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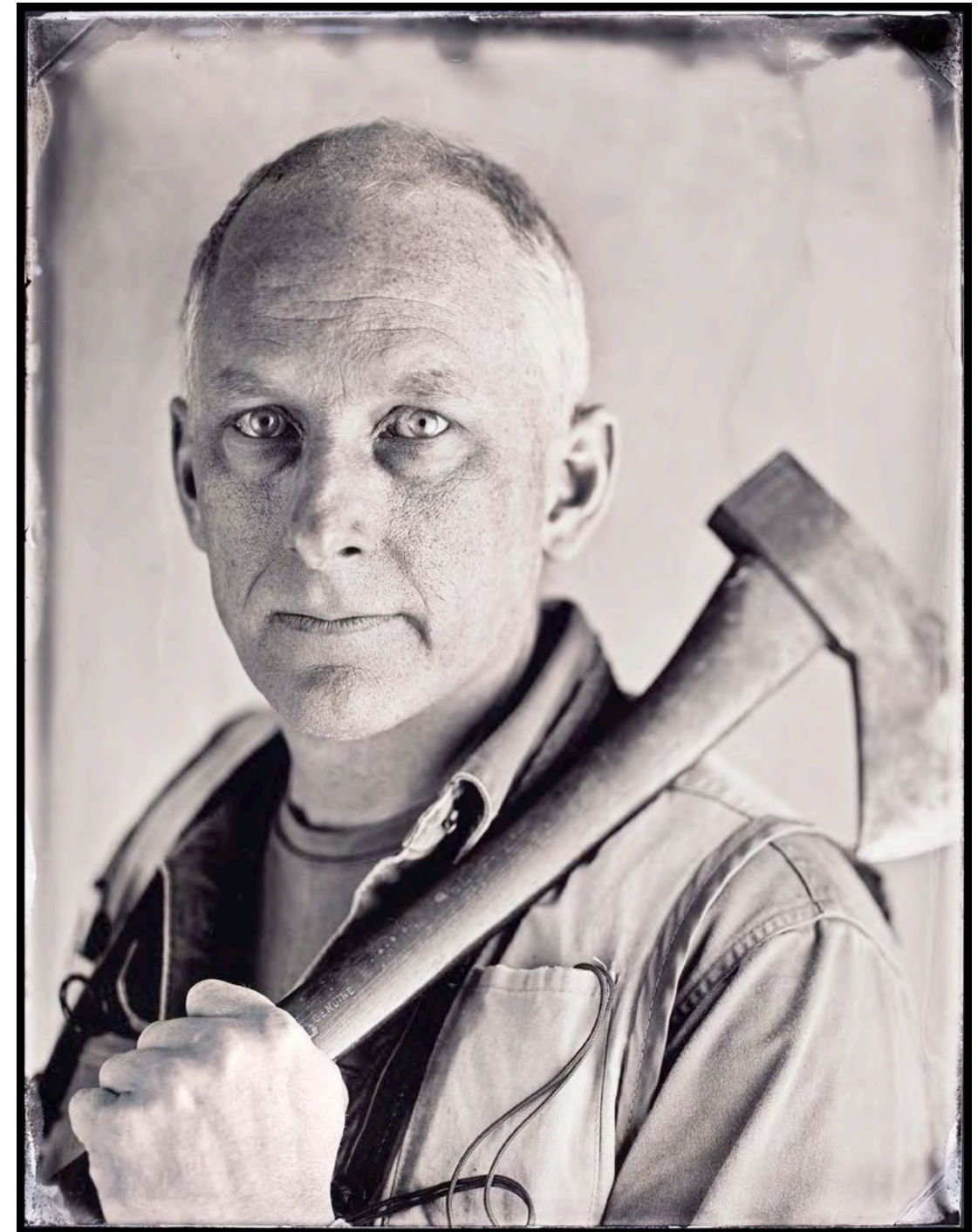


FAIR TRADE: Sergio Núñez de Arco '95 (bottom left) was dubbed the "king of quinoa" by *Time* for his sustainably conceived growth of quinoa imports to the United States, mainly from his native Bolivia. Eugenio Choque (right) and his family, farmers from the Uyuni region, inspect the harvest with Miguel Choque, the manager of their cooperative. Story on page 20.

PHOTO: Vitaliy Prokopets

BREAKTHROUGHS

UC BERKELEY COLLEGE OF NATURAL RESOURCES • SPRING 2014



TAMING SIERRA FLAMES

Banking on Nutrition | On the Ground with Human Disease Research



This year marks a century of forestry scholarship, education, and practice that shaped the field in California, the United States, and the world. To celebrate the centennial, *Breakthroughs* tells a forestry story that goes to the heart of Berkeley and the University of California. The Sierra Nevada Adaptive Management Project, or SNAMP, was convened to solve a problem uniquely suited to UC's land-grant mission, and in the process, the work became a model of science, community outreach, and land management (page 14).

The College's Atkins Center for Weight and Health has been doing research that has influenced high-profile policies like California's limiting of access to sugary drinks and snacks in schools. This summer, the Atkins Center will release a report documenting the recent trend toward nutritional improvements in food banks—the giant regional warehouses that supply local food pantries and soup kitchens. Food banks and their supporting agencies have come a long way in making the connection between public health and nutritious food in the emergency food system, the center's research shows. And, like any major paradigm shift, there's still some work to do (page 10).

Early this spring, the Campaign for Berkeley wrapped up its \$3 billion effort with a total of \$3.13 billion. Likewise, thanks to all of you—our alumni and friends—and our dedicated development team, the College exceeded our \$70 million campaign goal, raising \$84 million. Now, in honor of the forestry centennial, we turn our development efforts to the *S. Donald and Bernice Schwabacher Fund*. The fund has one purpose: help forestry students attend Berkeley's unique residential summer field course in the Sierras. It should surprise no one that costs for such a program continue to rise steadily; nearly all similar university programs have shut down. We invite you to help us fortify the Schwabacher Fund to preserve this only-at-Cal experience for generations to come (page 28).

I welcome your comments at gilles@berkeley.edu.

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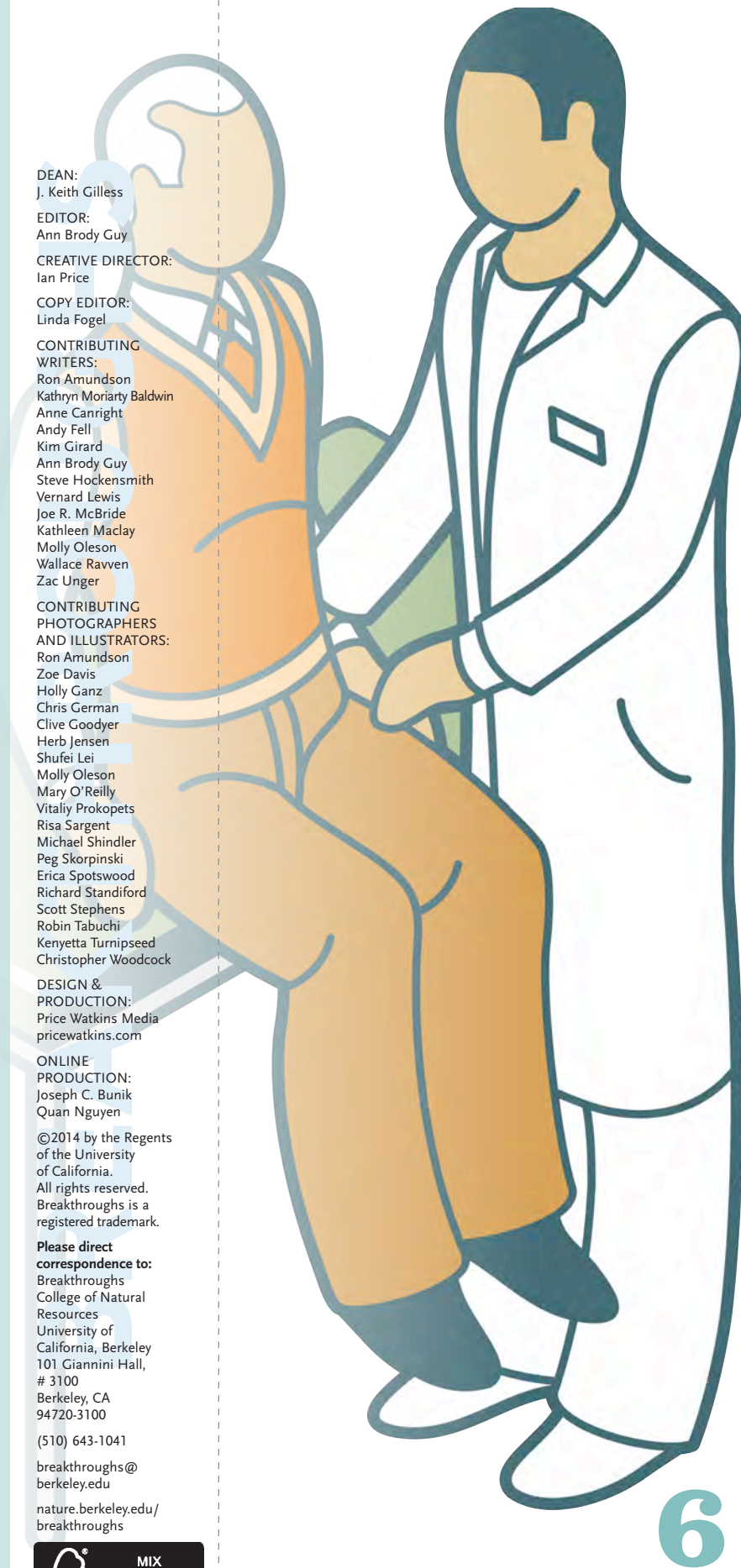
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SPRING 2014

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COLLEGE SUPPORT EXTRA Success! The Campaign for Berkeley
Go to nature.berkeley.edu/breakthroughs.

COVER: John Battles, professor of environmental science, policy, and management. Tintype photograph by Michael Shindler





PHOTO: Holly Ganz

Anthrax-Killing Virus Holds Promise for Treatment

Vultures gather at a zebra carcass in Etosha National Park in Namibia. Anthrax is caused by a bacterium that invades and kills its animal host.

From a zebra carcass on the plains of Namibia in Southern Africa, an international team of researchers has isolated a new, giant bacteriophage—a type of virus that invades and kills a bacterial host—that specifically infects the bacterium that causes anthrax. The discovery could open up new ways to detect, treat, or decontaminate the anthrax bacterium, *Bacillus anthracis*, and its relatives that cause food poisoning.

The anthrax bacterium forms spores that survive in soil for long periods of time. Zebras are infected when they pick up the spores while grazing. The bacteria multiply, and when the animal dies, they form spores that return to the soil as the carcass decomposes.

The first thing the team noticed was that the bacteriophage, or phage, was a voracious predator of *B. anthracis*, said **Holly Ganz**, a research scientist at the UC Davis Genome Center and first

author on the study. She began the work as a postdoctoral scientist on a team led by **Wayne Getz**, professor of environmental science, policy, and management (ESPM).

Bacteriophages are often highly specific to a particular strain of bacteria. When they were first discovered in the early 20th century, there was strong interest in using them as antimicrobial agents. But the discovery of penicillin and other antibiotics eclipsed phage treatments in most of the world. “With growing concerns about antibiotic resistance and superbugs, people are coming back to look at phages,” Ganz said.

Christina Law ’10 and molecular and cell biology professor **Richard Calendar** contributed to the National Institutes of Health–sponsored study, which was published on January 27 in PLOS One.

— ADAPTED FROM A STORY BY ANDY FELL ON EGGHEAD, A UC DAVIS RESEARCH BLOG

Key Process in Photosynthesis Likely Evolved Before Oxygen

Scientists studying methane-producing microbes, like the ones found in deep-sea hydrothermal vents, discovered that a process critical to contemporary photosynthesis likely developed on Earth 2.5 billion years ago, long before oxygen became available. The research, led by professor emeritus of plant and microbial biology **Bob B. Buchanan**, with

Virginia Tech colleague **Biswarup Mukhopadhyay**, opens new scientific areas in the fields of evolutionary biology and microbiology and has broad societal implications as it can shed light on natural gas production, climate change, and related fields. The findings were described in the February 7 *Proceedings of the National Academy of Sciences*.

PHOTO: Chris German, courtesy of NOAA Pacific Marine Environmental Laboratory

PHOTOS: Left, Kenyetta Turnipseed; right, Robin Tabuchi



Left: Rakim Turnipseed is a second-year ESPM PhD candidate with an emphasis in entomology. Right: Cooperative Extension specialist Vernard Lewis is an expert on bed bugs.

African American Voices in Entomology

ESPM Cooperative Extension specialist **Vernard Lewis** was invited to give a presentation on African Americans in entomology for the symposium, “Connecting with the World’s Best Talent: Attracting and Retaining Diverse Entomologists.” Nine other speakers at the November 2013 Entomology Society of America meeting covered a wide array of underrepresented groups in the field.

Lewis dug into a case study of UC Berkeley. No other university had attempted this type of research exercise at their home institution, he later learned at the symposium. Expecting to be able to count his results on one hand, Lewis was surprised that his research turned up 15 individuals over 60 years who self-identified as African Americans and had taken undergrad courses in entomology, with most graduating. Two on the list held faculty positions. The list skewed mostly male, but two women had taken courses and had gone on to receive PhDs.

At least half of the people on the list went on to have careers in entomology. But Lewis thinks the numbers have a clear message. “Obviously, a lot more needs to be done to attract and retain diverse and talented individuals in entomology, as well as for science and math in general.”

— ANN BRODY GUY AND VERNARD LEWIS

Genealogy of African-American Entomologists 1955–2013, UC Berkeley

- 10 earned PhDs
- 2 earned MS degrees
- 2 appointed to faculty (one adjunct)
- 2 took undergraduate courses (graduated in other majors)
- 1 current PhD student

OUTREACH: A new alliance that includes Berkeley, Stanford, UCLA, and Caltech, funded by the National Science Foundation, will attempt to recruit more underrepresented minority PhD students in science, technology, engineering, and math.

NewsMakers

“The affluent suburbanites that commute long distances more than make up for the low-transportation footprint of urban dwellers.”



Daniel Kammen, Professor, Energy and Resources Group and Goldman School of Public Policy, and Director of the Renewable and Appropriate Energy Laboratory

A January 14 *Los Angeles Times* story was one of many media stories covering a study led by Kammen, which found that suburbs produce half of all household greenhouse gas emissions, even though they account for less than half the U.S. population. The suburban pollution cancels out the energy-saving achievements of residents in urban areas with good public transportation.

“There will always be cold nights and cold days . . . but they’ll become rarer.”



Inez Fung, Professor, Environmental Science, Policy and Management (ESPM)

USA Today was one of numerous domestic and international news outlets covering the February 27 release of the public-facing report, “Climate Change: Evidence and Causes,” a partnership between teams from the National Academy of Sciences, led by Fung, and the United Kingdom’s Royal Society. “Actions today have long-term consequences,” Fung said at a Washington, D.C. release event.

“If it’s funded by a corporation, it’s more likely to generate patents, and it’s more likely to generate licenses.”



Brian Wright, Professor, Agricultural and Resource Economics

A March 20 *San Francisco Chronicle* story covered a study, led by Wright, that upended the common assumption that corporations’ narrow interests limit innovation from the research they sponsor. Researchers analyzed 15 years of UC data and found that corporate-funded studies yielded more patents and licenses than publicly funded studies. Wright said the study’s conclusions “turned out the opposite from what I expected.”

Golden Rice: The Cost of Inaction

A large body of scientific evidence points to Vitamin A-enriched rice (golden rice) as a cost-efficient means to significantly improve nutrition—and thereby lower health costs—for the world's hungry masses. Yet despite golden rice being available since early 2000, the crop has not been introduced in any country. Why the delay? Agricultural and resource economics (ARE) professor **David Zilberman** postulated that governments perceive that the added costs of addressing the public controversy around genetically modified organisms, or GMOs, will outweigh the crop's social benefits.

Zilberman and co-author Justus Wesseler, a professor at the Technische Universität München in Germany, developed a model to quantify those “perceived costs.” The results, based on a case study of India, show the annual perceived costs of GMO adoption to be at least US\$199 million per year for most of the past decade. “This is an indicator of the economic power of the opposition toward golden rice,” said Zilberman, citing this perceived cost as the explanation for the delayed approvals.

The researchers also calculated the human cost of delaying golden rice implementation to be approximately 1.4 million life years lost over the past decade, mainly due to hunger-related deaths or shortened lifespans. The perceived costs

are 85 times larger than the actual costs of implementing a golden rice agricultural program, the researchers reported.

“These findings explain why it's more difficult to convince regulators when a strong vocal opposition exists to a technology,” said Zilberman. “Having a better understanding of the political economy behind the perceived costs, and studying how to reduce them, seems to be economically much more important than conducting additional investigations into the costs of implementation planning, such as social marketing and maintenance breeding.” The study was published in January's *Environment and Development Economics*.

In a related study, Zilberman documented the positive social impact that genetically modified foods have already had. While acknowledging that agricultural biotechnology warrants continued investigation, and that each new transgenic crop might bring new or bigger risks, the article, published in the Winter 2014 *Journal of Economics*, concludes that the “balance of scientific knowledge weighs in favor of continued adoption of genetically engineered seed.” ARE PhD student **Geoffrey Barrows** and Steven Sexton, assistant professor at North Carolina State University, Raleigh, are co-authors.

— ANN BRODY GUY

Mary Wildermuth, associate professor of plant and microbial biology, in her lab.
PHOTO: Peg Skorpinski



Protecting Food Crops from Powdery Mildew

It looks harmless enough—a light dusting like baby powder sprinkled on the leaves. But powdery mildew can cause billions of dollars of crop damage in California. For example, the fast-spreading fungus is the most significant disease affecting grapes in California. Borne by the wind, its spores race through fields, resulting in crop losses of 30 percent or more.

Growers combat powdery mildew with sulfur, fungicides, and other deterrents, but treatment is costly, and timing is difficult. But a much more precise strategy may be on the way. Using highly refined dissection of infected plant cells, coupled with genetic analysis, plant and microbial biology associate professor **Mary Wildermuth** identified genes critical to a plant's response to mildew attack. Her research focuses on plant breeding strategies that can weaken powdery mildew's grip.

Wildermuth is applying her discoveries to protect commercially valuable crops. She uses a plant in the mustard family popular with researchers for its small, sequenced genome and a short life cycle. “We've already identified the parallel genes in a number of important crops,” she said. “By targeted breeding to limit these genes' powdery mildew-promoting effects, we should be able to protect plants without extensive chemical treatments.” Wildermuth's work is funded from the *Bakar Fellows Program*, which supports early-career faculty conducting commercially promising research.

— ADAPTED FROM AN ARTICLE BY WALLACE RAVVEN

TOP PAPER: ARE professor emeritus **George Judge** was a co-author, with colleagues in the United Kingdom and Russia, on the winning entry for the 2014 Best Paper Award from the journal *Entropy*, it was announced in February.

SUBJECT: Why I Do Science



ENTRY BY:
Joe R. McBride

ENTRY #:
011

My introduction to science began in junior high school when my biology teacher, Mr. Bradley, inspired a life-long interest in research. The idea that we could test assumptions through experimentation opened a whole new world for me.

My undergraduate work at the University of Montana and my graduate work at Berkeley focused this interest on forest ecology. As a graduate student, I started a career-long pursuit of the effects of land use on plant successions—changes in the structure of plant species over time. I followed patterns of livestock grazing, fire history, air pollution, and stream-flow regulation in a variety of California vegetation types. I have established field plots, analyzed aerial photography, and conducted greenhouse and laboratory experiments.

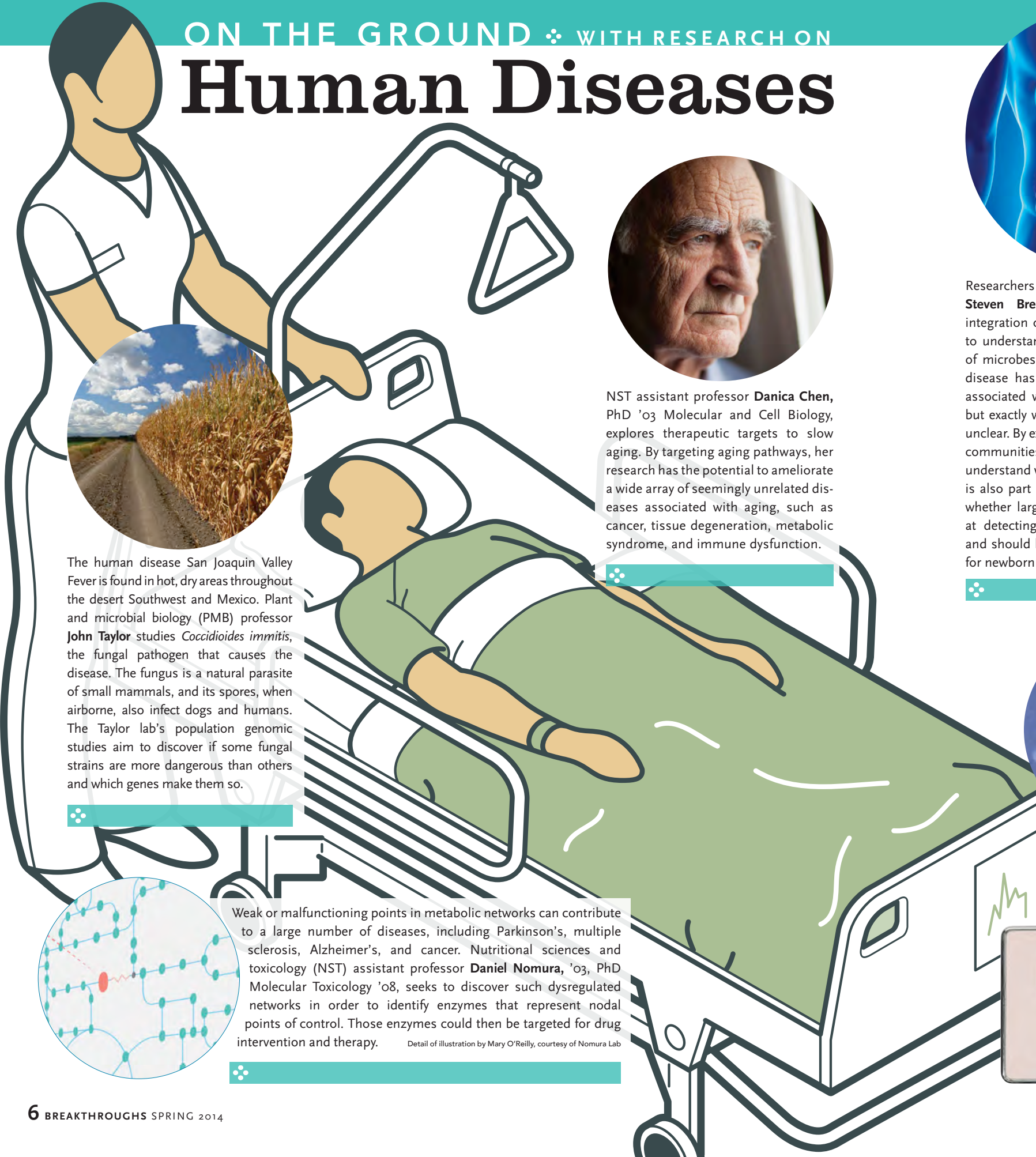
A compelling aspect of this work has been the evolution of my techniques. Often, my initial approach has led to subsequent experiments in basic plant physiology that I had not anticipated, but turned out to be essential to understanding what was taking place in the field. While I have always intended my findings to be of practical application to vegetation management, somehow parts of it have crossed into the realm of basic science.

Teaching also has been a great stimulus for my research and has kept me up to date. I have always felt an obligation to present currently evolving concepts, and students have been a valuable source of feedback on my work.

My interest in history has led to a number of studies on the development of urban forests in California and the way in which urban forests in Europe and Asia were reconstructed following the devastation of cities during World War II. I am currently investigating the potential impact of global warming on urban forests in California.

Joe R. McBride is a professor in the Department of Environmental Science, Policy, and Management, and in the College of Environmental Design. He is a fellow of the Society of American Foresters and a recipient of Berkeley's Distinguished Teaching Award, among numerous honors.

ON THE GROUND ✦ WITH RESEARCH ON
Human Diseases



The human disease San Joaquin Valley Fever is found in hot, dry areas throughout the desert Southwest and Mexico. Plant and microbial biology (PMB) professor **John Taylor** studies *Coccidioides immitis*, the fungal pathogen that causes the disease. The fungus is a natural parasite of small mammals, and its spores, when airborne, also infect dogs and humans. The Taylor lab's population genomic studies aim to discover if some fungal strains are more dangerous than others and which genes make them so.



Weak or malfunctioning points in metabolic networks can contribute to a large number of diseases, including Parkinson's, multiple sclerosis, Alzheimer's, and cancer. Nutritional sciences and toxicology (NST) assistant professor **Daniel Nomura**, '03, PhD Molecular Toxicology '08, seeks to discover such dysregulated networks in order to identify enzymes that represent nodal points of control. Those enzymes could then be targeted for drug intervention and therapy.

Detail of illustration by Mary O'Reilly, courtesy of Nomura Lab



NST assistant professor **Danica Chen**, PhD '03 Molecular and Cell Biology, explores therapeutic targets to slow aging. By targeting aging pathways, her research has the potential to ameliorate a wide array of seemingly unrelated diseases associated with aging, such as cancer, tissue degeneration, metabolic syndrome, and immune dysfunction.



Researchers in the lab of PMB professor **Steven Brenner** use meta-genomics—an integration of all DNA in an environment—to understand Crohn's disease and the role of microbes in the gut to cause it. Crohn's disease has long been hypothesized to be associated with these intestinal microbiota, but exactly what causes the disease remains unclear. By explicitly sampling these microbial communities, Brenner aims to better understand when they trigger the disease. He is also part of an ambitious effort to assess whether large-scale gene sequencing aimed at detecting disorders and conditions can and should become a routine part of testing for newborn babies.



Environmental science, policy, and management professor **Vincent Resh's** lab focuses on the interaction between humans and other organisms in the environment. He uses water-monitoring techniques and insect biology investigations to understand and control diseases with water-borne vectors, such as African river blindness, which is caused by worms that are transmitted by parasitic black flies. Previously, he applied this approach to control mosquitoes that are vectors of malaria.

PHOTO: Courtesy of Vincent Resh



Faculty in the **Department of Nutritional Sciences and Toxicology** explore a number of metabolic-level processes connected to obesity-related diseases. See On the Ground in the spring 2013 *Breakthroughs* (nature.berkeley.edu/breakthroughs/spring_2013).



Britt Glausinger, PMB associate professor, studies herpes viruses, including Kaposi's sarcoma, which is a major cause of AIDS-associated cancers. The insidious virus can actually reprogram cells to optimize the environment for replicating more viruses—for example, they can attack RNA, the nucleic acid necessary for making proteins. Researchers in her lab hope their work will shed light on virus-host interactions in other viruses as well.

Virus illustration by Zoe Davis, courtesy of Glausinger Lab

Cal Forestry Turns 100

This year, forestry education at UC Berkeley turns 100. Over the past century, the Cal Forestry program has had an impact on every dimension of the field and has produced the profession's most influential thinkers and doers.

Alumni of the program hold critical positions for the management of 95 percent of the industrial forestlands in California, and the research of our alumni and faculty has expanded knowledge in fire, remote sensing and geographic information systems, ecology, climate change, forest economics, the social sciences, and numerous other areas. (See Taming Sierra Flames, page 14.)

Cal Forestry is celebrating its centennial in style, with a party, a special publication highlighting faculty and alumni contributions to the field, and a conference that looks to the future of forestry education. The program is also holding a campaign to secure the future of the beloved summer field program in the Sierras, known as Forestry Camp.

FORESTRY 100 ACTIVITIES

North American Forestry Summit
May 7–9 (by invitation)

Centennial Party
Sept. 19, UC Berkeley Faculty Club

Centennial Publication
Available beginning Sept. 19 (distributed free to Centennial Party guests)

Support Forestry Camp
The *S. Donald and Bernice Schwabacher Fund* provides CNR with critical resources to preserve our forestry field class for future generations. See Save Our Only-at-Cal Forestry Camp, page 28, or go to nature.berkeley.edu/forestry100 and click the "Give Now" button.

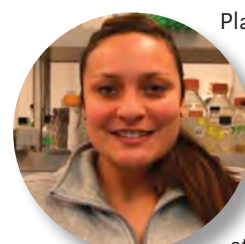
ESPM TURNS 20: In a special anniversary Q&A section, *Planet Earth* interviews the Department of Environmental Science, Policy, and Management. See page 22.



Go-Getters



María Fernández-Giménez, MS '92 Range Management, PhD '97 Wildland Resource Science, received the Outstanding Achievement Award for Research at the Society for Range Management's 67th annual meeting, held in February. Fernández-Giménez is a professor in the Forest and Rangeland Stewardship Department at Colorado State University.



Plant and microbial biology (PMB) graduate student **Nicole Abreu** has been awarded the American Society for Microbiology's prestigious Robert D. Watkins Graduate Research Fellowship and will receive up to \$21,000 annually over the next three years to continue her work on how bacteria function at a cellular level.



Rebecca Peters, a senior who focuses on water rights, has won a Marshall Scholarship, one of the nation's top honors for undergraduates. Peters is a double major in society and environment and international development economics. The scholarship funds U.S. students with high leadership potential to pursue graduate studies in the United Kingdom.



CNR graduate students dominated the 2013 Dow Sustainability Innovation Student Challenge Awards, which rewards graduate students working on innovative, interdisciplinary, and sustainable solutions to world challenges in energy and climate change, water, food, housing, and human health. Grand prize winner **Michael Gomez**, a PhD candidate in PMB, won \$10,000 for his efforts to engineer resistance to cassava brown streak disease, a serious threat to a vital food supply in Africa. **Gavin McCormick** and **Dilek Uz**, agricultural and resource economics PhD students, along with their biophysics and chemistry teammate **Anna Schneider**, were named runners-up for WattTime, a method for tuning electricity-consuming equipment to favor power from cleaner sources.

PHOTOS: Courtesy of academic departments

GO BEARS! *U.S. News & World Report* has once again chosen Cal for the No. 1 spot on its 2013 ranking of public universities.



Five Key Lessons

FROM ESPM C169

Adapted from an article by Steve Hockensmith
ESPM professor **Kate O'Neill** made last November's Warsaw-based climate change conference the centerpiece of her fall International Environmental Politics course. Each of her 125 students was assigned one of 26 nations, chosen to represent a range of political and economic interests, from superpowers to some of the world's smallest, poorest countries. After studying their assigned nation's population, economy, politics, and vulnerability to climate change, the students held mock treaty negotiations. *Breakthroughs* gleans five key lessons right from the students.

- 1** **Reza Abedi** says the experience helped him understand why setbacks happen. "What I came out with . . . is an understanding of why we don't see the negotiating outcomes we would hope for. I don't think there's enough trust between countries to uphold their promises to take action."
- 2** **Elizabeth Kent's** European Union team found that a mixture of empathy and flexibility was needed. "We learned very early on that you can only anticipate so much. . . . People make quick, emotional, and sometimes surprising decisions, and you have to be able to react and respond. It became clear that the more one can understand others' motivations and objectives, the more effective negotiations will be."
- 3** For **Julie Scrivner**, it was a valuable lesson in power dynamics. "I was surprised by how willing countries were to work together who had little leverage, and how stubborn powerful countries could be in the face of opposition."
- 4** Showmanship highlighted how those without influence have to be creative and flexible to get the kind of attention others take for granted. Some students dressed in clothes representative of their assigned nations. A delegate for the tiny island nation of Tuvalu brought a scuba mask to the second day of negotiations, declaring, "We will go underwater, and it's on you guys!"
- 5** For **Daniel Sparks**, the primary lesson was about the importance of leadership and the power of persuasion. "I realized that sitting quietly in the corner will not accomplish anything. You have to be confident in your positions and really sell them to other people."

1 Golf Goes Green

Bay Area golf lovers can thank **Stacey Baba '77** and her cohorts in the Northern California Golf Association (NCGA) for making a local golf course more sustainable. The group owns Poppy Ridge in Livermore and Poppy Hills in Pebble Beach. "The Poppy Hills renovation project cut water consumption by reducing the area of irrigated turf from 82

to 66 acres, even though the course was lengthened," said Baba, who is on NCGA's board of directors. Poppy Hills reopened this spring after completing a year of renovations that include a new irrigation system that applies water—already ultra-filtered sewage runoff—more selectively, among other enhancements. —ANN BRODY GUY

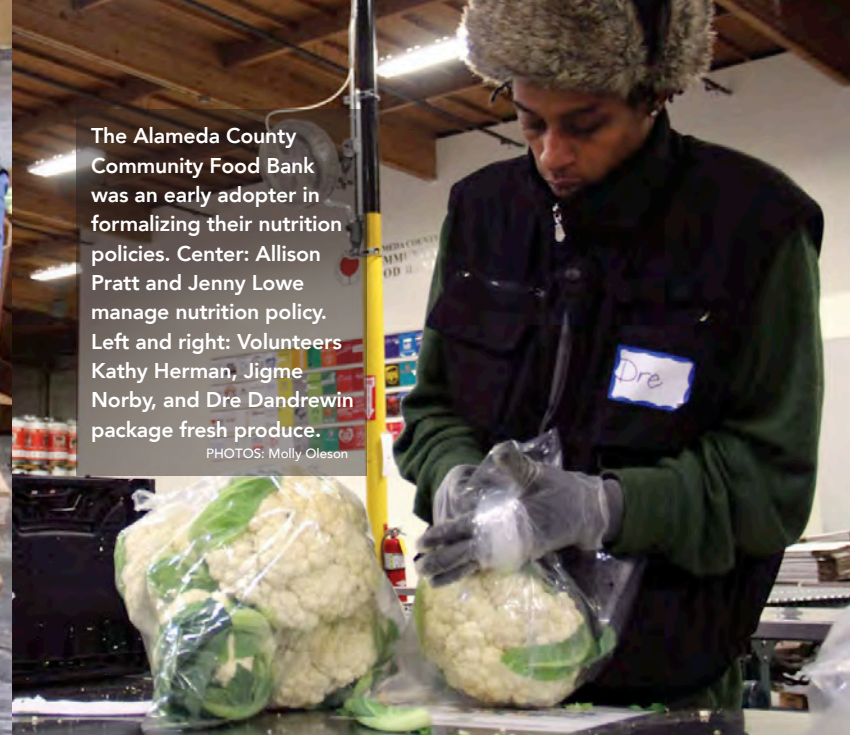
Harrison Fraker Named Top 2014 Architecture Educator



Harrison Fraker, an architecture professor known for his trailblazing work in sustainability, is the 2014 recipient of the Topaz Medallion for Excellence in Architectural Education, the leading award in architectural education in the United States. Fraker currently serves as the chair of the Energy and

Resources Group and is a former dean of the College of Environmental Design.

The Topaz Medallion honors an individual who has been involved in architecture education for more than a decade and whose teaching has influenced a broad range of students. The prize was announced December 17 by the Board of the American Institute of Architects and the Association of Collegiate Schools of Architecture, who commended Fraker for pushing the academic study of energy use in buildings to the forefront of the sustainability movement. —ADAPTED FROM AN ARTICLE BY KATHLEEN MACLAY



The Alameda County Community Food Bank was an early adopter in formalizing their nutrition policies. Center: Allison Pratt and Jenny Lowe manage nutrition policy. Left and right: Volunteers Kathy Herman, Jigme Norby, and Dre Dandrewin package fresh produce. PHOTOS: Molly Oleson

BANKING ON NUTRITION

The Emergency Food System's Path to More Healthful Food

By Kim Girard



It's a drizzly winter morning, and dozens of volunteers at the San Francisco–Marin Food Bank are slowly breaking down a 2,000-pound sack of whole oats into 1-pound bags, their hair tucked back in neat plastic caps.

A decade ago, volunteers were more likely to be boxing up canned foods items. Today, 60 percent of everything ferried out of this warehouse is fresh produce. No soda or chips are in sight, and whole grains like these General Mills oats are standard.

For food banks nationwide to move in a similar healthy direction, coordinated efforts must increase at all levels. It will take leadership like that provided by Feeding America, the national food bank network organization; expanded support for nutrition policies at the local and regional levels; and donor efforts to supply more healthful foods. It's a tall order. But with the growing ranks of the food-insecure and obese, there is more pressure—and desire—than ever to provide low-income families with healthful food and create support for food bank nutrition policies to ensure that happens, says **Patricia Crawford**, Cooperative Extension specialist

and director of UC Berkeley's Atkins Center for Weight and Health (CWH), a partnership between the College of Natural Resources and the School of Public Health.

"People managing food banks are taking charge and doing the difficult thing of modifying the healthfulness of the food donations they solicit," says **Karen Webb**, a nutritional epidemiologist at CWH. "On the one hand, the food banks want an ample supply of foods to hand out, but they're also advocates for people in our most vulnerable population, so the nutritional quality of that food is important."

There has been progress, which CWH researchers and their colleagues, at the request of the Institute of Medicine (IOM), the health arm of the National Academy of Sciences, have documented in 'A Movement Toward Nutrition-Focused Food Banking,' an upcoming discussion paper to be released in summer 2014. The report details the evolution of food banking as the number of people served by these organizations jumped a whopping 46 percent from 2006 to 2010, according to Feeding America. Today, 12 percent of the population uses the emergency food

system. Driven by increased demand, food banks have shifted from an emergency lifeline to a service filling a chronic need.

While organizations move to provide more healthful food, it's clear that pantry users, or clients, want these foods. A 2011 CWH study asked clients to rank calorie-dense snack-type foods and beverages as well as healthy options by order of preference. "Food pantry clients ranked the most nutritious foods highest," says Webb, a co-author of the IOM report. "Those foods are expensive, and they want to receive them. Meat, dairy, and fresh produce are at the top of their list, while soda and candy rank lowest."

What Policy Looks Like

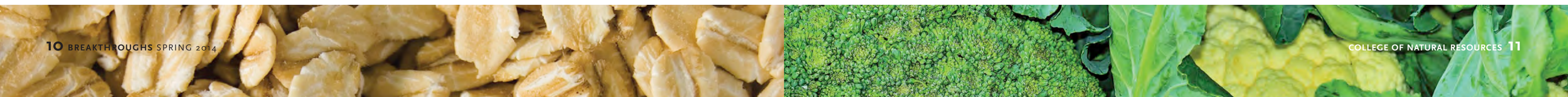
Getting healthier food into clients' hands requires changes in both policy and practice, but what exactly is a nutrition-driven food policy? Many stakeholders are trying to effect change—food banks and the umbrella groups that support them, organizations and corporations that donate, and state and federal governments—but there are few cohesive policies and common standards to govern how they work together.

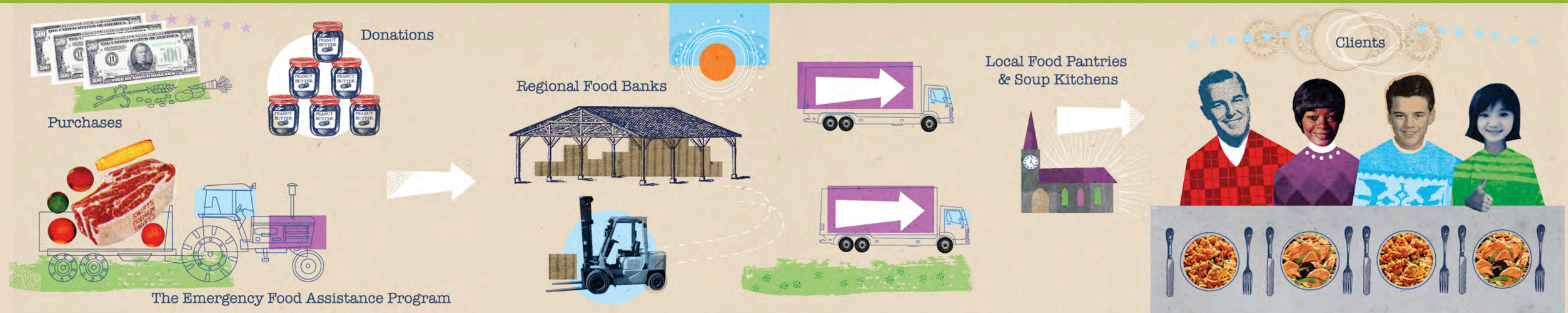
To start with, food banks can benefit from formal written guidelines that address the nutritional quality of the foods and beverages that they purchase or acquire from donations, according to the recommendations in the IOM report, whose authors include CWH's **Elizabeth Campbell** and **Michelle Ross**, Heather Hudson of the Food Bank of Central New York, and Ken Hecht, formerly with California Food Policy Advocates. A policy should guide the nutritional quality of the food bank's inventory as well as provide data analysis to track how successful the food bank is at distributing foods like produce and limiting unhealthy ones such as processed crackers and chips. Some 56 out of 200 food banks have a policy in place, according to a recent Feeding America survey, but more must be done.

Alameda County Community Food Bank (ACCFB) is a policy model, Crawford says. It established a written policy in June 2013, with the help of the nonprofit anti-hunger group MAZON and CWH. The project, which included several other food banks, was funded by Kaiser Permanente.

"We held focus groups with staff members and

PHOTOS: Below and on pages 12–13, iStockphoto





agency representatives,” says Jenny Lowe, ACCFB’s nutrition education manager. “We wanted to get everyone on the same page. We asked, what are our practices? We’d been following this for a long time, but never wrote it down.” The food bank’s policy is now clear. They purchase fresh fruits and vegetables, low-sugar canned fruits, low-salt canned vegetables, low-fat milk, lean proteins, nut butters, beans, whole grains, packaged meals, and soup.

To track the healthfulness of food, they use a computer system that ranks inventory by nutritional level (1, 2, or 3) and employ “traffic light” labeling on the warehouse floor and on order forms. Green is “choose frequently,” yellow “moderately,” and red “sparingly.”

“Green” foods are now more readily available at food banks across California because of the California Association of Food Banks’ (CAFB) Farm to Family program, which connects state growers and packers to food banks. In 2011, CAFB, a nonprofit, membership-based umbrella group, sponsored AB152, now a state law, which enables farmers to get a 10 percent tax break on the inventory costs of fruits and vegetables they donate.

CAFB exemplifies how agriculture, advocates, and food banks can work together to create policies that incentivize the support system for healthy diets. Since 2005, the group has increased food bank produce donations by 92 million pounds of fruits and vegetables that might have otherwise been plowed under in the fields. “In California, we have a progressive agricultural community as well as progressive food bank organizers,” Crawford says. “It’s that convergence that has made California a model and

brought national attention to what we’re doing.”

Other positive steps: Feeding America appointed a director of nutrition in 2011, and in 2012, it implemented Foods to Encourage, nutrition guidelines for promoting health—the food bank network’s first-time effort at national guidelines. It’s also running a pilot program that connects food-insecure clients who have Type 2 diabetes with nutrition, health education, and medical care.

Even with successes like these, there’s still a long way to go.

Fresh Food, New Challenges

Six California food banks participated in a 2010–11 CWH study on inventory trends, funded by the Robert Wood Johnson Foundation. All six had significantly increased the amount of produce they provide to pantries, the study found, but hardy onions and potatoes made up about half of those gains. While the increase in fresh produce was dramatic, getting a variety of vitamins and minerals from different types of produce is key to good nutrition, Webb says. “Food banks now must tackle the next challenge: adding more colorful yet hardy vegetables, such as bell peppers and broccoli.”

Part of that challenge is providing better distribution systems to pantries. Many food banks boast state-of-the-art facilities with refrigerated trucks and big walk-in refrigerators, but the pantries they serve are often basement kitchens and church halls with little access to refrigeration or storage. Policy changes must consider how to improve these conditions. For example, ACCFB provides farmers-market style distribution in

parking lots to some clients, and both ACCFB and the state of New York help provide pantries with equipment grants to improve facilities.

Sourcing is another hurdle. Although emergency food clients strongly prefer low-fat dairy, lean proteins, and whole grains over soda and other less nutritious foods, it can be difficult for food banks to procure donations that align with these preferences and with nutritional quality guidelines. In 2013, 66 percent of donated foods came from big companies and represented the largest source for food banks, according to Feeding America. Donations of sugary beverages and snack foods have declined substantially, but have not disappeared from the shelves of the six California food banks in the CWH study. In 2010, one California food bank alone distributed over a million pounds—208 million calories—of what Crawford calls “liquid sugar” drinks. “That’s a heck of a lot of excess calories going out to the most vulnerable people, who have a greater likelihood to be diabetic and overweight than higher-income folks,” Webb says.

Crawford notes that both the Central New York and Alameda County food banks have successfully implemented nutrition policies without offending donors or losing support.

Moving Nutrition Forward

In February 2012, anti-hunger leaders convened in Oakland, Calif., to discuss their findings from the 2010–11 Robert Wood Johnson Foundation study. There, CWH and California Food Policy Advocates called for food bank procurement policies that meet or exceed the Foods to Encourage guidelines, which were due to be released later that year.

In the most recent nudge forward, the IOM report recommends that items available through U.S. Department of Agriculture (USDA) food distribution programs align with key recommendations from the 2010 Dietary Guidelines for Americans. Most food that the USDA supplies to food banks is already healthy, a recent study showed, and the agency is moving quickly to further improve nutritional quality by adding items like whole-grain pastas and brown rice. The report also recommends that food banks and advocates work with donors to find new ways to incentivize nutritious donations.

The IOM report represents a formidable increase in visibility for the issue of food bank nutrition, and Crawford wants to take advantage of the momentum. She’s calling for a meeting of key stakeholders to discuss how to keep improvements to the emergency food system’s nutritional quality moving forward.

Obesity and diabetes risk continue to plague the nation’s health, and food banks will face big challenges in the coming year, including an expected rise in the number of clients as a result of the recent \$8.6 billion in cuts to the Supplemental Nutrition Assistance Program—or SNAP, formerly known as food stamps—part of the farm bill passed in February, and as a consequence of California’s drought, which is expected to bump up food prices.

“Those of us working in the field of hunger and food insecurity want the best for the people we serve,” Crawford says. “There is a moral imperative to do more than to provide just calories. We must provide foods that will help protect the health of the most vulnerable in our society.” **31**

Taming Sierra FLAMES

A UC team tamps down fire danger
and finds common ground

By Zac Unger, MS '00
Tintype photography by Michael Shindler

The summer of 2002 was a bad fire season in the United States. Twice as many acres burned than in 2001, and more total acres were destroyed than in all but one of the previous 40 years. The McNally Fire in Sequoia National Forest was only the second largest fire in California that year, and it alone cost more than \$50 million to extinguish. It was against this smoky backdrop that George W. Bush launched the Healthy Forests Initiative, a wide-ranging plan to reduce the severity of western wildfires.

In California, the plan coalesced around the concept of Strategically Placed Landscape Treatments, colorfully shortened to SPLATs. **Mark Finney**, PhD '91, Environmental Science, Policy, and Management (ESPM), a researcher at the Missoula Fire Lab in Montana, proposed that instead of thinning entire old growth forests, land managers could “treat” a fraction of the land with tree thinning and prescribed burns. These treated plots would slow a fire’s rate of spread, acting like speed bumps along a road. It was an interesting but untested idea, and by 2004 the plan ran into bureaucratic roadblocks. Because while the federal government owns the national forests, the old-growth dwelling wildlife—fishers, goshawks, spotted owls—can fall under state or federal management, depending on the species. Closer to the action, the local communities of Foresthill and Oakhurst were concerned about large-diameter trees being cut as part of the thinning effort, and about

the effect of prescribed burning on issues like home safety, wildlife, and water quality.

It was beginning to look like then-Governor Arnold Schwarzenegger, a Republican and a self-professed environmentalist, was going to sue the Bush administration over its forest policy mandates—an expensive, bitter process that nobody relished. Instead, a novel approach was conceived: The U.S. Forest Service agreed to test the unproven SPLAT approach along with state agencies, like Fish and Game, Department of Water Resources, and CAL FIRE, as long as a neutral third party could be tasked with analyzing the results. And that third party would be the University of California.

And thus, the Sierra Nevada Adaptive Management Project was born, with another endearing acronym, SNAMP. Today, as SNAMP reaches the end of a 10-year run, the project has proven to be a multidisciplinary, multiagency, multimedia success that has the potential to transform not only how we view forest fires, but more intriguingly, how scientists, government agencies, and public stakeholders interact in the pursuit of common goals.

“Honestly, nobody wanted to do this,” recalls **John Battles**, a professor of forest ecology and the chair of ESPM’s Ecosystem Science Division. “It seemed like it was going to be a quagmire of wasted



“Anyone can talk about ‘resilient forests,’ but if you go to the Rim Fire you can . . . show someone that *this* is how a high-severity fire sterilizes the soil.”

Kim Rodrigues with her “triangle of success”—balancing relationships, process, and results to reach shared goals.



“You have to keep listening to your participants. These kinds of networks . . . can be fragile, but they can also be really strong if nurtured correctly.”

Maggi Kelly with her Trimble GeoXT GPS receiver, which collects information about her location in the forest.



“All parties deeply care about the fate of these landscapes, and it was this care that sustained SNAMP for the long haul.”

John Battles with his logger’s tape, used to measure distances and the diameter of trees.

time.” Take the always contentious issues of fire, water, and wildlife, then add in an alphabet soup of local, state, and federal agencies, and it’s easy to see why most academics would keep their heads down and hope not to be called upon. But the governor was looking to the UC system to step up, and Battles, as head of Berkeley’s Center for Forestry, felt that he could not refuse. “That’s what we do,” he says. “That’s the stuff that we *should* do.”

Gradually, a plan took shape. With the ultimate goal of moderating fire behavior, the U.S. Forest Service would conduct prescribed burning and tree thinning as they saw fit. It would then be up to UC scientists to study the results—not just in terms of fire, but also the impact on wildlife, water, and forest health.

Working with Stakeholders

Modern adaptive management takes into account complex factors—climate change, human impact, a century of fire suppression, marijuana farms on federal lands—requiring forest managers to continually adapt their strategies to new information, new methods, and new facts on the ground. Even so, a traditional study of various fire treatments would have been fairly straightforward: Do a range of experiments, analyze the results, publish some papers.

PUBLIC INFO: Learn more about the project at snamp.cnr.berkeley.edu.

But SNAMP’s goals went far beyond simply figuring out the best way to slow a wildfire’s spread. The experiment proceeded along parallel tracks, studying fire, forest health, fishers, owls, water quality issues, and spatial data. And crucially, public participation wasn’t an afterthought or an also-ran, but the key piece of the puzzle. According to **Kim Rodrigues**, PhD ’08 ESPM, a UC Cooperative Extension regional director at the time, “The overall goals of public participation are efforts to reduce conflicts around resource management on the ground.” Rodrigues focused on figuring out how to make public participation more meaningful and relevant.

While the Endangered Species Act and the National Environmental Policy Act both require public comment periods, actual community participation is often disappointingly low. “You really can’t just pay lip service to interaction when you have contentious issues,” says **Maggi Kelly**, Geography ’88, an ESPM professor and Cooperative Extension specialist who is a principal investigator (PI) of SNAMP’s Public Participation Team as well as its Spatial Team. “You have to dive in and do it in a committed way. You have to keep listening to your participants. These kinds of networks and coalitions can be really fragile, but they can also be really strong if nurtured correctly.”

How to best engage the public was an open question. The team eventually settled on a simple strategy: try everything. Kelly and others created a comprehensive, interactive website stuffed with videos, summaries

of scientific findings, and a huge trove of documents available for scientists, agency employees, and any member of the general public who took an interest. Perhaps the best feature was the discussion section, where people submitted questions about topics as varied as fuel break maintenance, government intrusion onto private lands, and the affects of the Native American practice of gathering pine roots. The questions received thorough responses from the team members, a level of public engagement that’s truly unusual for scientists who are more accustomed to responding only to peer reviewers.

The website was moderately successful. “But our stakeholders really prefer face to face,” says Kelly, so her team ramped up its in-person efforts. Extension agents who lived in the affected communities of Oakdale and Auburn made themselves available for public questions and concerns at board of supervisors meetings, PTA gatherings, and fire-safe councils. Beyond the standard bad-coffee talkathons, the scientists also held field trips to show these theoretical issues in action.

“Anyone can talk about ‘resilient forests,’” Rodrigues says, “but if you go to the Rim Fire [the massive 2013 Yosemite blaze] you can operationalize these terms. You can show someone that *this* is how a high-severity fire sterilizes the soil.” And the learning went both ways, according to **Lynn Huntsinger**, MS ’82 Rangeland Science, PhD ’89 Wildland Resource Science, an ESPM professor recruited by Battles for

her experience working with landowners. “I’ve seen management programs in the past where scientists don’t come to meetings and face stakeholders,” she says. “But in this case, the stakeholders ended up influencing the kinds of research questions that the scientists asked.”

Research in a Fishbowl

For the scientists, the entire process was occasionally frustrating as well as eye-opening. With the Forest Service creating the treatment plans, the PIs didn’t have the same experimental control that they might have had on UC-owned land. And not only did the researchers have to learn how to share their results with lay audiences, they had also committed to sharing their results with the public on an accelerated pace, before everything was in its final form and ready for publication. “It’s risky work doing research in a fish bowl,” says Rodrigues, now the executive director of academic personnel at UC’s Division of Agriculture and Natural Resources. “Scientists don’t like to be questioned, especially by non-scientists. And this team was questioned by the public, by team members, by managers.”

To start things out on the right foot, the entire UC team signed an explicit Statement of Neutrality. While

CENTENNIAL: Cal Forestry turns 100! See *Campus Briefs*, page 8.

acknowledging that such impartiality is difficult after a career spent studying the exact issues at hand, Battles quickly came to see how valuable neutrality was. Many of the participants from both management agencies and environmental groups had long and contentious histories with each other, often on issues unrelated to SNAMP.

“You really had to listen, just say your piece, and then not repeat it,” said Battles. “People would come to our meeting who had been cross-examining each other in court the day before. But our meetings had different rules, and they became a safe haven.” Many of the regular participants were employees of environmental organizations, the very people who—for better or worse—often make life difficult for professional land managers. And yet, just having them at the table, engaged in dialogue, helped to defuse tensions at an early stage.

CAMP OUT: Preserve UC Berkeley’s unique summer forestry field class for future generations. Support the Schwabacher Fund. See College Support, page 28.

Amid all the great meta-research going on, hard scientific questions were still being asked, specifically: Does treating a fraction of the land have significant effects on the rate of fire spread? The answer seems to be yes. “The best outcome,” according to Battles, “is to have no treatment and also no fires. But you’re just rolling the dice then. One percent of the landscape burns every year, and with climate change, that’s going to increase. Are you willing to live with that? What if it goes to 2 or 3 percent?”

While the SPLAT speed-bump idea has proven effective, implementing it more widely is not a slam dunk. According to Forest Service ecosystem management director Deb Whitman, “In reality, it’s hard to implement the way it was designed.” Managers must consider more than just fire spread when they lay out treatment plots. If a plot of land designated for clearing falls on an archaeological resource or a spotted owl nest, the ideal herringbone pattern of treatment must be adjusted.

Scaling Up

SNAMP has become a model for engaging the public on land management issues, but the



“The stakeholders ended up influencing the kinds of research questions that the scientists asked.”

Lynn Huntsinger with her ever-present clipboard

resources simply aren’t there to spend 10 years and \$12 million—the timeframe and budget allotted to SNAMP—every time a forest must be thinned. By some estimates, if you extrapolate the current rate of fuels treatment over the next 30 years, as much as 60 percent of the land that needs treatment won’t get it. “That’s a nightmare scenario,” says **Scott Stephens**, PhD ’95 Wildland Resource Science, a PI on the Fire Team. “Take the Rim Fire forward in an era of warming climate, and that’s really unacceptable.”

More prescribed burning and thinning means more need for the stakeholder participation that has been SNAMP’s hallmark. “We can’t have a science team or a Cooperative Extension team at every site,” says Rodrigues, but her team now offers train-the-trainer seminars to teach community groups, agency representatives, and others how to lead collaborative group discussions, facilitate diverse groups, work through conflicts, document key agreements, and other skills. According to Christine Nota, the Regional Foresters’ representative for the Forest Service, the techniques used in SNAMP “are very common now throughout our forests. We were just

counting up forest-based collaborations, and I think we’ve got 17 or 18 scattered around the state.”

Even better, it seems that the tools used to talk about prescribed fires are applicable to other areas where public concern is high, issues as varied as youth development, water conflicts, and even urban housing disagreements. “I really wish I’d had this kind of experience and training when the spotted owl was listed in the ’90s,” Rodrigues says ruefully. “Maybe we could have gotten better dialogue much earlier on.”

One point of general agreement that saw all SNAMP’s constituencies through difficult times was that the forests of the Sierra Nevada are worth working to protect. “All parties deeply care about the fate of these landscapes, and it was this care that sustained SNAMP for the long haul,” Battles says.

Another key consensus was that being in the middle of this chaotic process is exactly where UC needs to be. Faculty members love to dive deep into theory and advanced research, but the essential framework of a land-grant institution will always be mission oriented, a quest to solve concrete problems on the land. “I’m not a Forest Service employee, and I don’t work for an advocacy group,” Battles says. “And that’s the pitch for the public university. You have the independence. You can speak to power. And when the state asks for your help, you say yes.” **311**

PHOTO FINISH: The Metcalf-Fritz Collection is a photographic record of 100 years of Cal Forestry. See *The Big Picture*, page 29.



Public meetings were central to the SNAMP project. Clockwise from top left: Kim Rodrigues leads an April 2013 workshop; Scott Stephens at the 2012 annual meeting; a participant comments on a spotted owl presentation.

PHOTOS: Shufei Lei



CREATING A NEW STAPLE

1995 POLITICAL ECONOMY OF NATURAL RESOURCES

SERGIONÚÑEZdeARCO

In November 2013, *Time* magazine devoted a cover story to “thirteen gods of food . . . people who influence what (and how) you eat.” Among the top-flight chefs, food activists, and cookbook authors was Sergio Núñez de Arco, an energetic, 40-year-old Bolivian-born entrepreneur who makes his home in the Bay Area. *Time* grandly dubbed him the “king of quinoa,” but Núñez prefers a broader identification. Although he makes his living as a distributor of this ancient pseudo-grain (it is in the goosefoot plant family, which includes beetroot and spinach),

By Anne Canright | Photos by Vitaliy Prokopets

he is also, and more proudly, a champion of the indigenous people of his homeland who have raised this ultranutritious, gluten-free, biodiverse crop for centuries. And now their traditional knowledge, boosted by modern technology and market forces, is providing 45,000 Bolivian farm families a better life.

Quinoa grows best in harsh conditions, like those in the *altiplano* of the Andes, where elevations are between 8,500 and 12,500 feet, temperatures are severe, rainfall rarely amounts to 8 inches, and soils are full of salt. The people here live in dispersed communities, each comprising 30 or so families. “A farmer usually wakes up at 4 to 5 o’clock to get out and herd his llamas, which provide the fertilizer for the quinoa,” Núñez says. “After that, he’ll go help with the harvest, which is completely manual.” They plant in September, harvest by April.

In 2007, Bolivian quinoa farmers were making \$45 a month; now their monthly income is between \$400 and \$600—thanks in large part to Núñez, though he demurs. “It’s not one of those ‘here’s a handout’ kind of things. It’s *them* lifting *themselves* out of poverty. It’s a really cool story.”

The story begins, in a sense, in 1991, when Núñez enrolled at UC Berkeley. “I knew I wanted to work in poverty alleviation somehow. And I went to the College of Natural Resources because I love nature, too. So my idea was, how can we alleviate poverty but not exploit the environment? Mining is out of the question. But, sustainable agriculture?” Alain de Janvry, a professor of agricultural and resource economics, suggested that he take some archeology classes. “‘How could empires like Tiwanaku feed thousands of people,’ de Janvry asked me, ‘when now Bolivia is the second poorest country in the hemisphere with rampant malnutrition?’ He encouraged me to link this heritage and existing social structures to bring about development.”

After earning his bachelor’s degree, Núñez returned to Bolivia for seven years and was eventually hired by a development group to do market penetration strategy for quinoa. There, he found his niche as he began to interact with the farmers themselves and to realize the grain’s potential on the world commodities market.

In 2005, now back in the United States, Núñez started supplying 25-pound bags of Bolivian quinoa to small health food stores. He quickly realized that he would have to think more ambitiously. “The first big step was buying our first container of 20 tons,” says Núñez. “In every truckload, there’s a year’s product from 20 families. We targeted six truckloads that first year. Today, we sell almost 37 truckloads a month—740 tons—which is minuscule in terms of the commodity market, but it’s still bigger than wild rice.”

He took another leap in 2010 when he and several partners (including his brother Fabricio, a UC Davis graduate) set up a factory in La Paz to process quinoa. “There’s no off-the-

“What we’re seeing here is the birth of a new commodity, which is even more rare than Halley’s Comet. It’s a real discovery: a staple.”

shelf equipment. We had to adapt equipment to clean quinoa properly,” explains Núñez. They wash it free of tiny stones and twigs, remove the toxic powdery coating known as saponin, and sort the grains by color. It’s sophisticated equipment, run by indigenous workers. “The factory is impressive for people to see, and we wanted that, because pride for Bolivians is important.” It also provides “the same certification of food safety that a high-end U.S. factory would have.”

Regarding concerns that this success is pricing locals out of their traditional staple, Núñez says that farmers themselves continue to subsist on the grain, and city dwellers, typically, have never consumed it as a staple. A greater potential issue, he says, is the impact on native growers should production spread to regions such as China and India, causing prices to plummet worldwide. But for now, the benefits to his fellow Bolivians are quantifiable as *altiplano* communities enjoy improved health, education, and opportunity.

“What we’re seeing here,” Núñez says, “is the birth of a new commodity, which is even more rare than Halley’s Comet. It’s a real discovery: a staple. A staple that’s actually going to take.” But even more than that, it’s a staple that has proven “how it’s possible to bring about poverty alleviation through smallholder family farm development and sustainable, mainly organic agriculture.”



Left: Núñez (right) with Fabio Quispe, a farmer from a community in Salinas, Bolivia. Above: Local workers from the Anapqui cooperative at a regional cleaning factory.

Q&A Presents A Special Anniversary Interview

In this special edition of *Breakthroughs* Q&A, the planet Earth interviews the Department of Environmental Science, Policy, and Management (ESPM) on the occasion of the department's 20th anniversary.

BY RON AMUNDSON, ESPM PROFESSOR AND DEPARTMENT CHAIR



Earth: The rest of the planets have been concerned and are asking me, "What's up with your complexion?" I keep telling them I've had an outbreak of *Homo sapiens*, but they obviously can't relate. Maybe you can help me understand more about these blemishes I started to experience a few thousand years or so ago?

ESPM: We're humbled that you're coming to us for help. Around the time we formed the department, many people were starting to recognize that humans had made so many modifications to your surface that we had entered the geological epoch of humans, which has been referred to as

the Anthropocene. The name is a recognition of our close partnership with you. As you know from being around the last 4.5 billion years, the boundary between one geological period and another is commonly marked by catastrophic environmental change and mass extinction.

Earth: Yikes. Now that you mention it, I've been feeling a little feverish lately. I'm a bit dehydrated and I keep catching fire.

ESPM: We've noticed you're changing, too, and that we have a lot to do with it. So, 20 years ago we decided that to "save the Earth" (pardon the expression), we needed to have a mission of translating science into meaningful policy and educating a new generation of students to become leaders and innovators in environmental change.

The real challenge was that there was no program like this, so we merged several existing departments—many that had long Berkeley traditions, including forestry (see *Cal Forestry Turns 100*, page 8) and agriculture, into one. It wasn't a painless transition, but we realized that change and evolution are good (a lot better than extinction), and in the process, we were able to come up with a blueprint of how to do things differently—and better. We are now one of the most vibrant and exciting departments on the Berkeley campus and in the country. Our motto, "Our Environment at Berkeley," gets to the heart of what we are about: We believe that the environment is not some pristine forest in a remote mountainous landscape; it is our home, our community, and the future we hope our children will experience.



CRITTER: Climate change may be threatening the survival of the alpine chipmunk, ESPM research showed in 2012.

PHOTO: Risa Sargent

Earth: Just because you have all these people together now, does it really mean you can, as you say, save me?

ESPM: A lot is going to happen in the next 50 years—your climate will change, your reserves of oil will run out, your areas of new cultivable land will cease to exist, and we will outgrow what you can provide us. We hope to at least have a positive impact, and we believe that the ways ESPM has changed will allow us to do so. Being together and working toward a shared mission really does change what people do. Our teaching and research are geared toward ways to live within the resources of what a small rocky planet can provide.

program to develop strategies that alleviate poverty and decrease the pressure on biodiversity. As climate changes, the management of forests to prevent catastrophic wildfire is critical. Our Center for Fire Research and Outreach is the go-to voice for fire policy and management in the western United States and beyond. Soil is the foundation of civilizations, and ESPM continues its long history of international leadership in managing and preserving soil in agricultural and non-ag settings.

Earth: So, is this what that "one Earth is not enough" ruckus is all about? It's always something with you guys.

For example, we realized that the hunting of African wildlife for food is driven by social and economic pressures, and thus we have launched the Biodiversity, Health, and Livelihoods

ESPM: In the past several decades, human society has been consuming a bit more than what you annually provide for us or can naturally replace. Actually, most of us in ESPM believe



HANDY: Graduate students do soil research as part of Professor Ron Amundson's ESPM 122 class, Field Studies of Soil Formation.

PHOTO: Ron Amundson

you provide plenty for us. We just need to improve the ways we produce and distribute food, produce and recycle consumer goods, harness and conserve energy, and manage the soil and water.

Earth: Hmmm, that's a pretty big task list.

ESPM: True, but UC Berkeley is a big place, and ESPM is part of the great strides that the University is taking to address these goals. We helped launch the new Berkeley Food Institute, which is facilitating research and education opportunities in the science and policy of modern food systems. We are key partners in the Berkeley Initiative for Global Change Biology, a program geared toward shepherding our ecosystems through the changes of this century. Our faculty and students are leaders in the Berkeley Center for Science, Technology, Medicine, and Society and in the Berkeley Center for Green Chemistry. Some have even started public-benefit corporations, like Good Guide, which puts expert advice on the environmental and social impacts of consumer goods right in the mobile phones we carry. Some of our faculty and staff have also worked with the state to create cal-adapt.org, an interactive website that helps people understand how climate change will affect California.

Earth: Well, this seems like it might help. I was recently talking to Venus and Mercury about what to do with all of you. Mercury suggested I just boil off my atmosphere and that would take



ISLAND TIME: Graduate student **Erica Spotswood's** research investigates how the introduction of non-native fruit-eating animals, like this Tahiti kingfisher, and fruit-bearing plants on oceanic islands has altered seed dispersal relationships between birds and plants. PHOTO: Erica Spotswood

care of it. However, I really like the blue complexion all the humidity gives me. And, of course, I wouldn't want to wind up like Mars! We all get lots of laughs joking about how rusty Mars is. Whenever he orbits near us, we all yell, "Take off that red shirt!!!"

ESPM: Hmmm. We have a small private institution down the road that's sort of rusty and lifeless, too.

Earth: It certainly sounds like you've done a lot in just 20 years as a department, but you can't solve all my problems by yourselves.

BARKING: Research led by ESPM Extension specialist **Brice McPherson** and co-authored by professor emeritus **David Wood** found compounds in the inner bark of coast live oaks that predict a tree's susceptibility to the pathogen that causes sudden oak death, the devastating West Coast tree disease. These biomarkers could give forest managers their first nondestructive method to rate the risk their forests face, data that could drive efforts to preserve the most resistant forests. The paper appeared in the February 2014 *Forest Ecology and Management*.

PHOTO: iStockphoto



LONG RANGE: The UC Berkeley Range Ecology Lab, under the leadership of ESPM professor **James Bartolome**, is measuring vegetation change across space and time in Tejon Ranch's grasslands and isolating environmental factors driving the change. The Lab's findings will inform the management of the Tejon Ranch Conservancy, which contains portions of five major ecological regions.

PHOTO: Rebecca Wenk



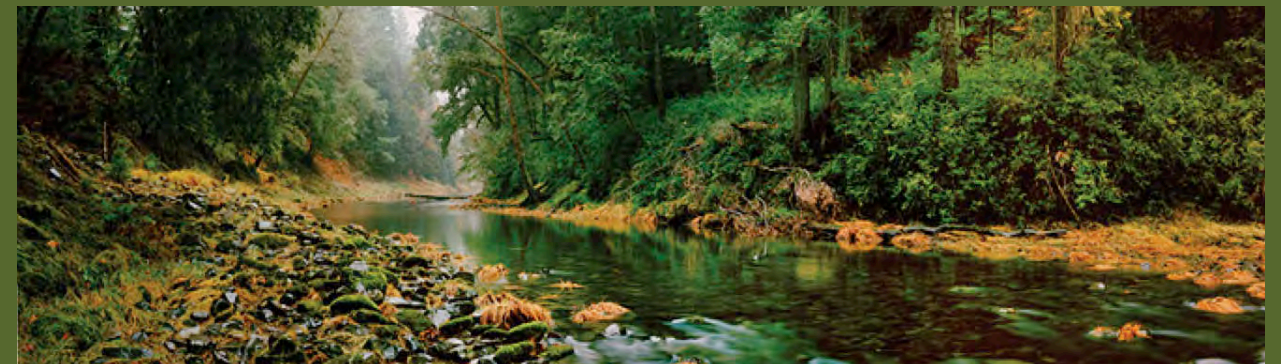
HEAT SOURCE: The fire-management technique of prescribed burns are tested at Blodgett Research Forest. PHOTO: Scott Stephens

ESPM: You are exactly right, so we are betting that our undergraduate students will be a leading force for change. ESPM now has more than 800 undergraduate students in five majors! And we are still growing. Our students are concerned about their future, the food they eat, the climate they will live in. But the most important thing about these students is that they are incredibly bright and want to do something about the world that they are inheriting. They have a lot at stake.

And, while we are excited about how fast we are growing, we are also proud of the small-college experience we provide these students. In fact, ESPM just became one of only 10 departments on the campus to participate in the

Berkeley Connect undergraduate mentorship program, which places students in a small group of peers that meets once a week with a graduate-student mentor. The students also get one-on-one mentoring, fun lessons about the campus's storied history, trips to our museums, and guidance on how to navigate through the Berkeley system—all with a free dinner! In just our first semester, we are already approaching our ultimate goal of 300 participants.

Earth: That sounds great! I try to keep a down-to-Earth outlook on life, but I have to say, you've inspired me. If the Anthropocene has this bright generation to keep an eye on me, color me optimistic. Happy anniversary, ESPM!



MISSION CRITICAL: A group of ESPM and earth and planetary science faculty will receive \$5 million over five years to study Northern California's Eel River watershed, one of four new National Science Foundation-funded Critical Zone observatories. "Critical zone" refers to the thin veneer of Earth from the groundwater to the tree tops that is critical to aquatic and terrestrial life. What the researchers uncover may eventually allow scientists to predict the impact of changing climate and land use on future droughts, floods, and water supplies.

PHOTO: Christopher Woodcock





THE ECONOMIC POWER OF HONEY

1996 POLITICAL ECONOMY OF NATURAL RESOURCES

AYELESOLOMON

Ayele Solomon says that “epiphany” might be too strong a word to describe what he experienced while driving through southwestern Ethiopia’s Kafa forest in 2009. But his realization that replacing traditional tree-hanging beehives with modern frame hives had the potential to solve multiple economic, environmental, and social ills in the region—an ecosystem under heavy threat of deforestation—has been a driving force in his work ever since.

By Molly Oleson | Photos by Molly Oleson

The Bay Area–based Ethiopian native is the director of project sourcing in Africa for Wildlife Works, the world’s leading REDD+ (Reducing Emissions from Deforestation and Degradation) project development and management company. He’s in the process of getting a 30-year carbon rights agreement signed by the government of Ethiopia. If secured, the agreement would allow Wildlife Works to manage a quarter of a million hectares (roughly 618,000 acres) of Kafa, where the company would encourage low-impact honey harvesting as a major alternative source of income to the crop farming driving deforestation. They could then quantify the amount of carbon saved in the trees, and sell carbon credits that would directly profit the surrounding communities.

“To me, that would be really big,” Solomon says. “Because I, along with Wildlife Works, would have brought to Ethiopia one of the largest REDD+ projects in the world and also the biggest conservation project in the country in terms of size and investment.”

The Kafa forest is a place that Solomon was passionate about long before he began working for Wildlife Works nearly three years ago. His thesis project at Berkeley focused on creating markets for the wild-growing *Coffea arabica* in Kafa, which was declared a UNESCO Biosphere Reserve in 2010.

Solomon was motivated by the economic challenges of average Ethiopians. Influenced by growing up in an agricultural family in Kenya—his agronomist father relocated for work from then-communist Ethiopia—at a time when his native country was in the news for famine, he knew he’d be back doing conservation work in Africa someday. “I’ve always had a connection with the land,” he says.

An internship at the U.S. Environmental Protection Agency, graduate work in natural resource development at Michigan State University, and field work in land degradation and sustainable land management shaped Solomon’s ultimate goal of leaving the nonprofit sector while still addressing agriculture, conservation of biodiversity, food security, development, and natural resource issues. Business school provided Solomon with a new approach. “It had some growing pains,” he says of his leap from research to the corporate world. But it was his launch of a consulting company in Ethiopia that led to the job at Wildlife Works and to his other current undertaking: the production of honey wine.

Evidence of people cutting trees in Kafa to produce charcoal and crops to supplement low incomes inspired Solomon to come up with a strategy that would provide an incentive for the conservation of natural resources. “You can’t just tell people to stop cutting trees and give them a little bit of carbon money,” he says, crediting Berkeley for influencing his pragmatic approaches to environmental issues and resource economics. “You have to create alternative livelihoods.”

Solomon is trying to get a 30-year carbon-rights agreement signed by the Ethiopian government. It would be the biggest conservation project in the country.

Solomon identified honey production using modern frame beehives as a key alternative livelihood that would not only create a five-fold increase in annual honey yields and a rise in the incomes they provide, but also create jobs for women, who have long been excluded from the tree-climbing practice of traditional honey collecting. Honey wine, known as *t’ej* in Ethiopia, could be an extension of the improved beehive, Solomon thought. He imagined that proceeds from wine production could fund the conversion of thousands of traditional hives to modern ones.

“I just sort of continued with the idea when I came back to California,” Solomon says of his desire to produce the golden drink, also called mead. “I developed a strong business plan, and the wine turned out great.” Originally, he’d hoped to use Ethiopian honey and export the wine from there. But the lack of both a wine industry infrastructure and a commercial market—“Everybody drinks their grandmother’s and mother’s honey wine”—convinced him to choose San Francisco as the base of his venture, The Honey Wine Company (BeeDvine.com).

Over the past four years, Solomon, whose business card title reads, “Imaginer,” has been perfecting his Bee D’Vine honey wine recipe in his East Bay garage. Collaborations with biochemists, professional winemakers, and Northern California beekeepers led to the maiden bottling in early 2014.

Someday, Solomon hopes to source specialty Kafa honey produced in modern hives. “We’re trying to link the two together,” he says of his Wildlife Works project in Kafa and his honey wine business. Both would contribute to improving a place he’s always been connected to. “So, full circle.”



Left: Solomon visits his beehives in Northern California. Above: He shows off a bottle of Bee D’Vine honey wine and his book, *The Celebrated Story of Honey Wine*.



Students at class in the woods at the 2011 Forestry Camp. Left to right: Christine Stontz, Alex Christensen, and Alanna McDermott.

PHOTO: Richard Standford

Photo by Herb Jensen

Herb Jensen, Fred Grover, Art Halloran, and a 1915 Ford on their way to Forestry Camp in 1928. The photo is part of the Fritz-Metcalf Photograph Collection, a treasure trove of historic photos of forestry at UC Berkeley, assembled by professors emeriti Emanuel Fritz and Woodcliff Metcalf. The collection was digitized and placed online in 2011, with free and open access, by the Marian Koshland Bioscience and Natural Resources Library.



Save Our Only-at-Cal Forestry Camp

In 1969, the *S. Donald and Bernice Schwabacher Fund* was established through a bequest by Mina Schwabacher and a gift from her nephew, S. Donald Schwabacher, and his wife, Bernice. Nearly a half century later, the endowed fund, which created a long-term revenue source, is still an essential resource to one of the College's defining educational experiences: the summer field class known as Forestry Camp.

Forestry Camp has provided thousands of students with a formative field-learning experience. It began in Quincy, Calif., in 1915 and then moved to a site in the beautiful mountains of the Plumas National Forest in 1917, where it still offers forestry majors and minors hands-on residential study in the forest. As the forestry program celebrates its 100th anniversary, this "classroom in the woods" remains an essential element of what makes our program so special, with many camp alumni describing their experience as life-changing.

The eight-week course provides an introduction to the scientific and professional dimensions of forest and wildland resource management. Students learn about ecology, plant life, range and wildlife management, silviculture, and forest operations and products.

Regrettably, because of rising costs, most colleges of natural resources have either scaled back their comparable programs, dramatically increased program tuition, or simply shut them down. Berkeley has been fortunate that

the Schwabacher family invested in the program, and several generations have continued to support it.

The simple fact is that Forestry Camp has survived and thrived because of the Schwabacher Fund, which makes it possible for the College to help make up the gap between student fees and the actual cost to run the field course. While students are taking the course, they do not have time to work over the summer months to help pay their way.

To celebrate the centennial of forestry at Cal and preserve the same quality of education for future generations of natural resource researchers and professionals, the College has set out to grow the Schwabacher Fund.

Gifts to this endowment fund will help meet the rising costs of tuition and camp operations, and sustain CNR's superior forestry field experience as an only-at-Cal distinction. According to Laura Oftedahl, the CNR alumni relations officer who is leading the campaign, "We're trying to preserve access to this huge part of what makes Cal forestry education at once rigorous, practical, and memorable."

— KATHRYN MORIARTY BALDWIN

GIVE TO THE SCHWABACHER FUND NOW

Go to nature.berkeley.edu/forestry100 and click the Give Now button, or contact Laura Oftedahl about other ways to support the forestry program: Oftedahl@berkeley.edu, (510) 643-9904.

See the Bigger Picture. Make a Better World.

Support the College of Natural Resources at givetocal.berkeley.edu. Just search for "CNR."