinator and natural resources and environment officer at the FAO Integrated Management of Lagoon Activities in Thua Thien Hue Province Project.

Solomon David (Ph.D. '12) joined the Shedd Aquarium in Chicago as a post-doctoral research associate at its Daniel P. Haerther Center for Conservation and Research. His research is focusing on the importance of migratory patterns of near-shore fish in Lake Michigan and the role these migrations play in the Great Lakes ecosystem. This work is part of a joint position between Shedd and the University of Wisconsin-Madison. While at the University of Michigan, his doctoral work focused on Great Lakes fishes, including lake trout and spotted gar. He also is writing a blog about the research for National Geographic's website.

DAVID

Share Your News

Send us updates and photos about your new job or personal achievements. Visit snre.umich.edu/alumni and fill out our online update form. Or, send your information to Kevin Merrill, SNRE's director of communications, via e-mail (merrillk@umich.edu) or regular mail. The address is School of Natural Resources and Environment, Office of Communications, University of Michigan, 440 Church St., Ann Arbor, Mich., 48109-1041. We're looking forward to hearing from you and spreading your good news.

ENRICHING EXPERIENCE

Fund transforming student, alumni engagement

Through support of students and alumni, the new Student-Alumni Enrichment Fund has sponsored regional dinners, happy hours, and networking events. Any member of the SNRE community—alumni, student, friend, or donor—with a learning or professional development opportunity can request funding from the SAEF.

The fund was created last year as a result of the successful "Every dollar is a seed" 2012 Class Gift Campaign. The class gift committee wanted to honor student and alumni generosity and foster connections between the two groups. After surveying students, the fund was born and funded through gifts: $5,000 each year over three years.

Getting a jump start on the concept is the SNRE Alumni Gateway, a subcommittee of SNRE Student Government. The Gateway's purpose is to facilitate meaningful connections between alumni and students; toward that end, it launched monthly networking events in major cities across the country last summer, and continues to host events in Ann Arbor all year round. This summer, the Gateway will bring together students conducting summer internships with alumni in cities such as Seattle, San Francisco, Denver/Boulder, Chicago, Boston, and Washington, D.C. They will help the SNRE Alumni Relations Office expand the idea and grow these events into regional alumni chapters that will host a variety of events long after the students have gone back to campus. The fund also was used to partially support SNRE's first "Career Week," during which students invited alumni for talks on topics ranging from professional development to networking in the environmental field.

The Gateway also plans to use the fund to organize field trips to the offices of local alumni for informational interviews. There, students will get a first-hand look at what a typical work day might be like at cutting-edge environmental organizations.

"We hope that when people hear about the fund, it sparks an idea for how they might organize something in their community to talk about important environmental issues, network or just catch up on what's happening at the school," said Kate Harris (M.S. '13), who helped create the fund while a member of Student Government.

ALUMNI HANG OUT IN WASHINGTON, D.C. THIS SUMMER AT A HAPPY HOUR ORGANIZED AS PART OF THE FUND.

Host an Event

The one-page application is at snre.umich.edu/alumni. An SNRE student needs to be involved in the planning process and the main audience should include students and alumni (although events could be open to others, including anyone interested in but not currently affiliated with SNRE). If you want to host an event but need a student co-host, contact alumnigateway@umich.edu.

Remembering the impact

Frederick A. Erb, noted philanthropist and generous supporter of the School of Natural Resources and Environment, died Jan. 10. He was 89. Mr. Erb started with a single coal and lumber store and grew it into a multi-state enterprise. He later become synonymous with business sustainability at the University of Michigan and nationally.

Mr. Erb and his wife established the Frederick A. and Barbara M. Erb Institute for Global Sustainable Enterprise at U-M, where he earned a business degree in 1947. This innovative graduate program between SNRE and the Stephen M. Ross School of Business is nationally known for the talents and accomplishments of its dual-degree students, research output, and leadership on issues related to the convergence of the environment and business.

The Erb Environmental Management Institute, as it was called in June 1996 when established by the Erbs with a $5 million gift, was the first organization of its kind. It was designed to serve as a catalyst for innovation at the business-environment interface. By making the gift, Mr. Erb hoped to make the world a better place for his grandchildren's grandchildren.

"Mr. Erb's vision for finding synergies between the environment and business interests was truly visionary, as well as transformative for the School of Natural Resources and Environment," said Marie Lynn Miranda, professor and dean at SNRE. "The commitment of the Erbs has fostered a new generation of leaders committed to sustaining our planet."

More than 400 M.S./M.B.A. students have benefited from generous scholarships, faculty support, specialized courses, and interaction with sustainability innovators in business and academia. In the words of their son, John, these students and alumni are the standing legacy of Fred and Barbara's gift.

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CAN'T WE ALL USE ANOTHER "FRIEND?"

Stay in the loop of what's going on with the SNRE community through the SNRE Comm Facebook page! Whether it's photos of the SNRE Annual Chili Cook-off, an image of the Diag bustling with students (and squirrels) on a snowy winter day, or information about upcoming events, there's always something to check out. Join the masses (1,337 and counting) and "friend" SNRE Comm today….

www.facebook.com/snrecommunity