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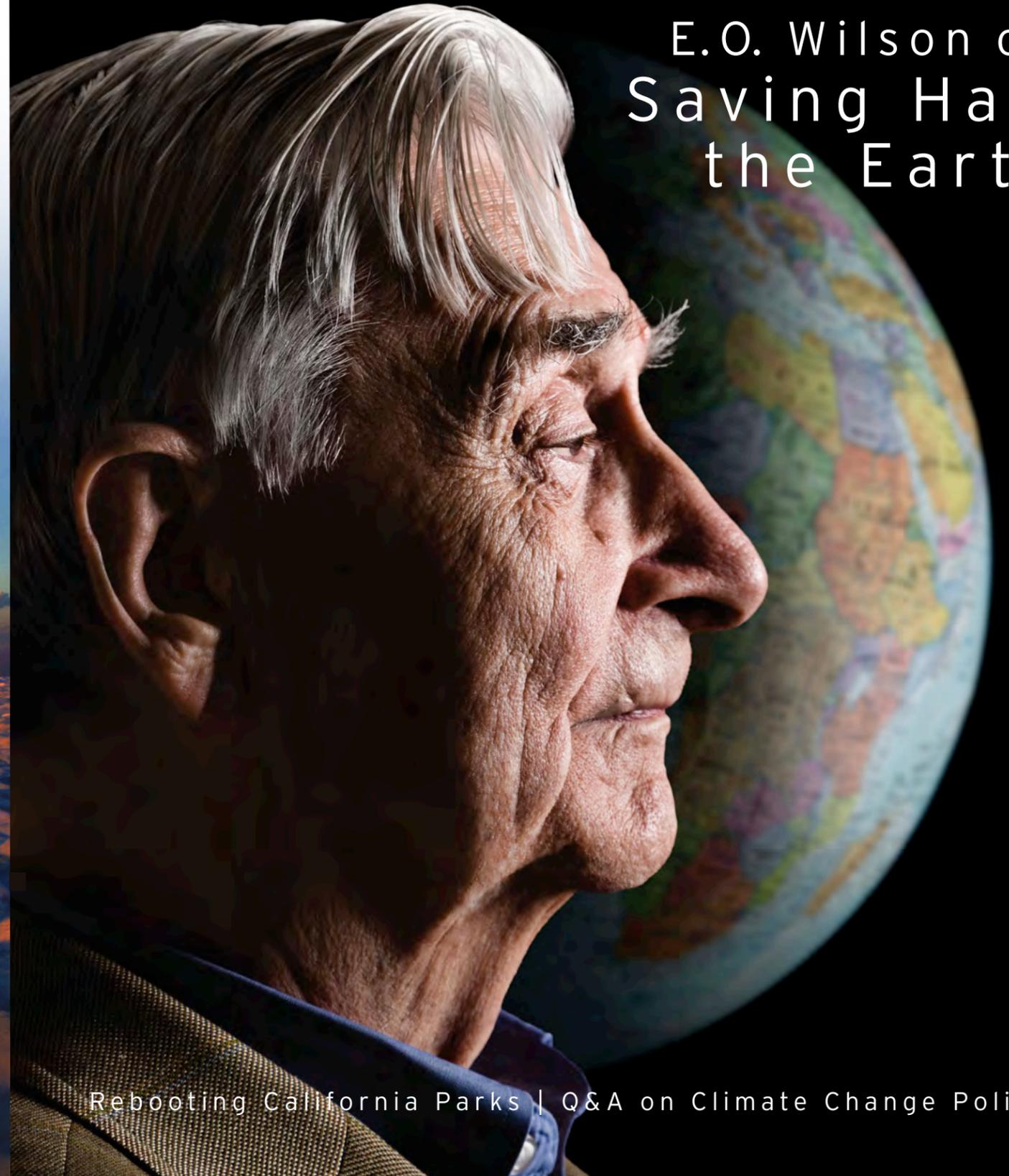
BREAKTHROUGHS

Lassen Volcanic National Park is one of numerous national and state parks that host UC Berkeley research projects. See *On the Ground*, page 8. iStockphoto

BREAKTHROUGHS

UC BERKELEY COLLEGE OF NATURAL RESOURCES • SPRING 2015

E.O. Wilson on
Saving Half
the Earth



Rebooting California Parks | Q&A on Climate Change Policy



“The best classrooms have no walls,” Secretary of the Interior Sally Jewell said during this spring’s Albright Lecture in Conservation, addressing the rich partnership between public education and public lands. To be sure, national and state parks across the globe treat the eyes and nourish the soul. But they do so much more. They provide a living classroom for young people to learn about their environment, a laboratory for scientists to understand the ecosystems on which all life depends, and a data source for learning how those systems and their components are impacted by a warming climate.

Using these protected spaces to save Earth’s biodiversity for future generations is the life’s work of preeminent biologist E. O. Wilson. We are privileged beyond measure to have Dr. Wilson grace our pages this issue. He was at UC Berkeley to keynote the CNR-led “Science for Parks, Parks for Science” conference, which convened scientists and parks and environmental professionals to plan a new century of partnership. As we celebrate the centennial of the U.S. National Park Service and Berkeley’s long and pivotal relationship with it, we stand behind Wilson’s efforts to dramatically increase the percentage of land and sea permanently reserved to nurture what Wilson calls “the rest of life” (page 14).

Turning from a global to a state scale, we look at how California’s beleaguered state parks organization is reinventing itself, complete with technological upgrades and a mission focused on welcoming a new generation (page 10). And bringing this issue’s theme even more local, On the Ground maps the surprisingly diverse park-based research across the Berkeley campus (page 8).

Finally, College Support serves up a love story as well as an important reminder that big gifts aren’t the only way to give back. If everyone gave just a little whenever they could, as Todd and Kristen Jones do, it would make all the difference (page 28).

I welcome your comments at gilles.berkeley.edu.

J. Keith Gilles
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SPRING 2015

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PHOTO: Lewis Scharpf

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- “America’s Two Best Ideas: Public Education and Public Lands,” the Spring 2015 Albright Lecture in Conservation
- Edible Education Lectures

Go to nature.berkeley.edu/breakthroughs.

COVER: Photography by Edward Caldwell; design by Ian Price

Sensing Distant Storms, Birds Flew the Coop



This male golden-winged warbler is carrying a geolocator on its back and identification bands on its legs. PHOTO: Gunnar Kramer

When birds unexpectedly flee their nesting grounds, it may be an indication from Mother Nature's early-warning system that a massive storm is approaching.

While tracking the migratory patterns of a group of golden-winged warblers, a research team led by ecologist **Henry Streby** discovered that birds in the eastern Tennessee mountains fled their breeding grounds one to two days ahead of the arrival of powerful supercell storms. One such storm swept through the central and southern United States in April 2014, generating 84 tornadoes and killing 35 people.

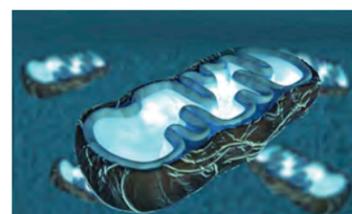
"It is the first time we've documented this type of storm-avoidance behavior in birds during breeding season," said Streby, who conducted the work while he was a National Science Foundation postdoctoral fellow and a visiting

research scholar in the Department of Environmental Science, Policy, and Management (ESPM). Other members of the team are from the University of Minnesota, the University of Tennessee, and the U.S. Geological Survey.

"We know that birds can alter their route to avoid things during regular migration, but it hadn't been shown until our study that they would leave once the migration was over and they'd established their breeding territory to escape severe weather," Streby said. The warblers flew a total of 932 miles to avoid a severe weather system, then came right back to their nests after the storm passed. Notably, the birds fled while the storm was still 250 to 560 miles away, and local signs of inclement weather—changes in atmospheric pressure, temperature, and wind speed—were largely absent.

"At the same time that meteorologists on the Weather Channel were telling us this storm was headed in our direction, the birds were already packing their bags and evacuating the area," said Streby, who led a paper describing the "evacuation migration" that was published December 18, 2014, in *Current Biology*.

After an analysis of the flight-pattern anomaly, infrasound—sound below the normal limits of human hearing—emerged as the most logical explanation. Scientists have known for decades that tornadoes produce very strong infrasound, and that birds can hear and respond to infrasound frequencies. But this paper presents the first evidence that birds use infrasound to remotely detect storms. — SARAH YANG



MAKING OLD BLOOD YOUNG AGAIN

Scientists have identified a new molecular pathway critical to aging, and confirmed that the process can be manipulated to help make old blood like new again. The researchers found that blood stem cells' ability to repair damage caused by inappropriate protein folding in the mitochondria, a cell's energy stations, is critical to their survival and regenerative capacity.

The discovery, published in the March 20 issue of the journal *Science*, has implications for research on reversing the

signs of aging, a process thought to be caused by increased cellular stress and damage.

"Ultimately, a cell dies when it can't deal well with stress," said study senior author **Danica Chen**, an assistant professor in the Department of Nutritional Sciences and Toxicology (NST). "We found that by slowing down the activity of mitochondria in the blood stem cells of mice, we were able to enhance their capacity to handle stress and rejuvenate old blood. This confirms the significance of this pathway in the aging process." The study gives researchers a new target for controlling the aging process, Chen said. Co-lead authors of the study are postdoctoral researcher **Mary Mohrin** and graduate students **Jiyung Shin**, **Yufei Liu**, and **Katharine Brown**, all of NST. — YANG

Mitochondria. iStockphoto

NewsMakers

"The more you do it, the more energy you will [burn]."

Hei Sook Sul, Professor, Department of Nutritional Sciences and Toxicology

A *Washington Post* story was one of numerous articles about Sul's finding that exposure to cooler air temperatures leads to the production of protective brown fat, which can jump-start metabolism to produce heat and burn bulge-causing white fat. (See News, left.)



"The fact that they came back with the geolocators was supposed to be the great success of this season. Then this happened!"

Henry Streby, Former Postdoctoral Fellow, Department of Environmental Science, Policy and Management

A December 18 BBC article was part of worldwide coverage of a study by Streby and colleagues that found, quite by accident, that a population of tiny golden-winged warblers sensed an approaching storm system long before measurable changes in barometric pressure occurred in their environment. The scientists made the discovery after placing electronic sensors on the tiny birds to try to track their migration. (See News, opposite page.)



"One of the biggest advantages of lentils, from the farmer's perspective, is that they don't require much water."

Liz Carlisle, Postdoctoral Fellow, Center for Diversified Farming Systems

In the January 23 *San Francisco Chronicle* op-ed "Learn to Live with Drought—Eat More Lentils," Carlisle summarizes her research on a group of grain-belt farmers who dared to experiment with drought-resistant, soil-enhancing lentils. The *Chronicle* was also one of several media outlets to review Carlisle's new book on the topic, *Lentil Underground*, which it called "an important contribution to the sustainable agricultural genre." (See Campus Briefs, page 6.)



PHOTO: Coleen Reid



A college student in Boston enjoys the winter's record snowfall.

Chill Out, Lose Weight

A shot of cold air may kick-start extra fat-burning. A study found that exposure to cold temperatures increases levels of a newly discovered protein that is critical for the formation of brown fat, the type of fat in our bodies that generates heat.

With extended exposure to chilly air, the protein, called transcription factor Zfp516, also helps the more abundant white fat in our bodies—the kind that stores excess energy—become more similar to brown fat in its ability to burn energy. Mice with boosted levels of the protein gained 30 percent less weight than control mice when both groups were fed a high-fat diet. The new findings were published online January 8 in the journal *Molecular Cell*.

"Knowing which proteins regulate brown fat is significant because not only is brown fat important for [generating heat], but there is evidence that it may also affect metabolism and insulin resistance," said principal investigator **Hei Sook Sul**, professor of nutritional sciences and toxicology.

The researchers noted that there are many steps between discovering the protein in mice and determining whether it can be useful in humans, but they said that having a clear target is an important development. — YANG

SPARKLEMUFFIN! ESPM graduate student **Maddie Girard** identified two new species of peacock spider, a genus known for its bright colors and elaborate courtship "dances." Watch the impressive booty-shaking in this Science Friday video featuring Girard and the sparklemuffin, one of her recent discoveries: www.sciencefriday.com/video/09/19/2014/shake-your-silk-maker-the-dance-of-the-peacock-spider.html.

PHOTO: Maddie Girard



New Mushroom Species Found on Campus

Researchers **Else Vellinga** and **Nhu Nguyen**, PhD '13 Plant and Microbial Biology (PMB), have named the first new species of mushroom from the UC Berkeley campus in more than 30 years. They found and described *Helvella dryophila*, a beautiful black “elfin saddle” associated with oaks on Observatory Hill, an open space area next to the C. V. Starr East Asian Library. The mushroom is edible, but doesn't taste good and may be poisonous if not cooked properly. A paper about their finding was published in the November 2014 issue of *Mycologia*.

“So far only 11 other species have been described from campus,” said Nguyen, who is now a postdoctoral scholar at the University of Minnesota. “The last time this happened was in 1985.”

The Berkeley campus serves as the “type locality” for the new species. “Type localities have elevated scientific value, because they are where the representative specimen was found,” said Nguyen. The finding illustrates the importance of retaining open space and healthy vegetation on Cal's 1,232-acre urban campus, the researchers said.

— ADAPTED FROM AN ARTICLE BY KARYN HOUSTON



PMB research associate Else Vellinga shows off a new species of mushroom discovered on campus. PHOTO: Jewel Reaso

Warmer, Drier Climate Altering California's Forests

Drought is reshaping California's forests, according to a study that compared forest surveys conducted by **Albert Wieslander** '14 in the 1920s and '30s with recent U.S. Forest Service data. The density of large trees has declined in all regions of California, with decreases of up to 50 percent in the Sierra Nevada highlands, the south and central coast ranges, and Northern California, the study found. “Based on our data, water stress helps to explain the decline of large trees,” said study leader **Patrick McIntyre**, the manager of biodiversity data for the California Department of Fish and Wildlife, who began the research as an environmental science, policy, and management (ESPM) postdoctoral fellow. “Areas experiencing declines in large-tree density also experienced increased water stress since the 1930s.” At the same time, the density of less-thirsty smaller trees is on the rise.

Co-author **David Ackerly**, professor of integrative biology, said that stressed forests and the loss of large trees could exacerbate the global carbon situation, especially since many are hoping that forests will soak up more and more fossil fuel emissions. “There's no question that if you are losing large trees, you are losing the standing carbon in the forest,” he said.

The findings suggest that increased temperatures and changing water availability may lead to large-scale changes in forest composition throughout western North America.

— ADAPTED FROM AN ARTICLE BY ROBERT SANDERS

Albert Wieslander's photo of French Lake and English Mountain shows a large area of barren and semi-barren oak that today is thick with smaller growth. PHOTO: Marian Koshland Biosciences Library



Large numbers of dead sunfish and largemouth bass in April 2014 following a severe winter on Wintergreen Lake, Kalamazoo County, Mich. PHOTO: Gary Mittelbach

Mass Animal Die-Offs on the Rise

Mass die-offs of birds, fish, and marine invertebrates have increased in frequency every year over the past seven decades, according to a study co-led by ESPM associate professor **Stephanie Carlson**. Mass die-offs—when more than 90 percent of a population dies within a short period of time—are still rare and fall short of extinction, but the effects are devastating, and the events are often tied to human activity.

“This is the first attempt to quantify patterns in the frequency, magnitude, and cause of such mass kill events,” Carlson said.

Overall, disease was the primary culprit, accounting for 26 percent of the mass die-offs. Direct effects tied to humans, such as environmental contamination, caused 19 percent of the mass kills. Toxicity triggered by biological events such as algae blooms accounted for a significant proportion of the deaths, and processes directly influenced by climate—including weather extremes, thermal stress, oxygen stress, and starvation—collectively contributed to about 25 percent of the mass mortality events. The most severe events were those with multiple causes, the study found.

The study, published January 12 in the *Proceedings of the National Academy of Sciences*, and co-led by Yale and the University of San Diego, suggests that in addition to monitoring physical changes such as shifts in temperature and precipitation patterns, it is important to document the biological response to regional and global environmental change. The researchers highlighted ways to improve such documentation, including the possible use of citizen science.

— SARAH YANG

SUBJECT: Why I Do Science



ENTRY BY:
Zinmay Renee Sung

ENTRY #:
013

My mother brought me up to be a self-reliant woman. After majoring in botany in college, I pursued higher education and a career as a university professor. By then I was accustomed to spending day and night either in the lab doing experiments or writing manuscripts for publications and grant proposals for funding.

The life I lead is not ideal for many, and a professor's salary, divided by the hours we work, could be considered a low wage. Most people work in order to go home and play, while I am always lingering in the lab or office late into the night. Why? Maybe because I am habituated to the lifestyle and work has become a hobby. But whatever problem I am studying, I think about it constantly, and unconsciously, at work, at home, and at play.

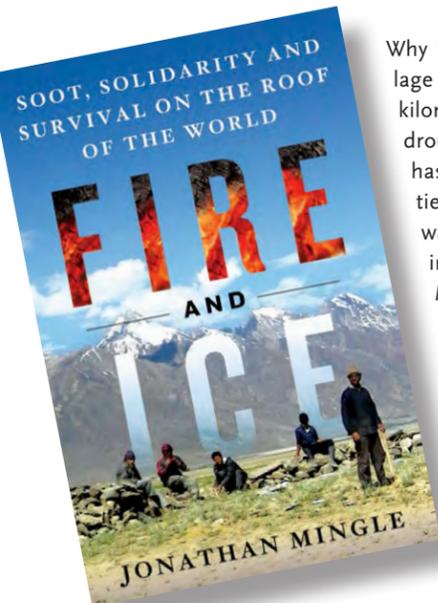
What is so interesting and captivating? I think it is the unknown, the unexpectedness. When designing an experiment to test a hypothesis, my students and I have some predicted outcomes in mind. However, results often turn out the opposite way or are incomprehensible. We can sit on these results for months, unable to comprehend them. And then one day, it dawns on me what the results are telling us. This has happened many times. These are the exhilarating moments that we live for, and I break out a bottle of champagne to celebrate with my students!

During the semester, teaching is my first priority. It gives me great joy to talk with students and witness their enlightenment when they finally get something they've been struggling to understand. Moreover, teaching plant biology has given me more insights about plants than I've gained from my experimental findings.

Great technical advances that benefit mankind have been made as a result of unexpected scientific results. However, what keeps me doing science is the satisfaction I derive from understanding a small, tiny piece of nature.

PMB professor **Zinmay Renee Sung**, PhD '73 plant biology, served as Graduate Division associate dean and on the Academic Senate's Committee on the Status of Women and Minorities.

Trouble on Top of the World



Why would the entire Himalayan village of Kumik pick up and move three kilometers away? The short answer is drought—the village’s one stream has dried up. The long answer is tied to a complex web of climate warming, pollution, and a developing economy, and is the subject of *Fire and Ice*, a new book by freelance writer **Jonathan Mingle**, MS '09 Energy and Resources Group (ERG).

Ever since Mingle first visited Ladakh, the northernmost region of India, more than a decade ago as a volunteer teacher and farmhand, he's returned there, or to neighboring Zaskar, nearly every year—as a teacher, a researcher, and, most recently, a writer.

Over time, he started observing changes. He listened to older residents describe the trends of hotter summers, shorter winters, and declining snowfall over their lifetimes. He saw glaciers and permanent snowfields shrinking, causing water stress in more and more communities. Pollution became more visible as particulate matter from diesel-burning

vehicles and generators and coke- and kerosene-burning heaters increased along with the region's population.

His own hacking cough during visits was enough to wake him up to a problem, but an ERG talk on black carbon and methane by School of Public Health professor **Kirk Smith** sent Mingle headlong into his own investigation.

He soon discovered extensive research connecting the melting snow not only with increased greenhouse gas emissions but also with rising levels of black carbon pollution. It's a cycle that, if unbroken, could lead to ruinous results for the iconic Himalayan region but, if mitigated successfully—at least in part by solar energy that takes advantage of Ladakh's 315 sunny days per year—could become a model for other developing countries.

“The Ladakh-Zaskar region has been a laboratory for understanding the feedback loops operating between culture, climate, and economic choices at the household and policy scales, and for understanding the consequences of energy transitions,” Mingle says.

His debut book launches with an endorsement from climate change warrior Bill McKibben, who mentored Mingle as part of a science journalism fellowship at Middlebury College. (See Mingle's interview with E. O. Wilson, page 14.)

— ANN BRODY GUY



PHOTO: Courtesy of Arthur Bart-Williams

APP CHAP: Entrepreneur **Arthur Bart-Williams**, BS '88 Engineering updated the forestry faculty—designed tree tour as a smartphone app. It was released in March. See The Big Picture, page 29.



Five Key Lessons

EDIBLE EDUCATION 101

By Julie Van Scoy

Edible Education, the popular food-systems course originated by **Michael Pollan** and **Alice Waters**, has found a permanent home at the College of Natural Resources. This spring, Professor Emeritus **Garrison Sposito** taught the course with two cohosts: Pulitzer Prize-winning poetry professor **Robert Hass** and *New York Times* writer **Mark Bittman**, who is a distinguished visiting scholar at the Berkeley Food Institute. You can watch the lectures online at nature.berkeley.edu/edible-ed-101. For now, here are five key lessons:

1 Eating is an ecological act. Our food choices may well be our most powerful engagement with the land and with other species. The modern agricultural system has dramatically altered our landscape and the composition of species on Earth. As Wendell Berry put it, “How we eat determines how the world is used.”

2 The food system has transformed in just a few decades. In the 1930s, U.S. food markets had 1,000 products on their shelves. Today, our supermarkets offer up to 40,000 products, many of which are highly processed. With new technologies and fewer farmers, our food system is efficient but has significant environmental, social, and health costs.

3 The planet needs biodiversity. The industrial food system largely consists of farms growing single crops year after year and animals being raised in factorylike settings. These practices have very high yields but also create a dependence on harmful hormones, fertilizers, and pesticides.

4 Food is central to many of our biggest problems. For example, food production and distribution comprises 20 percent of U.S. fossil fuel consumption. And 75 percent of health care expenditure goes to treating diet-related diseases. So when we make progress in reforming our food system, we'll also make progress on energy, health care, and climate change issues.

5 We're in this together. Improving sustainable and urban agriculture, advocating for farmworkers and food workers, promoting public health—the food movement includes many perspectives, but has a systems view.

Ping, You Have Water

Many of the 9.9 million people in Bangalore, India, never know when they'll turn on the tap and find water flowing. Water is scarce and rationed. Each household gets about 4.5 hours of running water every other day—but when, and if, it will run can be unpredictable. While high-income households can afford tanks that automatically turn on when the water does, in low-income households, women devote countless hours each week to waiting for and storing water.

ERG graduate student **Christopher Hyun** is examining how the people of Bangalore can get more reliable and timely information about when and how long they'll have water each day. “In the developed world, we're used to just turning the water on and it's there. We don't know how it got there,” says Hyun.

The project was prompted by the work in that region of tech start-up Nextdrop, whose founders include UC Berkeley alumni. Nextdrop developed a text-messaging system to communicate with the service workers who manually open and close the valves controlling water flow, then alert residents when water is coming. The research, led by **Alison Post**, assistant professor of political science and global metropolitan studies, and **Isha Ray**, ERG associate professor, is examining the effectiveness of the system.

— ADAPTED FROM AN ARTICLE AND VIDEO BY ROXANNE MAKASDJIAN



Chris Hyun, left, observes as men gather to fix a broken water line in Bangalore, India. PHOTO: Courtesy of Chris Hyun

Eat Your Legumes

The farmers who introduced Missoula, Mont., native **Liz Carlisle** to the revolution taking place deep in her home state's grain belt ranged from lefty liberals to fundamentalist Christians. But they shared a common plight: Years of drought and costly chemicals had damaged their bottom line and their soil, and threatened their family farms.

Carlisle, PhD '15 Geography, a postdoctoral fellow at the Center for Diversified Farming Systems, first encountered the farmers while working for U.S. Senator Jon Tester. They were disparagingly called “weed farmers” by Tester's more conservative constituents because of the messy, low-lying appearance of the plants they raised: organic lentils.

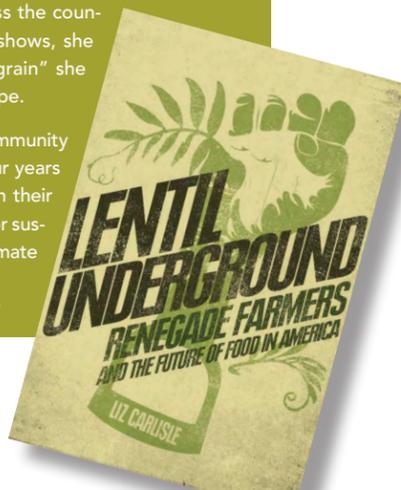
As Carlisle notes in her book, *Lentil Underground*, the legumes were a natural for Montana's water-stressed landscape. When there's no water, the plants neither wither nor bolt—they simply pause their growth cycle. So they don't require irrigation. On top of that, they preserve nitrogen in the soil, fertilizing themselves and leaving behind healthier soil for the next crop.

By cooperating instead of competing, the group of former conventional farmers built a successful company, Timeless Seeds, and showed doubters, including their own state university, that sustainable farming was both possible and profitable.

Carlisle, who studied with **Michael Pollan**, is herself part of the colorful cast of characters she paints in the book: Before arriving at UC Berkeley, she spent several years as a professional country singer. As she gigged her way across the country and chatted with farmers after shows, she learned that the “amber waves of grain” she sang about didn't live up to their hype.

Carlisle implanted herself in the community of Timeless Seeds farmers across four years of dissertation research, and through their story she lays out a workable vision for sustainable agriculture in the age of climate change. (See NewsMakers, page 3.)

— GUY



ON THE GROUND

A SAMPLING OF RESEARCH IN

Science in Parks

Research across the UC Berkeley campus that focuses on regional, state, and national parks. To read all 49 entries, go to parksnext100.berkeley.edu/research.

Thomas Bruns, professor, plant and microbial biology (PMB), Koshland Hall, focuses on the ecology and evolution of fungi that form symbiotic associations with plant roots. Bruns also conducts surveys to catalog the macrofungi—those species visible without a microscope—present in the parks, collaborating with citizen scientists from local mycological societies. *Point Reyes National Seashore, Yosemite National Park, Channel Islands National Park*

Chelsea Specht, assistant professor, PMB and integrative biology, Koshland Hall, collects plants that are native to the park and surrounding areas and investigates the genetics underlying adaptation to environmental and interspecies interactions. *Lassen Volcanic National Park*

John Battles, professor, ESPM, Hilgard Hall, studies forest dynamics and tree demography. The goal of his research is to know how and why forests change. *Delaware Water Gap National Recreation Area, Sequoia & Kings Canyon National Parks, et al.*

Patrick O'Grady, assistant professor, ESPM, Hilgard Hall, studies how biological diversity forms and is maintained in natural systems. His research focuses on the Hawaiian *Drosophila*, a group of over 1,000 species of flies, all of which are found only in Hawaii. *Hawai'i Volcanoes National Park, Haleakalā National Park, Koke'e State Park*

Reginald Barrett, professor emeritus, ESPM, Mulford Hall, researches ecology and management issues of specific wildlife species, including the response of wildlife to thinning and prescribed burning in the Sierra Nevada, the population ecology of fishers in the southern Sierra, and the comparative population dynamics of two tule elk populations. *Point Reyes National Seashore, Yosemite National Park, Hawai'i Volcanoes National Park, Lassen Volcanic National Park*

Kevin O'Hara, professor, ESPM, Mulford Hall, researches the ecology and management of redwood forests. *Redwood National and State Parks, Montgomery Woods State Natural Reserve, Del Norte Coast Redwoods State Park, Big Basin Redwoods State Park, Marin Municipal Watershed*

Michael Manga, professor, earth and planetary science, McCone Hall, studies volcanoes, geysers, and how earthquakes affect fluid flow in the crust. *Lassen Volcanic National Park, Yellowstone National Park*

Vincent Resh, professor, environmental science, policy and management (ESPM), Wellman Hall, studies stream and river ecology and the monitoring and detection of pollutants. *Yellowstone National Park, Glacier National Park, Samuel P. Taylor State Park*

Margaretta Lovell, professor, history of art, Doe Library, takes her students to Yosemite to discover the sites of 19th-century paintings of the valley. They analyze the aesthetic process of the artist as well as the ecological shifts in the landscape over the course of a century. *Yosemite National Park*

Ian Duncan, professor, English, Wheeler Hall, is the editor of Arthur Conan Doyle's 1912 novel *The Lost World* for Oxford University Press (2008). He has argued that Yellowstone is a prototype for Doyle's Amazonian lost world, and that the story is informed by a rising discourse of species extinction and protected spaces. *Yellowstone National Park*

Roger Bales, adjunct professor, civil and environmental engineering, Sutardja Dai Hall, is the principal investigator at the Southern Sierra Critical Zone Observatory, a multicampus program. *Yosemite National Park, Sequoia & Kings Canyon National Parks*

Nicholas Sitar, Edward G. Cahill and John R. Cahill Professor of Civil Engineering, Davis Hall, researches rock-fall and rock-slide hazard identification, monitoring, and prediction. *Yosemite National Park*

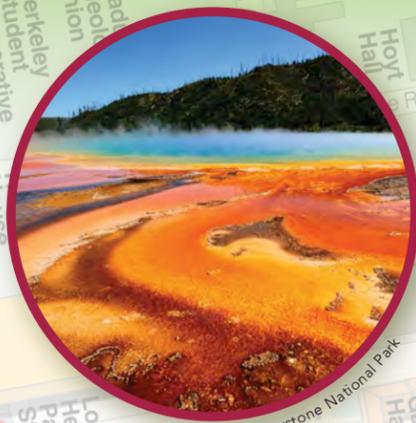
Philip Stark, professor and chair, statistics, Evans Hall, researches the impact of pack animals on the Yosemite toad, a protected species, and the implications for managing land use in Yosemite. *Yosemite National Park*

Khatharya Um, associate professor and chair, ethnic studies, Stephens Hall, serves on the advisory panel for the National Park Service's Asian American Pacific Islander Theme Study, a project investigating the stories, places, and culture of people of Asian American and Pacific Islander heritage. Her research includes work with Oakland's Peralta Hacienda Historical Park for an exhibit about Cambodian refugees in Northern California. *Peralta Hacienda Historical Park*

Jennifer Wolch, professor and William W. Wurster Dean, city and regional planning, Wurster Hall, addresses park access and environmental justice. Her recent research analyzes connections between urban design, physical activity, and public health, and she develops strategies to improve access to urban parks and recreational resources. *Santa Monica Mountains National Recreation Area*

Eric Biber, professor, law, Simon Hall, conducts research on public land management, including how to best structure public land management agencies to ensure higher-quality monitoring and how to structure legal and regulatory systems to ensure effective adaptation to climate change by public land managers.

Kent Lightfoot, professor, anthropology, Kroeber Hall, focuses on archaeology, both precolonial and colonial periods. *Pinnacles National Park, Año Nuevo State Park, Fort Ross State Historic Park, Sonoma State Historic Park*





Antelope Valley California State
Natural Poppy Reserve
PHOTO: Courtesy of California State Parks, 2015

REBOOTING CALIFORNIA'S PARKS

Parks Forward launches the future of the state's finest natural resource

By Anne Canright

When you think of California state parks, maybe hiking through a cool redwood canyon comes to mind. Or tent-camping in a star-studded desert. Or perhaps you've visited Sutter's Mill, where the gold rush—and with it, in a very real sense, California—began.

Or do you think instead of overflowing trash cans, too few rangers, and persistent cries about lack of funds?

California state parks, now more than 150 years in the making, are rich and diverse, full of natural wonders and amazing stories—and they both show their age and reflect the penny-pinching mode of the present day. As Robert Doyle, general manager of the East Bay Regional Park District, quipped recently, “Yellow caution tape seems to be the biggest investment in state parks lately.”

And it doesn't help that they're part of a government bureaucracy, where inertia can be a potent force.

A few years ago, California state parks—279 properties covering 1.6 million acres and 280 miles of coastline, and infusing an estimated \$6.5 billion annually into the state's economy—were in crisis. With funding allocated each year by the state legislature, the Department of Parks and Recreation's budget was an ever-fluctuating line item. In the 1970s, 90 percent

of the department's budget came from the General Fund, but by last year that portion had plummeted to around 24 percent. By the first decade of this century, the parks suffered under the weight of a \$1.3 billion maintenance backlog, and there was scarce money to fill vacant ranger and interpretive positions.

In 2008, Governor Arnold Schwarzenegger toyed with the idea of shuttering some 50 parks to help close the gap in a \$24 billion statewide budget deficit. Four years later, Jerry Brown's administration similarly proposed, more seriously, that 70 parks go on the chopping block. That is to say, a full quarter of all state parks—each one a gem—were to be axed in order to save \$22 million: a mere drop in the then-\$16 billion deficit bucket. And those parks would be gone for good.

Californians were outraged, and many rallied together to sponsor, do volunteer maintenance work in, or even potentially run their favorite local parks. Ultimately, the crisis was averted—owing to, among other things, a financial scandal. But there was fallout: The public was now on alert. Were state parks just a political football?

As the parks were getting their second reprieve in four years, the legislature passed the California State Parks Stewardship Act, AB 1589, which required the Department of Parks and Recreation to develop

“You've got to get the people in. You've got to open the door just a little, let the sunshine through, and pretty soon you've got a wide-open door and someone standing there basking.” — Caryl Hart



PHOTO: Leslie Sterling

Innovation, accessibility, and inclusivity are watchwords sprinkled throughout the commission's report.

a prioritized action plan to increase revenues at state parks. But lack of revenues was just one factor contributing to a systemic, institutional malaise.

To address this deeper issue, the collaborative Parks Forward Initiative was launched in June 2013, and the independent commission Parks Forward was created to undertake a top-to-bottom evaluation of the department and devise a viable action plan. This February 6, the commission set out its vision for the future in a 56-page report, which it presented to a full house at the Railway Museum in Old Sacramento State Historic Park.

The report summarizes findings and recommendations from 18 months of meetings, public hearings, surveys, and studies. What set it apart from previous similar efforts that went nowhere (as recently as 2013, the Little Hoover Commission issued a comprehensive report titled *Beyond Crisis: Recapturing California's State Park System*) are two things: receptive leadership in John Laird, secretary of the state's Natural Resources Agency, and Lisa Mangat, acting director of the Department of Parks and Recreation; and, perhaps even more important, the launch of a proactive Transformation Team to implement the report's top-level action items over the next two years.

Parks Forward commissioner **Caryl Hart**, PhD '09 Environmental Science, Policy, and Management, and the director of Sonoma County Regional Parks, says that the 2012 crisis was both a good and a bad thing. "I'd rather it hadn't happened, but since it did, [the commission] is a good outcome. Something *needed* to happen. The California State Parks [organization] needed to reinvent itself, figure out how it was going to engage a new, diverse, urban population as well as a younger population, and learn what it needs to do to become a modern-day agency. It took a crisis."

And change has already begun. The day the Parks Forward report was issued, the Department of Parks and Recreation launched a sparkling redesign of its website (www.parks.ca.gov), now featuring luscious photographs, map- and activity-based search capabilities, and non-English-language options. The management, it seems, has rolled up its collective sleeves and gotten to work.

Technology and Design Innovations

One of the first priorities has been fee collection, with a move from old-fashioned "iron ranger" fee-collection

boxes to app-based payment systems and credit/ATM card options at modern pay stations. This improvement has been implemented at 120 parks, with another 50 to go. One advantage, besides ease of use, will be greater flexibility: Beachgoers who only want to stay an hour or two, for example, now need only *pay* for an hour or two, rather than getting charged for an entire day. The electronic system will also streamline accounting.

At the February 6 meeting, commission cochair Lance Conn, former president of Vulcan Capital, the company that runs Microsoft cofounder Paul Allen's business and philanthropic affairs, presented three of the commission-generated projects already underway that give potential park visitors a taste of what awaits them and demonstrate innovation, accessibility, and inclusivity, watchwords that can be found sprinkled throughout the commission's report.

The first project features four designs by architecture students at Cal Poly Pomona, who were presented with the design challenge "Revamp the Camp." Commission-sponsored studies had found that although there are plenty of campsites at state parks, younger people tend not to use them, not yet having built personal connections to parks and the outdoors, or simply not having the equipment required to enjoy them, like tents and sleeping bags. But what if they could rent a comfortable cabin for the night, with views, security, and protection from the elements? The consensus was, they would come and discover—and hopefully want to further explore—the pleasures of California's wild outdoors.

Conn also introduced two technology-driven projects. For one, Google Maps was contracted to provide 360-degree Street View coverage of 20-plus trails in 14 state parks, beaches, and reserves, with more to come. For young people or families who are unsure what a nearby park might have to offer, or whether a long drive will pay off, taking a virtual walk along a trail may quell fears or, even better, entice.

The other project is a web-based app for "search and discovery of parks," also intended to facilitate social sharing of pictures and comments via Instagram and Flickr. By applying filters based on place and activity, users can see parks and their amenities, as well as people like themselves enjoying the outdoors.



Garrapata State Park in Monterey County is one of numerous parks now accessible through a virtual tour created by Google Maps. PHOTO: Screenshot of Google Street View Trek

Hart is enthusiastic about projects such as these and the reasoning behind them: "You've got to get the people in—you've got to open the door just a little, let the sun shine through, then open it a little more, and pretty soon you've got a wide-open door and someone standing there basking."

Behind the Scenery

Another watchword of the Parks Forward report is *accountability*. Although new projects are exciting, Hart says, "most of the upcoming changes are going to be beneath the surface." The commissioners, in their sum-up comments at the February 6 meeting, noted that the most important goal for the next two years is to rebuild public trust and a sense of transparency.

The most pressing tasks they identified include opening up new pathways to leadership—moving beyond the antiquated system of advancing only law enforcement rangers into administrative roles—and expanding park access for underserved communities, especially among city dwellers, who are expected to comprise 75 percent of the state's population by 2050, and youth. Fiscal transparency is another priority.

First and foremost, however, stable funding, divorced from the state's General Fund, is imperative, and to this end a key proposal is the establishment of a new nonprofit called Parks California. One of its main jobs would be to raise money to support parks projects, as the Golden Gate National Parks Conservancy does. In the end, Hart envisions Parks California as helping to create a "seamless network of parks. Instead of state, county, and city parks each being in their own little bubbles, there begins to be an approach of everyone working together."

Commissioner Julie Packard, executive director of the Monterey Bay Aquarium, called the parks—and the network necessary to promote them back into a state of vibrancy—an "ecosystem." "We have no

excuse not to get this right," she said of the effort to restore that ecosystem to health. "We have a wealth of talent, energy, and passion. We also have amazing resources to protect, super-strong conservation in the NGOs, and the best universities and supporting organizations. We've got all the pieces."

Parks and Recreation director Mangat acknowledged that "the heavy lifting is still ahead of us." But with a 10-year plan that includes goals such as universal transportation options, the promotion of healthy lifestyles, and management in the age of climate change, along with the Parks Forward promise of a "specified process of renewal and of institutionalizing change," things may now be on the right path—as we get in front of change rather than continuing to fall behind.

But the change must lead, ultimately, to greater public engagement. Referring to E. O. Wilson's biophilia construct, Hart points to the huge human need for connection to nature. "With all the issues we have these days—with water, with climate change—we have to encourage people to connect," she says. State parks have an important role to play in instilling a love of nature and the outdoors—and a sense of caring and connection—in all of us.

And the first step, Hart says, is bringing the experience of California's extraordinary park system to newer, broader audiences who have never glimpsed the vast landscapes available to them. "That's what we're going for," Hart says. "I really feel that's the key: Expose people a little, and they're going to become park lovers. It's inevitable." ■

TECH TOOLS

Take a virtual tour of the California State Parks system at www.parks.ca.gov/whatsnew. Search and discover, then share at www.caliparks.org. Learn about new accommodations at www.revampthecamp.com.

E. O. Wilson on SAVING HALF THE EARTH

By Jonathan Mingle,
MS '09 Energy and Resources Group
Photography by Edward Caldwell



Breakthroughs interviews the renowned biologist on his bold vision to rescue the planet's biodiversity.

When I called E. O. Wilson—the world's foremost biologist, expert on ant societies, coiner of the concept of “biodiversity,” and founder of the field of sociobiology, among other notable achievements—he was hard at work on his 31st book, due out in 2016, tentatively titled *Half Earth: The Struggle to Save the Rest of Life*. He offered a preview of the book's detailed arguments for legally preserving more land and ocean to protect the world's rapidly disappearing species.

We discussed the long-term odds for Earth's biodiversity (including the rather self-absorbed human species that happens to depend on “the rest of life”), as well as his work helping to restore Mozambique's Gorongosa National Park; the success of the E. O. Wilson Biodiversity Foundation's iBooks Textbook, *E. O. Wilson's Life on Earth*; and the importance of the national park system in educating the next generation of citizen scientists.

Breakthroughs: The subject of your keynote address at the UC Berkeley-based national parks summit this March was “Setting Aside Half the World for the Rest of Life.” In your 2002 book *The Future of Life*, you noted that just 10 percent of the planet's land surface was “protected on paper,” and that this was not enough to save “more than a modest fraction of wild species.” Since you wrote that, has the urgency of protecting land to preserve biodiversity increased? Or have we made any progress?

E. O. Wilson: I think we've had mainly a holding operation. The figures for success or failure on major conservation efforts for the past 100 years—and

On a recent visit to UC Berkeley's Museum of Vertebrate Zoology, E. O. Wilson held a specimen of the southern-dwelling Carolina parakeet, which went extinct in the early 1900s due to human factors like deforestation and the millinery trade. The emperor penguin, right, was listed as “near threatened” in 2012 by the International Union for the Conservation of Nature (IUCN) and, along with nine other species of penguin, is currently under consideration for inclusion under the Endangered Species Act due to the effects of climate change and industrial fisheries. Also in 2012, the IUCN uplisted the grey crowned crane, left, from vulnerable to endangered. It is threatened by the degradation of wetland breeding areas due to the use of agricultural pesticides and to drought-related changes in land use.

“There really has to be a shift in the moral ground by which we consider the living world.”

they’ve been noble and hard-won advances—have been about 20 percent of vertebrate species saved that were endangered. That’s OK, that’s an effort. But when you run that over a long time period ahead, it doesn’t bode well for Earth’s biodiversity.

Specialists using fossil data have found that due to human activity, we are at very roughly somewhere between 100 and 1,000 times the background extinction rate [the standard rate of extinction during Earth’s geological and biological history before human influence]. And that’s accelerating, because of continued shrinkage of the biologically richest areas. It’s essentially a death of a thousand cuts—a little bit taken here, a little bit ceded to an oil company there.

Plus there’s the impact of global warming and acidification of the ocean. These things are mounting. Even though there are efforts to slow them down, they aren’t working too well. We have to do something very much more ambitious. There really has to be a shift in the moral ground by which we consider the living world.

We live on a little-known planet. The number of new species described every year is about 18,000. That means that we will complete the census of the world’s flora and fauna in the 23rd century. By that time, a large part of it will be gone. Now you know why I’m suggesting we keep one half of the planet in reserves.

It reminds me of that H. G. Wells quote from *The Outline of History*: “Human history becomes more and more a race between education and catastrophe.”

It’s the only option we have besides sitting and watching it go down the drain. Our descendants will be peeved when they find out we’ve let a lot of it go down the drain. The obvious solution is to save as much of the world’s biodiversity as possible.

Do you think that’s really possible—setting aside half the planet?

I’m confident we can go from 10 percent to 50 percent coverage, land and sea. A large part of my

new book is devoted to where [that 50 percent] is, what’s in it, how it can be pieced together. It could be immense reserves that still exist, like in the Altai Mountains of Mongolia; in the taiga, the major wilderness areas of Congo; in Papua New Guinea, the Amazon—these can be made inviolate reserves; they can be pieced together. Likewise for smaller reserves all the way down to 10 hectares granted to the Nature Conservancy somewhere.

And this includes the necessity of accommodating people living within those reserves. Any proposal to massively increase the protected land and sea is going to have to take into account what most people consider primary to their hopes and intentions. Our species might just luck out, with enough dropping population, improved production, and shrinking ecological footprint that we can win the race to save the rest of life.

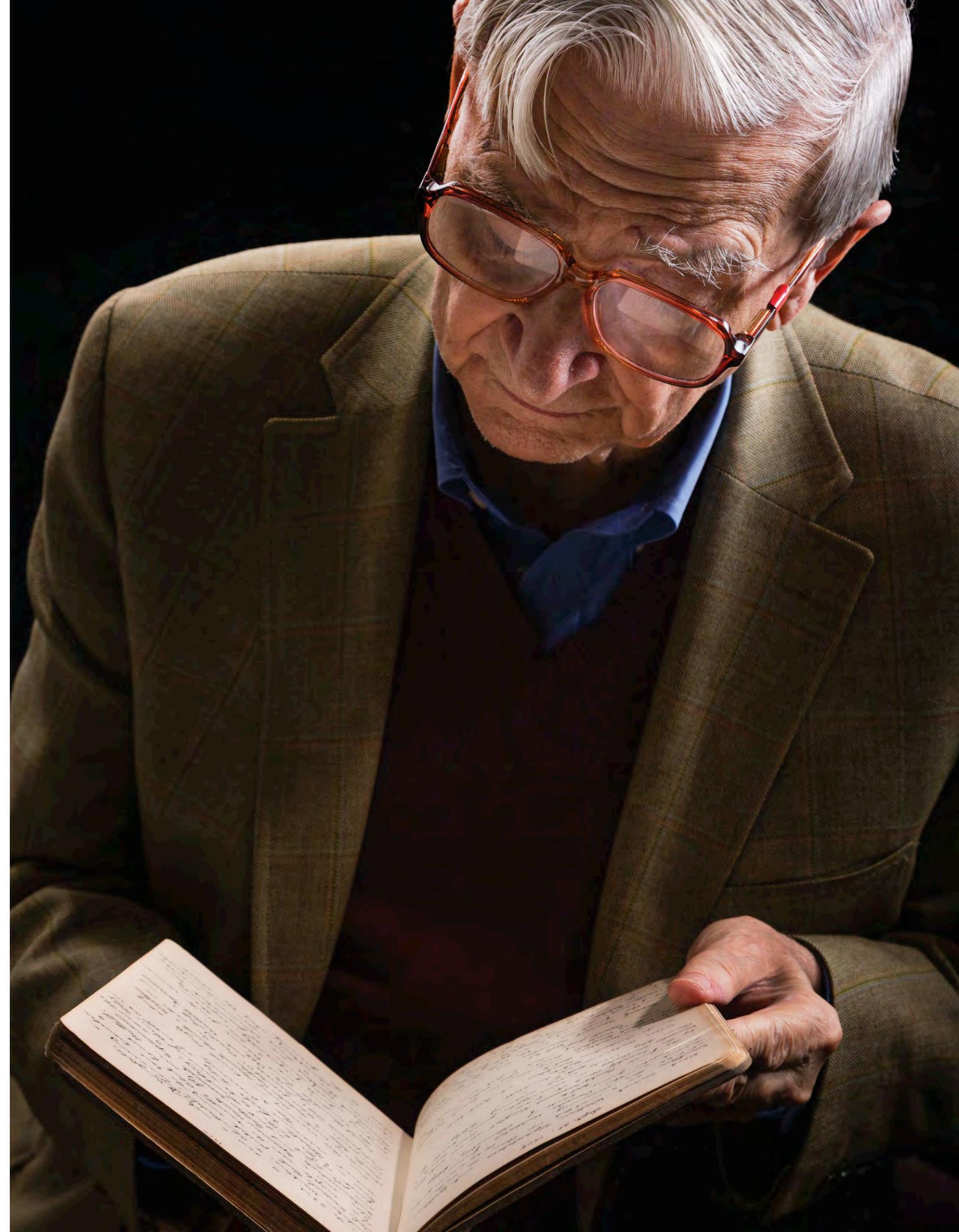
How do the national parks figure into this larger effort?

I was present with Jonathan Jarvis [director of the National Park Service] when he inaugurated the National Parks Institute, a university–national park partnership. In 2011, we were at Yosemite and the University of California, Merced, which is environment-oriented. The idea is an alliance in which the university is leading research and education, enhanced by the resources of Yosemite. Now with Jarvis and his advisers, and I hope with the approval of Secretary of the Interior Sally Jewell, we could have a whole new chapter.

We have shown in [Mozambique’s] Gorongosa National Park what a huge difference it makes to have education and science be central to the park, in terms of the quality of conservation in the park and, in addition, doing research on biodiversity at the expert level, with facilities for visiting scientists. Also, young Mozambicans can start their education in schools located around the park, go to high school level, then get further training and move on to higher education and important positions in government.

Coming back to the United States: The best way to introduce students to science—not just those committed to being scientists but everybody—is to have them explore the biodiversity around them. You can be a citizen scientist very quickly. You can involve students in park systems and reserves, in projects that give them a much better view of science than just telling them about submersibles in the Mariana Trench [the deepest region of the world’s oceans, in the Pacific]. Take them out and

While at UC Berkeley in March to keynote the “Science for Parks, Parks for Science” conference, E. O. Wilson enjoyed reading one of Joseph Grinnell’s original field notebooks from 1910, housed at the Museum of Vertebrate Zoology.





say, “Here’s what’s going on! Half of the species in this group can be found here!” That’s the idea.

What is the importance of the U.S. National Park Service in protecting biodiversity? Does it lie mostly in preserving habitat for critical ecosystems, or in educating the public about their importance?

They are complementary. The bigger we make our national park system, and the more that we can engage science and education activities within it—those two together are going to make the NPS extremely valuable. I’m hopeful our leaders will see that.

What are some special places in the United States that you think should be considered for some kind of national preserve or park status? For example, you’ve been advocating for a preserve in Alabama’s Mobile-Tensaw River Delta?

There is no major national park anywhere on the Gulf Coast. That’s amazing! The Everglades don’t count, and they’ll be underwater in the next 50 years, anyway. [Editor’s note: The Jean Lafitte National Historical Park and Preserve is located in Louisiana but is not considered a “major” national park.] The Mobile-Tensaw River Delta national park unit would encompass up to 450,000 acres, including the Red Hills, just to the north, a deeply cut system of ravines with old-growth longleaf pines, Ice Age flora left in the deep ravines when the continental glaciers retreated—great stuff!

There are two rivers, the Mobile and Tensaw, running parallel on either side of a geologically depressed area. It creates a large wild area that’s never been developed. It has the largest number of turtle species of anywhere in the world, something like 40 species. It’s a major flyway for migratory birds. It has a large percentage of the 350 species of freshwater fish found in Alabama. And on and on. Biologically, it would be the richest park in America.

When you look at the current state of conservation efforts, what gives you hope?

Young people give me hope . . . the NPS Biodiversity Youth Ambassadors and citizen scientists. The “bio-blitzes,” large-group species surveys, which have been so successful and have spread around the world. The iBooks Textbook *E. O. Wilson’s Life on Earth*, a

Top: Wilson and his regular collecting companion, Tonga Torcida, in Gorongosa National Park, in Mozambique.

PHOTO: Jay Vavra, courtesy of the E. O. Wilson Biodiversity Foundation

Bottom: A hut in Gorongosa National Park. Reserves must accommodate and enrich the lives of people living in and near them, Wilson says.

iStockphoto

“We all should be on a mission here. This is something that overarches a lot of our petty concerns in this country.”



project of the E. O. Wilson Biodiversity Foundation, is doing phenomenally well. Now it can be downloaded free, and with just word of mouth, over a half million chapters have been downloaded.

We all should be on a mission here. This is something that overarches a lot of our petty concerns in this country. I think it’s something younger people will be attracted to, especially if there’s a movement underway, with the prospect of making real change.

In 2011, you visited Yosemite and led a short bio-blitz, surveying species with youth and park staff. I read that you had also planned to search for a certain rare ant there. Did you find it?

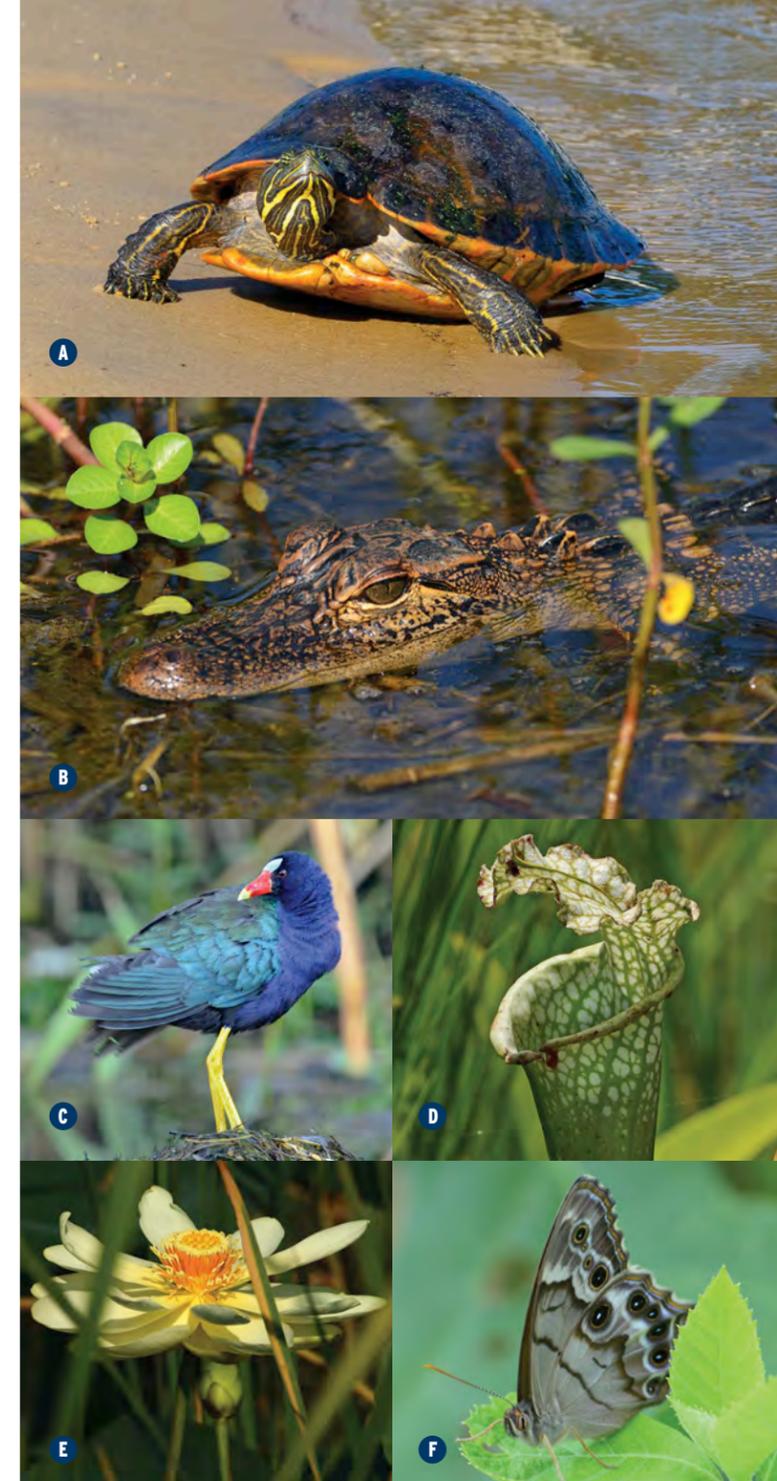
I doubt that the kids were more excited than I was! Let me tell you a story—what the real naturalists call “war stories.” When I was 22, I went with another grad student and, the way you’re supposed to do when you’re 22, we visited a lot of national parks in the West, at a time when you just drove in. They had signs that said, “Don’t feed the bears.” Of course, I fed the bears, and had one of them crumple in my car window trying to get food!

I was in Yosemite to get parasitic ants. A social parasite is one species that only lives in the nest of another. We camped at Polly Dome. I immediately found the host species, and I dug up countless colonies all around the base of Polly Dome. No luck.

I got back home and looked it up again and, good lord, it said, “One specimen was collected on the top of Polly Dome.” So this last time in Yosemite, I said to one of the rangers, “Boy, I’d like another shot at that parasitic ant species.” She said, “You come back and we’ll get to the top of Polly Dome.” So I want to get back there while I still can walk! 🚶

Interview lightly edited and condensed.

Watch E. O. Wilson’s “Science for Parks, Parks for Science: The Next Century” keynote address at parksforscience.berkeley.edu/livestream.



The E. O. Wilson Biodiversity Foundation is working to get the Mobile-Tensaw River Delta region of Alabama designated as a national park and preserve. Some life found there includes: (A) The Alabama red-bellied turtle, which was placed on the endangered species list in 1987. (B) The American alligator, whose population was decimated by hunting before it was listed as an endangered species in 1973; thanks to conservation efforts, it rebounded, and it was removed from the list in 1987. (C) The purple gallinule, found only in southern and tropical wetlands. (D) The carnivorous white-topped pitcher plant. (E) The American lotus, which thrives in wetland areas. (F) The pearly-eye satyr moth, found primarily in damp, wooded areas of the southeastern United States.

PHOTOS: Lewis Scharpf, except turtle photo by Jim Godwin

CHERYL FORBERG, RD

A HIT SHOW'S SECRET INGREDIENT

By Ann Brody Guy

Cheryl Forberg was working on a nutrition study for women with breast cancer at Cedars-Sinai Medical Center in Los Angeles when a colleague connected her with a doctor who was helping to develop a pilot for a reality TV show about weight loss. The show was looking for a nutritionist to plan, consult, and cook. Forberg, who was just starting to integrate her two hard-earned professional credentials of chef and registered dietitian, hit it off with the doctor and signed on. “We really had no idea how many people would watch,” she says.



The show, NBC's *The Biggest Loser*, would go on to become a ratings behemoth, making stars of its trainers and contestants and continuing for 16 seasons over 10 years—so far.

Behind the scenes, Forberg is everywhere. She cowrote the show's eating plan; teaches each crop of contestants to journal, cook, and shop; and leads weekly coaching sessions. She develops recipes and messaging for celebrity-chef cooking segments, and she has authored or contributed to all of the show's books, many of which have spent time on the *New York Times* best seller list, sometimes simultaneously.

Independent of the show, she recently wrote *Cooking with Quinoa for Dummies*. She was not enthusiastic about the initial call from Wiley Publishing. But she soon discovered that other quinoa recipe books were full of white flour, sugar, and butter. “I thought, it's totally negating all the healthful benefits! I took it as a challenge.” She highlighted quinoa's benefits—it's protein-rich and gluten-free—and considers the book a creative triumph.

But Forberg is most proud of the just-released *A Small Guide to Losing Big*. She calls it the Cliffs Notes to everything she shares with contestants and private clients. “I drained my brain in here. This is what I've been teaching and doing for 10 years, and it works.” Keeping the price down was critical, she adds. “Most of my audience is on a budget—many of them shop at Walmart. So this is accessible; this is mainstream.”

Long before *Loser*, Forberg was already on her way as a chef, including winning a 2005 James Beard Award for her recipes in *The Mayo Clinic Cookbook*. A graduate of San Francisco's California Culinary Academy, she'd apprenticed in France and was selected for the opening team of Postrio, Wolfgang Puck's first Northern California restaurant, where she quickly learned that a restaurant career wasn't for her.

She took on private clients, most of whom had dietary restrictions, from weight loss to the then-popular Pritikin diet. Forberg loved modifying classic French cooking with healthier ingredients, but had no mentors. Back then, she says, “chefs didn't know much about nutrition, and few nutritionists knew much about cooking.” She homed in on that disconnect and, after a few years as a part-time nutrition student, first at UC Davis, then at Berkeley, finally made the commitment to leave her Marin-based job cooking for filmmaker George Lucas and his family and devote herself full-time to school.

In Cooking Science professor and fellow chef **Barbara Sutherland**, Forberg finally found a mentor. “That class totally changed my cooking forever, because we didn't study food science in France, or in restaurants, or at the Culinary Academy. We didn't study why the size of a fat particle would make your pie crust flakier. We knew you had to do it with lard or butter, but we didn't know *why*.” Understanding that *why* has made all the difference for Forberg, her clients, and her readers.

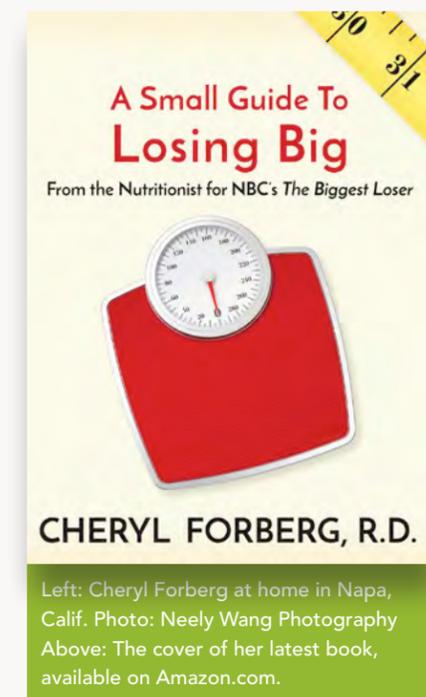
“That class totally changed my cooking forever.”

Most people get a little nostalgic when thinking back to their college days, but Forberg chokes up. “It changed my life on so many levels,” she says. “It was a completely different way of learning for me—the ideas, the people, the professors.”

And it was the timing. Her UC Berkeley memories are inextricably connected to the first real loss she ever experienced—the suicide of her best friend, who was in the early stages of AIDS. It was a devastating time, but also life-altering. “I was so vulnerable, I was just open to things—I was a wide-open slate,” she recalls.

Forberg is still open. As she sits in the state-of-the-art kitchen she and her boyfriend built, looking out over the acre they planted with wine grapes, vegetables, and fruit trees, she's looking ahead. She hopes to return to UC Berkeley's food sciences program to share her experience and expertise with students. She connects with her audience on social media, is open to more opportunities to be a spokesperson for healthy commodities—like work she's done for pistachios and avocados—and is thinking about developing her own products someday.

“It's easy for me to do media work and develop recipes and talk about the health benefits of eating certain foods,” she says. “That's a no-brainer for me—it's what I do.”



Left: Cheryl Forberg at home in Napa, Calif. Photo: Neely Wang Photography
Above: The cover of her latest book, available on Amazon.com.

Q&A

Talks About Climate Change Response

Alumni working on climate change–related policy talk to *Breakthroughs* about how their efforts impact energy, water, pollution, and public health.



Juliet Christian-Smith

PhD '06 Environmental Science, Policy and Management (ESPM). Climate Scientist, Union of Concerned Scientists, www.ucsusa.org

What you do: As a climate scientist for the Union of Concerned Scientists, my work focuses on the relationship between climate change and our water resources. Changes to our water system are one of the main ways that people can tangibly feel and see climate change impacts—from rising seas to reduced snowpack to more uncertain precipitation patterns, including both floods and droughts.

Success story: Last year, I supported efforts to pass comprehensive groundwater-management legislation in California, which was a long overdue and a historic change for the state. Until that time, California was the only western state with no comprehensive plan to manage its groundwater. Groundwater is an increasingly important water resource, as climate change is predicted to reduce our snowpack—the state's largest water reservoir—by as much as 80 percent by the end of the century.

Greatest challenge: When it comes to managing water in California, it has literally taken a generation for sound planning to triumph with last year's groundwater legislation. It will take another generation to actually see the results. After the current drought ends, it will be a challenge to keep public attention on this critical issue.

Scale that up—greatest global challenge: Water is vital to our economy, our food supply, and our public health. Access to clean water remains a global challenge that requires smarter management and technological innovation.

Motivation: I am deeply concerned about the world we leave to our children. I feel compelled to help make sure that science informs the choices we make and the laws that govern our world.

UC Berkeley influences: Being in the Environmental Science, Policy, and Management program at UC Berkeley allowed me to work in a truly interdisciplinary manner—my dissertation committee included a rural sociologist (Louise Fortmann), a landscape ecologist (Adina Merenlender), a hydrologist (Matt Kondolf), and an economist (Isha Ray). The complex environmental problems we face require a range of tools from a variety of disciplines. I am grateful to have had the opportunity to learn from the best in a variety of fields.



Juliet Christian-Smith

PHOTO: Courtesy of Juliet Christian-Smith



Daniel Lashof in Bordeaux, France, July 2014, sporting a shirt from the fall 2013 New York to Washington, D.C., Climate Ride. PHOTO: Diane Regas

Realistic outlook: It's never too late to try to make things better. The choices we make today can have a profound impact on the world our children inherit. Reducing our global warming emissions can help avoid the worst consequences of climate change while we also take steps to adapt to the changes already underway.



Daniel Lashof

MS '83, PhD '87, Energy and Resources Group (ERG). Executive Director, NextGen Climate America, nextgenamerica.org

What you do: NextGen Climate America's mission is to promote policies to prevent climate disaster and preserve American prosperity. What could be better than that? In practice that means focusing on reducing carbon pollution from power plants with federal and state policies, mostly in the East, and reducing carbon pollution from transportation with state policies in California, Oregon, and Washington.

Success story: After federal cap-and-trade legislation failed in Congress in 2010, conventional wisdom held that national action on climate would be stalled indefinitely. My colleagues at the Natural Resources Defense Council—where I worked for 25 years, until April of 2014—and I were able to show that the Clean Air Act could be used to make major reductions in carbon pollution from power plants, cost-effectively. Following a strong advocacy push from the broader environmental community, President Barack Obama directed the Environmental Protection Agency (EPA) to regulate carbon pollution from existing power plants, and the EPA proposed its Clean Power Plan last June.

Greatest challenge: The coal industry still has outsized influence on U.S. policy, even though the solar industry now employs as many people.

Scale that up—greatest global challenge: The scale of the global fossil fuel industry, particularly the oil industry, is pretty daunting.

Motivation: I love coming up with policy ideas that significantly reduce pollution and have a realistic chance of being adopted.

UC Berkeley influences: [ERG professor] John Harte's ER 102 instilled systems thinking, and John Holdren's Tricks of the Trade developed skills that I use to this day. More than any specific class or professor, though, the creativity and commitment of the ERG community—students and faculty—inspired my enduring belief that it's possible to change the world.

Realistic outlook: I'm actually very optimistic. The progress on solar in the last five years is truly world-altering. I think electric cars are poised to make the same leap into the mainstream in the next five. The U.S.-China agreement announced last fall is a really big deal. We still face many challenges, of course. The question is no longer whether we will take meaningful action, but whether we will act forcefully enough and fast enough to avert climate disaster.



Robert B. Weisenmiller

MS '77 ERG; PhD '77 Chemistry.
Chair and Scientist Commissioner, California Energy Commission, www.energy.ca.gov

What you do: The California Energy Commission is the energy policy and planning agency for the state. My specific responsibilities lie within research and development, electricity and natural gas supply and demand, legislative activities, inter-governmental affairs, management and budget, and overall quality of the work the Energy Commission produces. Governor Edmund G. Brown Jr. recently reappointed me to another five-year term. I'm looking forward to advancing renewable



Robert Weisenmiller test-drives a Zero Motorcycle at the Plug-In Electric Vehicle Showcase in 2013.

PHOTO: Courtesy of the California Energy Commission

energy, reducing our need for petroleum, and making our homes and buildings more energy efficient.

Success story: In 2010, we had a laser-like focus on renewable power development. We accelerated permitting for projects that were eligible for federal grants and/or loan guarantees. Given the turmoil in the financial markets and also the innovative nature of some of the technologies, these incentives appeared to be a unique, fleeting opportunity for California to provide jobs and economic development and finally reduce fossil fuel use (and thus greenhouse gas emissions). I served as the presiding member of our sitting committee, and we achieved timely decisions on nine projects representing more than four gigawatts [four billion watts] of new renewable electricity capacity.

Greatest challenge: Our ability to respond to climate change. Since buildings and transportation are California's largest greenhouse gas emitters, it is essential to mitigate the threat of climate changes through monumental leaps in these sectors.

Scale that up—greatest global challenge: Temperatures are higher, sea levels have risen, we face our fourth year of drought, and the threat of forest fires looms. As the producer of 1 percent of global greenhouse gas emissions, California cannot, by itself, reduce the world's greenhouse gas emissions, but we can lead the way. Recently, I was part of trade missions to Mexico and China with Governor Brown, as his principal adviser on energy issues. We're exchanging best practices and creating momentum by carrying the discussion forward. We must aggressively implement mitigation measures as well as build a system that can adapt.

Motivation: I really enjoy the challenge of communicating tough issues to the public, and it's especially rewarding when we provide a solution. For example, the Energy Commission provides millions of dollars each year to encourage innovative research and development. Through our research funds, we have helped create the nation's premier microgrid at the UC San Diego campus.

UC Berkeley influences: My time with Joseph Cerny and John Holdren [emeritus ERG professors] helped direct me to the professional life I have pursued. Cerny helped train me on what it takes to be a successful scientist. Holdren helped me focus my training on the important issues of energy and the environment.

Realistic outlook: In the 1970s and '80s, I also worked for the Energy Commission, in a different role, and was part of a state-wide team that transformed our energy system from one of excessive energy consumption and nuclear power plants to one where our per capita electricity demand has remained flat while the rest of the nation's demand has grown by 50 percent. Now I'm getting a second opportunity to make a difference, but this time my experience is much richer and more robust, and I'm excited about where we're going. Governor Brown has set three big goals for us: Increase from [using] 25 percent renewables today to 50 percent by 2030; reduce petroleum use in cars by

50 percent; and double the efficiency of existing buildings. Those are goals based on very high expectations, so we must not hang on the laurels of our past good work and must buckle down for the future.



Seth Shonkoff

MPH '08 Public Health; PhD '12 ESPM. Executive Director, PSE Healthy Energy, www.psehealthyenergy.org

What you do: PSE Healthy Energy is an energy science and policy institute that brings scientific transparency to energy policy. Its physicians, scientists, and engineers [PSE] generate, translate, and disseminate scientific information and put it into the places where it is used to ensure more responsible energy policy-making. The majority of our work is focused on evaluating the public health and climate dimensions of oil and gas development—for example, fracking, or hydraulic fracturing of rock to extract oil—and the transition to clean power. Most days, I conduct analyses, work with scientists, meet with leaders in the nongovernmental organization (NGO) world, talk to policy makers, and give talks in front of diverse audiences.

Success story: In 2010, much of the conversation about fracking was data-free; the oil and gas industry and environmental NGOs each had their own talking points, but there was little data to understand the climate and human health dimensions of the issue. At this time, PSE Healthy Energy began as a group that could bring scientific integrity and clarity to these discussions, highlighting what we know and what we don't know and the implications for energy policy and its impacts. Today, in household- to federal-level conversations about fracking, discussions about the science sit right next to those about the politics, which cannot be said for every energy issue. We think we can take some credit for that.

Greatest challenge: It is no secret that money corrupts very efficiently and effectively, and as such, special interests have great incentives to manufacture messages that serve their bottom line but don't necessarily shine light on reality. This creates a challenge to those scientists who seek to frame the conversation about the reality of what we know and don't know.

Motivation: A strong belief that independent science should inform and come before energy policies, especially when these decisions hold implications for human health, the environment, and exacerbation of climate change.

UC Berkeley influences: The chair of my ESPM dissertation committee was Rachel Morello-Frosch [also a professor of public health]. Rachel provided me with very strong guidance on how to get one's research to affect climate, health, and energy policy. We would never simply publish a paper and move on; we always made it a point to translate our find-



Seth Shonkoff

PHOTO: Jim Block

ings into formats that could be integrated into the platforms of groups working for more responsible energy policy. She also taught me how to firmly, but respectfully, not back down when interested parties who didn't like to hear what we had to say came out against us. Let the data speak for itself, but explain it clearly.

Realistic outlook: I still have hope that we can reduce greenhouse pollutant emissions sufficiently to avert the worst climate change scenarios outlined by the Intergovernmental Panel on Climate Change. An important strategy to get there is to put the public health co-benefits of climate change mitigation into the forefront of our efforts. For instance, reducing greenhouse gas emissions from power plants will also reduce health-damaging air pollutant emissions, thereby protecting communities that live, work, and play close by. When we reduce methane emissions from oil and gas development like fracking, we also reduce emissions of co-emitted hazardous air pollutants such as benzene and formaldehyde. Realistically, we can work towards our climate goals while decreasing environmental public health burdens in communities along the way.



UNDERSTANDING THE HANDS THAT FEED

PHD 1993 AGRICULTURAL AND RESOURCE ECONOMICS

SUSAN GABBARD

Susan Gabbard can walk into a grocery store, glance at the fruits and vegetables, and tell you what they are and when, where, and how they were grown. She can tell you what's ripe in any given region and where a drought, heat wave, or freeze is—or soon will be—affecting harvests and food prices. She can even tell you what the farmworkers who harvest a particular crop look like, where they probably came from, and where they might be headed next.

Story and photos by Molly Oleson

“My job is never boring,” says Gabbard, a national expert on migrant and seasonal farmworker populations and the project director and manager of the 26-year-old National Agricultural Workers Survey (NAWS). “Farm labor is always changing; things are never the same.”

The annual survey of U.S. farmworkers, which has, over the years, collected the demographic, employment, and health data of more than 56,000 workers in 12 regions, uses innovative techniques and complex models to provide the U.S. Department of Labor and other federal agencies with the most accurate and reliable data on continuously shifting farmworker populations and employment patterns.

“Our mission is to give a voice to farmworkers,” says Gabbard, who has worked on the survey since 1988. It began that same year as a response to the Immigration Reform and Control Act of 1986. “We are the source of data that people turn to when they need to understand how policies are going to affect farmworkers.”

It wasn't always that way, says Gabbard, who, as vice president of JBS International, also monitors and evaluates AmeriCorps and Senior Corps programs. “In the beginning, we had a lot of opposition from people who didn't want this kind of data to be out there, because we collect *very* sensitive data,” she says. “We really had to work very hard to establish the survey as legitimate research.” When the NAWS was getting under way, Gabbard was working in Salinas on her dissertation, which focused on whether giving undocumented farmworkers amnesty would cause them to leave farmwork.

She credits fellow alumnus and “labor-survey expert” **Rick Mines**, PhD '80 Agricultural and Resource Economics, with introducing her to California agriculture. Having experienced only the small farms of the East Coast, where she grew up, before landing at UC Berkeley, Gabbard says that she was stunned and intrigued by the massive size of California farms and their labor forces—which she first observed while accompanying Mines on a tour of research sites for a survey of the state's farmworkers.

“It just goes on *forever*,” Gabbard says of the rows and rows of different-colored greens in the Salinas Valley. “And for some reason it grabs me, unlike seeing rows and rows of wheat fields in Kansas—that didn't ever *grab* me.”

Gabbard says that Berkeley “took a chance” on her, because she was coming from a non-ag-econ background—she holds an MA in anthropology from Duke and a BA in anthropology from Rutgers. Prior to falling for California agriculture, she pictured herself studying international development and looking at small farmers in Asia or Africa.

“My grandfather was a small farmer,” she says, before recounting the once-scary but now-humorous event that dramatically colored her decision to work with crops rather than animals.

“Our mission is to give a voice to farmworkers.”

“I was stampeded by cattle at a very young age and had to project myself over a barbed wire fence while my father and grandfather laughed their heads off.”

Gabbard says that her grandfather did migrant farmwork as a teenager to put himself through school, and eventually became a chemist. A professional job allowed him to move his family into middle-class America, but he kept a small farm on the side. This legacy gives her work deeply personal resonance.

“I would really love to see people be able to pay their dues in farmwork and move their families up and along,” Gabbard says, adding that today, these laborers have limited options in the wider economy. “Now we have a situation where people aren't able to [do that].” Farmworkers are often treated poorly, discriminated against, and prevented from accessing other jobs, she says. “Whenever we find situations where people are being impeded from [pursuing] the American dream, it's always very upsetting.”

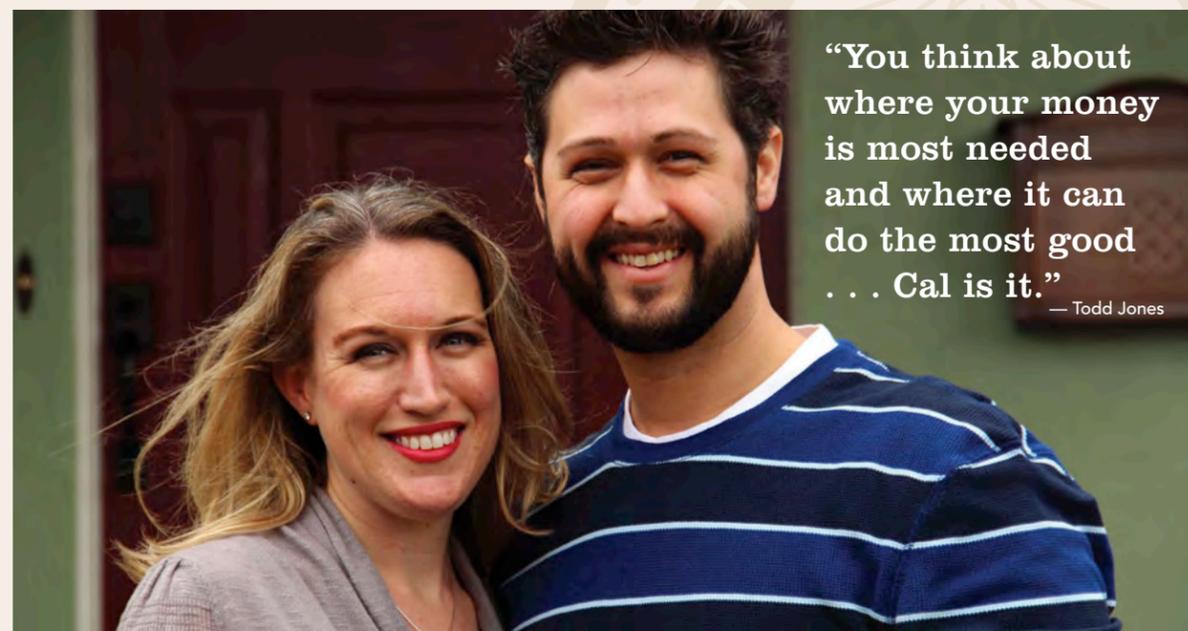
But one of the things Gabbard loves about her job is collaborating with agencies seeking information about the farmworker population so that they can offer health and education resources. It's rewarding, she says, to see the data that she and her colleagues collect being used to help better the lives of farmworkers.

And studying the trends in farm labor—which Gabbard says have shifted dramatically over the last 25 years—helps her understand what drives change and what supports progress.

“We try to be very agile in what we do because we know that our data is used in ways that are very important,” she says. “We're always self-evaluating and saying, ‘How can we take this to the next step, how can we make this better?’”



Left: Susan Gabbard at JBS International in Burlingame, with a map used to track its work on the National Agricultural Workers Survey. Above: Visiting mustard fields in Half Moon Bay.



“You think about where your money is most needed and where it can do the most good . . . Cal is it.”
— Todd Jones

PHOTO: Molly Oleson

Commitment—to Each Other and to Cal

If it weren't for a six-foot-seven man who had a habit of not retrieving his oversize clothes from the dryer, **Todd and Kristen Jones**, both 2004 UC Berkeley graduates, might never have fallen in love.

It was 2002, their sophomore year. Living on separate floors of a house on Panoramic Way, the two shared a washer and dryer with about 20 other people. “We met specifically because of his best friend's laundry,” says Kristen, a political science major who, up until the day she became fed up, gathered the neglected clothes, and knocked on his bottom-floor door, would typically wait hours to dry her own clothes. “I brought it down, and Todd opened the door,” Kristen says, noting that she had seen her future husband in political science classes and thought he was cute. “And I was like, ‘Oh my god, the cute guy lives here!’ And so I was no longer harrumphy.”

“I was pretty intimidated by her,” Todd says, admitting he avoided Kristen at every opportunity, including numerous random meetings in the house, before finding the courage to kiss her at a party one night.

Nearly seven years of dating led to marriage in 2009. Ever since their senior year, a priority for the couple has been to give back to the place that changed their lives both personally and academically. Their giving places them among the most loyal of more than 16,000 alumni who have donated to the New Alumni Challenge—a fund-raising campaign to encourage recent graduates to support Cal in its efforts to remain the top public university in the world. They have given at numerous times during the year, including 2014's first Big Give campaign.

“I feel very aware of how hard Berkeley has to work for money compared to private universities,” says Kristen, who went on to work for the American Cancer Society and the United Nations in Vienna before becoming the director of audience engagement at the San Francisco Opera. She loved the challenging academic environment that she found at Berkeley, as well as the people with different passions and points of view, from all walks of life. “It's important to support the places you care about,” she says.

“You think about where your money is most needed and where it can do the most good . . . Cal is it,” says Todd, a double environmental sciences and political science major who joined Kristen for work at the U.N. before getting his graduate degree at the Yale School of Forestry and Environmental Studies. He now works for the San Francisco-based Center for Resource Solutions on programs for renewable energy and carbon offsets. He provides analysis and guidance to energy and climate change policymakers and organizations. (See also Q&A, page 22.) Todd is grateful for unique CNR opportunities like joining professors for research outside the classroom. “Those types of experiences really made my education so much richer,” he says.

Both Todd and Kristen are San Diego natives, and both are from families that believe strongly in charitable giving. So they want to make sure future Cal students have the same opportunities they did. Knowing that they are contributing—even if it is a small amount—gives them a deep sense of pride.

“Anything we can do to help make it so more people can experience that, the better,” Kristen says. — MOLLY OLESON

Tall Tree Tales of Cal | Photo by Jim Block

This southern magnolia, located adjacent to Sproul Hall, is one of 16 distinctive campus trees featured on the new “Tall Tree Tales of Cal” audio tour, launched this spring. Originally developed by the forestry program and led by forestry students, the tour has been updated for smartphones and is now a selection on the Point app by Canogle, which is available free from the Apple and Android app stores. Canogle, a company founded by Arthur Bart-Williams, BS '88 Engineering, generously donated development time to CNR for the project. (See Campus Briefs, page 7.)



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