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Alumna Jen Guyton's photography raises crucial awareness about conservation. Read about her work on page 20.

PHOTO: Piotr Naskrecki

BREAKTHROUGHS

UC BERKELEY RAUSSER COLLEGE OF NATURAL RESOURCES • FALL 2020

The Sequestration Solution

Using compost to slow climate change and benefit farmers

PLUS

The Climate-COVID Connection

An Associate Dean for Equity & Inclusion

150 Years of Women at Berkeley

LETTER FROM THE DEAN

In 1870, the UC Board of Regents resolved to admit women on the same basis as men. Four years later, Rosa Scrivener became Berkeley's first female graduate, earning a degree from the College of Agriculture. Her historic accomplishment was one step toward a more just and equitable society. Throughout the year, we have highlighted Rausser College's exceptional women as part of the University's 150 Years of Women celebration.

In this issue, we feature a number of women who are advancing environmental scholarship. In a story about the connections between the COVID-19 pandemic and the environment, Rachel Morello-Frosch discusses disproportional health impacts on communities of color. Another piece spotlights Whendee Silver, who is examining how compost applications in soil could help mitigate climate change.

Our current moment is one of deep social upheaval. The groundswell of protest and other activism in the fight against systemic racism reminds us that, as an institution known for justice and free speech, we must continue to become more equitable and inclusive. Our new associate dean for equity and inclusion, Isha Ray, who is interviewed here, has been a thoughtful and dedicated advocate for addressing these challenges.

Meanwhile, Rausser College continues to face obstacles related to the pandemic, and I'm humbled by the dedication and resilience of everyone in our community. I want to express my thanks to our tireless faculty, staff, and students for their commitment to carrying out our public mission during this difficult time.

The College also acknowledges two important 2020 milestones in this issue: the 30th anniversary of the Department of Plant and Microbial Biology and the 50th anniversary of the conservation and resource studies major.

The following pages hold stories on these many developments and much more. I wish you good health and safety as we navigate these trying times, and I welcome your feedback at dackerly@berkeley.edu.

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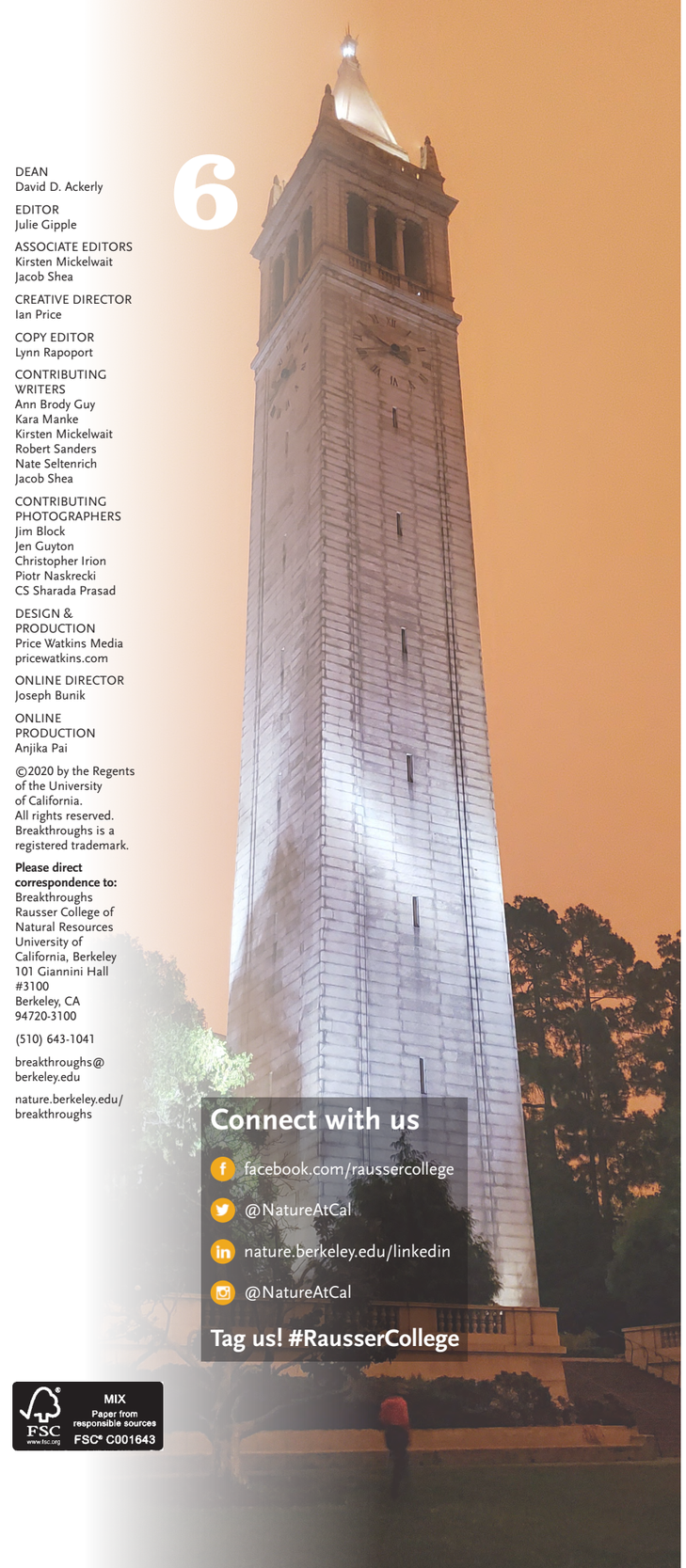

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PHOTO: Tony Gamez

FALL 2020

Berkeley Rausser
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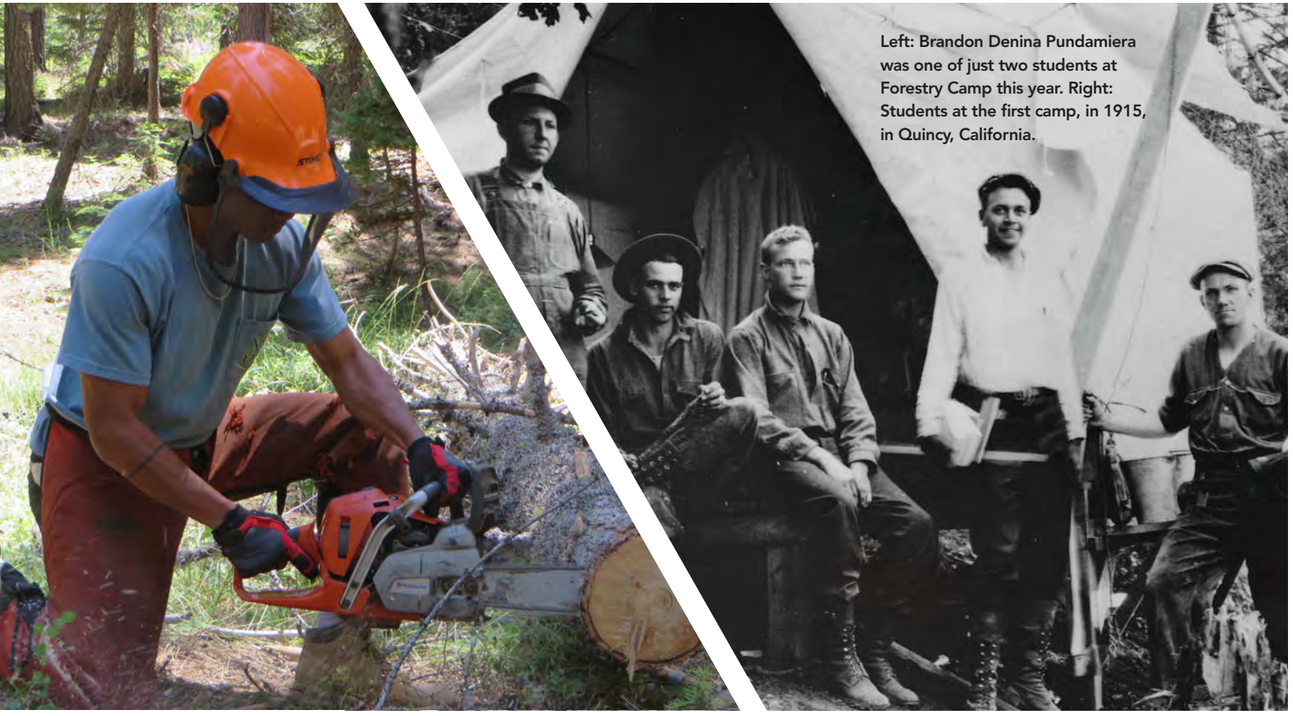
BREAKTHROUGHS

ONLINE

As part of the yearlong celebration of 150 years of women at Berkeley, the 150W History archive provides a glimpse of watershed historical moments through essays, oral histories, photo galleries, and more. View and contribute at **150w.berkeley.edu.**

COVER PHOTO: Adobe Stock



Left: Brandon Denina Pundamiera was one of just two students at Forestry Camp this year. Right: Students at the first camp, in 1915, in Quincy, California.

PHOTO (left): Scott Stephens

Distanced in the Woods: Forestry Camp Adapts during COVID-19

When it comes to the current pandemic, not even time-tested traditions have been spared disruption. But thanks to the resilience of Rausser College of Natural Resources students, faculty, and staff, a cornerstone of the forestry program—and one of the College's oldest traditions—continues.

Forestry Field Camp, an annual eight-week intensive program in the mountains of Plumas National Forest, introduces students to the scientific and professional dimensions of natural resource management. Students take courses in ecology and forest ecosystem management from both faculty and other forestry professionals. Normally, participants share sleeping quarters and eat communal meals. The camp offers a vital bonding experience and introduction to fieldwork.

This year, however, social-distancing mandates meant that the program could invite only a few applicants. Camp coordinators found a way to help ecosystem management and forestry majors **Brandon Denina Pundamiera** and **Natalie MacMillan** attend in order to fulfill their graduation requirements. They ate outdoors and stayed socially distant, while core faculty gave all the lectures rather than inviting guest speakers. Sadly, a collaboration with members of the Mountain Maidu tribe focused on Indigenous land management had to be postponed.

Since its founding in 1915 by Walter Mulford, the first director of forestry at Berkeley, the camp has been canceled only twice, during both World Wars. In the early 1900s, students had to take two trains to Quincy, then travel by horse and buggy on rudimentary roads. Some students even rode bicycles into the mountains—a distance of roughly 200 miles—camping along the roadside.

"Forestry Field Camp is a fantastic setting where students get learning opportunities, and the community that develops can produce relationships for life," said **Scott Stephens,** a professor in the Department of Environmental Science, Policy, and Management (ESPM) and the academic leader for the camp. "Our group really pulled together safely for an enriching experience, despite the pandemic."

— JACOB SHEA

Nobel Prize Honors Jennifer Doudna for CRISPR Discovery

Jill Banfield (left) and Jennifer Doudna at the inaugural Innovative Genomics Institute open house in 2017. PHOTO: Peg Skorpinski

UC Berkeley has long been a leader in producing Nobel Prize laureates. In October, biochemist **Jennifer Doudna** became the latest, winning the 2020 Nobel Prize in Chemistry. Doudna shares the prize with colleague Emmanuelle Charpentier for the co-development of CRISPR-Cas9, a revolutionary genome-editing tool.

CRISPR-Cas9 allows scientists to rewrite DNA in any organism, including humans, with unprecedented efficiency and precision. The groundbreaking power and versatility of CRISPR-Cas9 have opened up new and wide-ranging possibilities across biology, agriculture, and medicine.

Doudna's attention was first drawn to CRISPR by geomicrobiologist **Jill Banfield**—a professor in ESPM and the Department of Earth and Planetary Science—who encountered it while studying bacteria that live in extreme environments. Banfield reached out to Doudna in 2006 and, during a meeting at the campus's Free Speech Movement Café, sketched a diagram for her that outlined Banfield's understanding of CRISPR.

Today, the women are leaders in their fields. Banfield serves as the scientific director of microbiology research at the Innovative Genomics Institute, which Doudna leads. Charpentier is the director of the Max Planck Institute for Infection Biology. She and Doudna are the first women to win a Nobel Prize in the sciences together, which sends the message, Doudna said, that "women rock."

— ADAPTED FROM AN ARTICLE BY ROBERT SANDERS

Extracurricular Honors

There could be no better time than this, the year of the campus-wide 150 Years of Women at Berkeley celebration, to note achievements made by our own female faculty. Two Rausser College professors were recently recognized by the campus for projects outside their scholarly work.

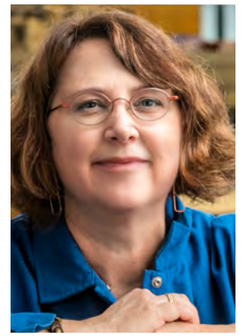
The inaugural Scheiber Emeriti Faculty Research Grant was awarded to plant and microbial biology (PMB) professor emerita **Zinmay Renee Sung** (below, left) for the study of Asian American women's experiences and representation on campus. Using historical records and journalistic interviews, Sung's project assesses the evolving social, cultural, and familial environments of Asian American women throughout the University's history.

As a PMB faculty member, Sung focused her research on flowering and seed development within plants at the chromatin level. This included examining specialization in the mechanisms behind plant-embryo development and analyzing the role of epigenetics in plant biology.

Another PMB professor, **Mary Wildermuth,** was granted the 2019–20 Chancellor's Campus-Community Partnership Award, which recognizes University-sponsored programs that improve the quality of life in communities outside the University.

Partnering with the city of Berkeley's three middle schools, Wildermuth designed and leads the Be a Scientist program, which for seven years has boosted science curriculum and provided mentorship by placing UC Berkeley researchers into seventh-grade classrooms. Over the past three years, more than 300 Berkeley research scientists have guided students through designing and carrying out their own scientific investigations.

— KIRSTEN MICKELWAIT



PHOTOS: Jim Block

Frontline Workers in the Fields

An estimated 800,000 farmworkers take seasonal jobs each year to help plant, pick, and package produce in California. During the pandemic, they have been forced to balance risk of infection and the need for income.

Developed by a broad coalition of researchers and community-based organizers, the COVID-19 Farmworker Study surveyed more than 900 farmworkers to gain an understanding of how the pandemic has exacerbated the challenges they face. Through phone interviews conducted in multiple languages, surveyors inquired about COVID-19 prevention at the workplace, housing conditions, health care access, and work-hour reductions, among other topics.

Susana Matias, a Cooperative Extension specialist in the Department of Nutritional Sciences and Toxicology (NST), participated in the survey design, data cleaning, and analysis. Rausser College undergraduate students **Celeste Nava, Alexander Gomez-Lara,** and **Stephanie Martinez** helped Matias analyze the data.

"Farmworkers play an essential role in the California food system and economy," said Matias. "Protecting this vulnerable population during the COVID-19 pandemic is critical for all of us."

Find study results and policy recommendations at covid19farmworkerstudy.org.

Rausser Groups Spearhead Pandemic Aid

PHOTO: Christopher Gee

In response to shortages of sanitization supplies and protective equipment during the COVID-19 pandemic, groups from Rausser College teamed up with the Energy & Biosciences Institute (EBI) to act. Since March, volunteers in the College have been producing and distributing hand sanitizer, masks, and disinfectant wipes. What began as the efforts of two graduate students in the Department of Molecular and Cell Biology spread across the University before coalescing into the Common Humanity Collective (CHC), a mutual aid group of Berkeley scientists, Bay Area activists, community leaders, and neighbors.

For example, in collaboration with EBI, the Coates lab started the Clean Hands Project (CHP), a volunteer-run initiative that provides sanitizer wipes to vulnerable communities. To date, CHP has produced at least 515,000 wipes, serving women's shelters, homeless encampments, and other sites across the Bay Area and the Central Valley, said **Yi Liu,** a researcher in the Coates lab. Volunteers in the Olzmann lab produced hand sanitizer and, working with the Berkeley Free Clinic, deployed bottles of it and handwashing stations to more than 20 homeless encampments. Another group, including professor **Arash Komeili** and Cooperative Extension specialist **Peggy Lemaux,** made more than 13,000 masks and distributed them to over 200 Bay Area locations and to Hmong and Mien refugee farmers in the Central Valley.

"There's been a shared spirit of both individual initiative and collective action in order to take some measure of responsibility for the well-being of our own communities," said **Christopher Gee,** a postdoctoral research associate in the Department of Plant and Microbial Biology who helped launch the mask-making effort.

Today, CHC has more than 100 active volunteers, a community-wide distribution system, and connections to more than 200 organizations. In August, Congressman Ro Khanna awarded CHC recognition for its support of Narika, a domestic violence organization. To get involved with CHC or donate, go to commonhumanitycollective.org. — JACOB SHEA

PHOTO: Courtesy of National Institute of Allergy and Infectious Diseases

In the best of times, research funding can move slowly. Now, during the COVID-19 pandemic—what many might call the worst of times—researchers are speeding up efforts to combat the virus. In April, a diverse group of venture capitalists created Fast Grants, a program that solicits research that will deliver quick-turnaround results to fight the pandemic. The goal was for projects to provide results within six months, and the Fast Grants team promised to evaluate proposals within 48 hours and send funding within weeks—much quicker than any other public or private agency.

To date, Fast Grants—which is part of Emergent Ventures, a project at the Mercatus Center at George Mason University—has distributed $22 million to more than 100 researchers worldwide. The roughly 4,000 applications have proposed research into nearly every aspect of the disease, from diagnostics to vaccines and treatments.

Daniel Nomura, a professor of chemical biology in NST, received a $1 million grant to lead a team developing highly potent small-molecule inhibitors that affect SARS-CoV-2's main protease, an enzyme that's critical for viral replication. "The rapid and substantial funding that we received from the Fast Grants program has been crucial in accelerating our progress toward the discovery of novel antiviral therapeutics to combat not only SARS-CoV-2 but also future coronaviruses," said Nomura.

His colleague **Anders Näär,** a professor of metabolic biology and the vice chair of NST, was awarded two grants to pursue novel treatments for viral diseases. With a $400,000 grant, his team is using antisense oligonucleotides to block the replication of SARS-CoV-2, targeting the virus's RNA genome. An additional $300,000 grant is funding detailed molecular analyses of host cell lipid synthesis and the pursuit of novel therapeutic avenues. — KIRSTEN MICKELWAIT

SUBJECT:
Why I Do Science

ENTRY BY:
Kathleen Ryan

ENTRY #:
019

There was no specific "aha" moment for my love of science; I grew up with an equal interest in STEM and the humanities. As an undergraduate, I majored in history of science at Harvard. Then I went on to an MD/PhD program at Johns Hopkins University and got my PhD in biochemistry and cellular and molecular biology. When it was time to finish my clinical training for the MD, however, I realized I didn't enjoy the medical environment. It was a pretty late discovery, but I was lucky to be able to correct my course.

One thing that drew me to science early on was an interesting property of living systems: the fact that cells as small as bacteria are highly organized and many of their component parts reside in specific subcellular locations. When I first learned that, it blew me away, and I wanted to know how bacteria do that.

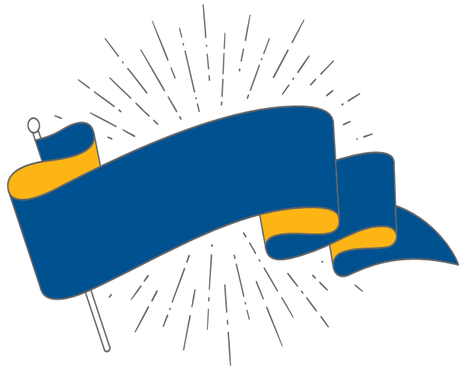
I'm fascinated by getting the bacterium to answer targeted questions. Generally, my experiments consist of asking, "How do you do that thing?" But the bacterium can usually only answer yes or no, so I have to be very clever in how I structure my questions. So I'll formulate a hypothesis and say, "I think you do it like this." Then the bacterium says yes (which is awesome but less frequent) or no (which is a bummer but more frequent). If the answer is no, I have to come up with another hypothesis and an experiment to test it, until the bacterium finally says, "Yes, that's how I do it! Glad you finally guessed right!"

My proudest moments have come from being a teacher and mentor. When my students reach their goals, like getting into graduate school or achieving tenure, I'm thrilled for them.

Kathleen Ryan is an associate professor in the Department of Plant and Microbial Biology. Her lab explores bacterial cell structure, regulation, and antibiotic resistance.

#Nofilter

After weeks of staying inside to avoid unhealthy air quality resulting from record wildfires burning across the West Coast, the Berkeley community awoke on September 9 to eerie, dark orange skies created by smoke sitting atop a heavy marine layer. Rausser College facilities manager **Tony Gamez** captured this picture of the Campanile around 9:30 a.m. Our fire experts regularly share their knowledge and research—including options for mitigation and adaptation—with policy makers, land managers, and the national news media. As part of Reunion and Parents Weekend in October, professor **Scott Stephens** delivered an online lecture titled "Fire in Western U.S. Forests: Friend or Foe?" Watch the recording at nature.berkeley.edu/fire-2020.



Two Departments Celebrate Landmark Anniversaries

Among other milestones at Rausser College this year, two departments are marking momentous anniversaries. The Department of Environmental Science, Policy, and Management (ESPM) is celebrating 50 years of the interdisciplinary Conservation and Resource Studies (CRS) program, which was designed for students to pursue the intersection between such environmental topics as natural resources, population, energy, technology, societal institutions, and cultural values.

CRS was originally co-founded as the Conservation of Natural Resources (CNR) major in 1969 by **John Hurst**—a Berkeley professor of education and a founder of Democratic Education at CAL (DeCal), a program of student-led, faculty-sponsored courses—and **Loren Cole,** who co-founded the Berkeley Ecology Center and the first urban recycling center in the U.S. The program was implemented in 1970. "The CNR major was one of the most innovative and creative majors to emerge from the free speech and educational movements of the '60s and '70s," said **Carolyn Merchant,** a CRS/ESPM faculty member emerita. "Today it remains as an inspirational opportunity for anyone interested in saving natural resources and the environment."

The Department of Plant and Microbial Biology (PMB) is also celebrating. For 30 years, it has built an internationally acclaimed reputation on its research and teaching programs in both plant and microbial biology. "PMB has risen from the disruption caused by the campus's 1986 reorganization of biology—merging four departments and two colleges—to place first in ecology (which includes plant biology) and second in microbiology in the 2020 *U.S. News & World Report* rankings," said microbiology professor **John D. Coates.** "Now we look ahead to another 30 years with a remarkably talented and diverse group of scientists researching the primary challenges of our times, including food security, climate change, and sustainability."

Saving Livestock by Thinking like a Predator

For predators like wolves, cougars, and snow leopards, a cow out to pasture may make for an easy and tasty meal. But when wild animals eat livestock, farmers face the traumatic loss of food or income, which frequently sparks lethal conflicts between humans and carnivores.

For thousands of years, humans have struggled to reduce the loss of livestock to wild carnivores, yet solutions remain elusive. According to a recent study led by ESPM graduate student **Christine Wilkinson,** the answers are rooted in basic ecology.

Wilkinson and her co-authors argue that understanding ecological interactions between predators and livestock—as well as the surrounding landscape—will allow farmers and wildlife managers to better target interventions to discourage predation by wild animals.

"There is no one-size-fits-all solution for livestock predation, because the variables at play change depending on the stakeholders, the landscape, and the carnivores and livestock involved—as well as the scale and cost of management tools," said Wilkinson. The study was published in the journal *Conservation Biology.*

PHOTO: Courtesy of Christine Wilkinson/National Geographic Society

A cow explores a predator-proof enclosure in Kenya's Soysambu Conservancy.

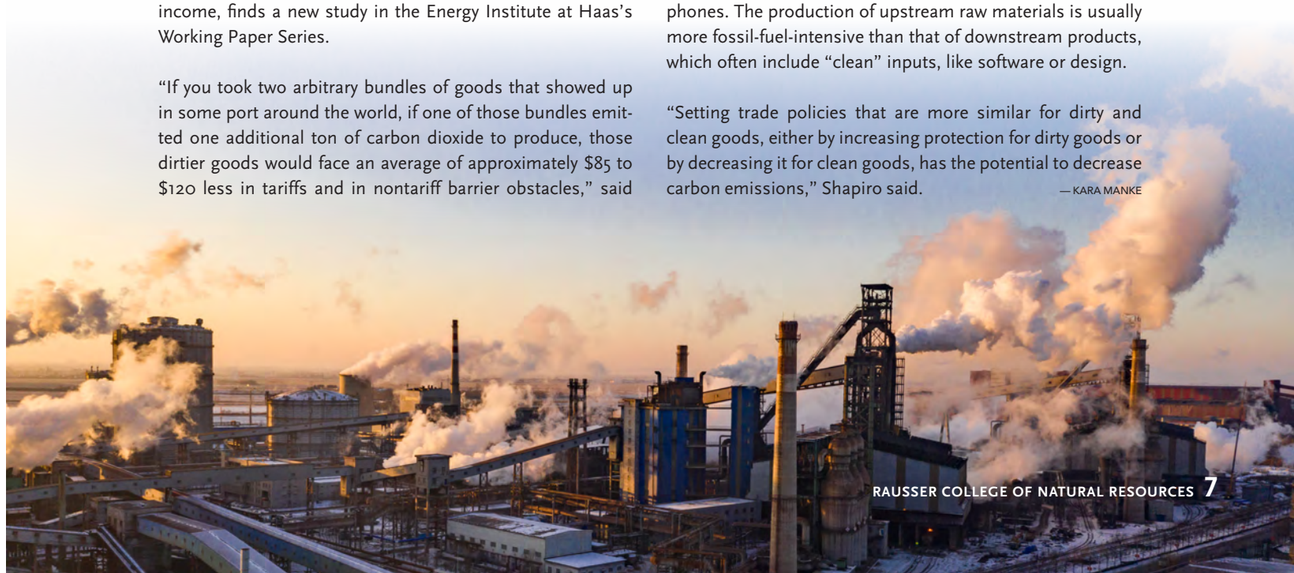
Using various case studies around the world, the paper demonstrates that management and deterrence strategies are more effective when tailored to these variables. It suggests that many nonlethal deterrents—such as guardian dogs, lights, electric fencing, or brightly colored flags—can help keep carnivores away. — ADAPTED FROM AN ARTICLE BY KARA MANKE

Lowering Carbon Emissions While Protecting Global Income

In recent years, products made by high-carbon-emitting, or "dirty," industries—including those using iron or steel, industrial chemicals, or paper—have faced much lower import taxes than cleaner products. Fixing this worldwide "environmental bias" in trade policy could greatly lower global carbon emissions while having little impact on global income, finds a new study in the Energy Institute at Haas's Working Paper Series.

"If you took two arbitrary bundles of goods that showed up in some port around the world, if one of those bundles emitted one additional ton of carbon dioxide to produce, those dirtier goods would face an average of approximately $85 to $120 less in tariffs and in nontariff barrier obstacles," said study author **Joseph S. Shapiro,** an associate professor in the Department of Agricultural and Resource Economics. The discrepancy between tariffs on products by dirty and clean industries is likely due to what economists like to call "upstreamness." Raw goods, like steel and aluminum, are the base materials for consumer goods, like automobiles and cell phones. The production of upstream raw materials is usually more fossil-fuel-intensive than that of downstream products, which often include "clean" inputs, like software or design.

"Setting trade policies that are more similar for dirty and clean goods, either by increasing protection for dirty goods or by decreasing it for clean goods, has the potential to decrease carbon emissions," Shapiro said. — KARA MANKE



The Climate-COVID Connection

Understanding the links between environmental change and public health is essential for creating effective solutions

By Ann Brody Guy

Lemurs are cute. For more than half of northeastern Madagascar's rural Malagasy people, they're also dinner. Once abundant, most of the 101 species of these primates are now critically endangered. Many members of the rapidly growing Malagasy population—driven by extreme poverty and food insecurity—overhunt, depleting a food source people have relied on for generations. They also clear trees to grow crops, eliminating lemur habitat and forests that provide planet-sustaining carbon sequestration.

Well-meaning conservation acts such as hunting bans aimed at preserving biodiversity haven't addressed the social drivers of this cycle. "Conservation efforts without considerations for how the Malagasy were actually using the forest appeared futile," says **Christopher Golden** (MPH '10; PhD '11 Environmental Science, Policy, and Management), an assistant professor of nutrition and planetary health at Harvard.

Madagascar epitomizes how climate change, human health, and social conditions interact on the ground. Rausser College of Natural Resources researchers have long studied this nexus, but the coronavirus pandemic—with its worldwide economic and human-health tolls—has laid bare the relationships for everyone to see. Social factors like poverty and urbanization change land use, which shifts biodiversity and animal habitats. In turn, increased contact between wild animals and people creates more opportunities for zoonotic diseases—those that jump from animal hosts to humans—to spread. The coronavirus that causes COVID-19 was one such opportunistic virus, which scientists believe was transmitted by a bat.

These systemic problems require interdisciplinary solutions. The good news is that Rausser researchers have been formulating such solutions for decades. The most sustainable of these share the premise that climate change, emerging disease, and social equity cannot be disentangled.

SUSTAINABLE FOOD, SUSTAINABLE FORESTS

The term "zoonotic disease" may not be widely known, but the epidemics caused by crossover into humans—such as COVID-19, Ebola, AIDS, Zika, and West Nile fever—are household names. More than half of the emerging diseases worldwide are caused by these crossover events.

Golden has been studying the environment-health-culture nexus in Madagascar for two decades, working with Malagasy communities to develop a sustainable protein source as an alternative to lemurs and other bushmeat.

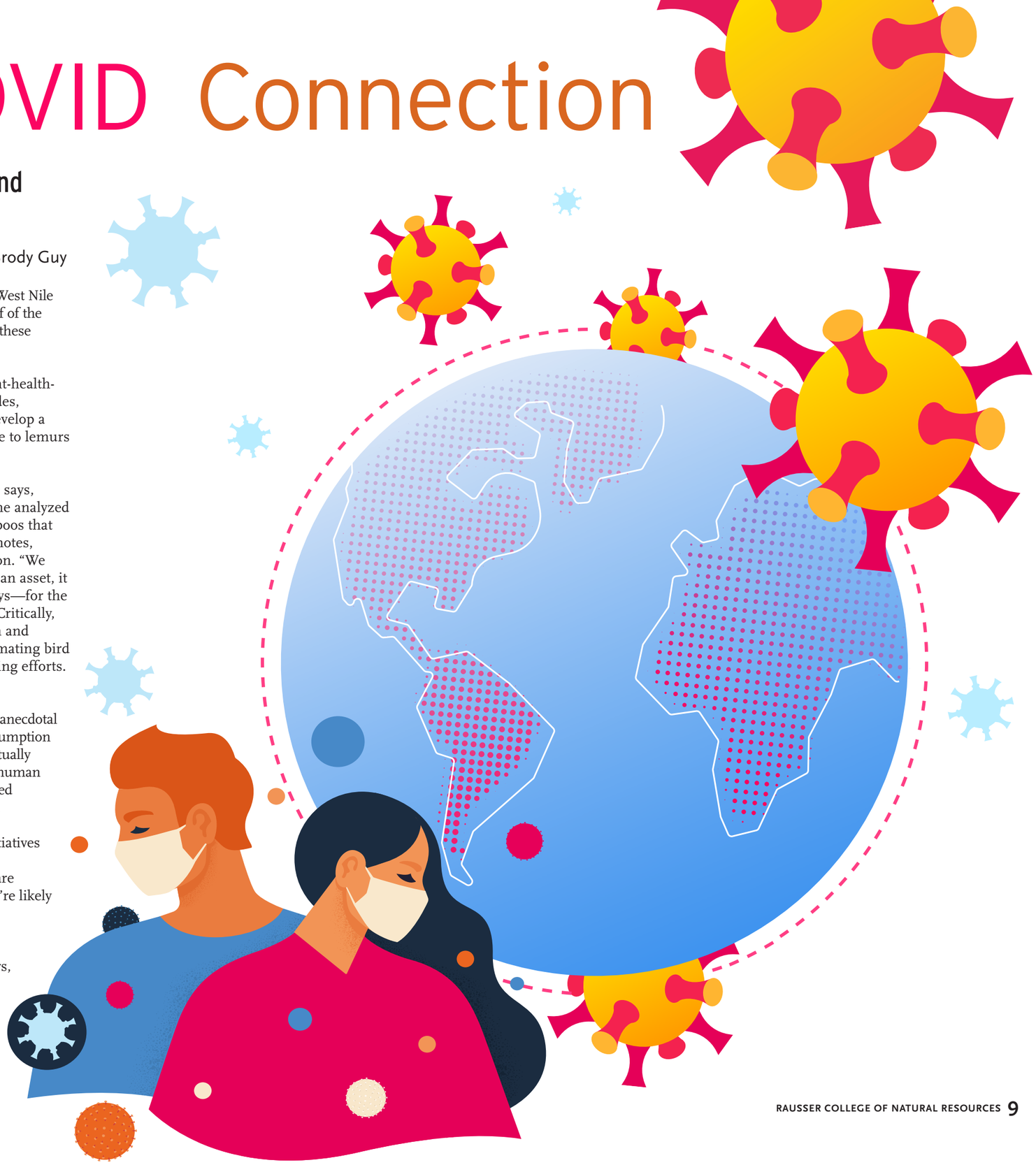
"Chicken was the top taste preference," he says, citing the findings from a study in which he analyzed 31 meats. Chicken skirted local cultural taboos that disqualified many other options. And, he notes, women typically manage poultry production. "We know that when women have control over an asset, it tends to be used in beneficial ways," he says—for the family's food, health care, and education. Critically, Golden spent years developing vaccination and training programs to mitigate a flock-decimating bird blight that had upended local chicken-raising efforts.

His innovations are now making poultry an economically viable choice, judging by early anecdotal reports, which show increased chicken consumption and reduced hunting. Golden hopes to eventually see benefits on all fronts: decreased animal-human contacts, less forest destruction, and improved nutrition and food security for the Malagasy.

"Pairing conservation and development initiatives together supports local people's needs," he says, "particularly when wild food sources are unsustainable and even more so when they're likely disease reservoirs."

KEEPING ANIMALS AND HABITATS HEALTHY

Bats are particularly active disease reservoirs, according to **Cara Brook**, a Miller Institute postdoctoral fellow working with the labs of **Britt Glaunsinger** and **Mike Boots**. Brook has collaborated with Golden on lemur studies, but her specialty is bat-borne zoonotic disease.






Modeling of infectious-disease transmission uses three factors, she explains: the infectiousness of the disease-carrying host, the susceptibility of the recipient host, and how often the two come into contact. "Any lever that pushes and pulls on those three components impacts the transmission rate," she says.

Live-animal markets, for example, pull two levers. They create frequent animal-human contacts, and the stressful market environment—stacked cages—makes the animals more infectious. "Animals tend to shed more virus in the same way that humans who host herpes viruses do: we get cold sores when we're immunocompromised," Brook says.

Likewise, the stress of malnourishment makes bats more infectious, and when habitat shifts like deforestation bring them closer to people, transmissibility goes up. Brook works with Bat OneHealth, an international group of zoonotic-disease researchers who study bat-human contact at sites worldwide, including near Brisbane, Australia, where fruit bats have been roosting in downtown parks and shedding the lethal Hendra virus.

In a pilot project, Bat OneHealth scientists are replanting bat roosting and feeding habitats to improve the animals' nutrition and draw them back into the forest—and away from people. Tree planting mitigates both climate warming and disease risk. "That's a way that improved conservation of forest resources for these animals can also reduce greenhouse gases, a win-win," Brook says.

UNDERSTANDING DISEASE-VECTOR CHANGES

Valeri Vasquez (MS '18 Energy and Resources Group), an ERG doctoral candidate, is using computational models to research how genetic technologies might work as public health interventions. "We've had pandemics before; what we haven't had is access to this volume of data," says Vasquez, who spent five years working in the Office of the Special Envoy for Climate Change in the Obama administration's State Department. Her models help scientists explore how disease vectors like mosquitoes will react to climate change and how methods to control them—for example, gene-editing or sterilization techniques—may need to shift accordingly.

Vasquez's dissertation comprises case studies related to malaria, dengue, and other mosquito-transmitted diseases. As global warming shifts precipitation patterns, mosquitoes are moving. "Are we going to see more or less malaria, or might it start surfacing in new geographic areas?" she asks.

If scientists can better understand how disease vectors might adapt to climate change, more-effective preventative measures can be taken.

HEALTH EQUITY

In the United States, ESPM professor **Rachel Morello-Frosch** (BS '88, MPH '93, PhD '97) has spent her career focusing on communities that are the most vulnerable to health impacts from climate change.

"From a biological standpoint, viruses don't discriminate," Morello-Frosch says. "But COVID-19 has shown us how racial inequality, climate change, and public health are intimately connected—for instance, how inequality and structural racism result in COVID-19's disproportionate impact on African American, Latino, and Indigenous communities."

America's racialized division of labor is partly to blame, she says. People of color and those living in poverty are more likely to hold such "essential occupations" as grocery clerk, farmworker, or home health aide—jobs that tend to increase virus-exposure risk while providing limited health care coverage. These same communities have a higher prevalence of underlying health conditions—cardiovascular disease, diabetes, asthma—that exacerbate COVID-19's impacts. And they are often located in neighborhoods with higher air-pollution exposure, which, research shows, damages the respiratory system and can lead to COVID-19's worst outcomes.

Morello-Frosch says that understanding these linkages provides opportunities for change. As California updates the climate goals first laid out in Assembly Bill 32—at the time of its enactment, the most ambitious climate-change policy in the nation—it's simultaneously lowering greenhouse gas emissions and strengthening public health. For example, California's Community Air Protection Program, part of Assembly Bill 617, funds local air-quality monitoring and action plans to reduce pollution emissions.

"There are huge opportunities for short-term public health benefits, because with every ton of greenhouse gas emitted, there are also co-pollutants, like particulate matter, that affect health right now," Morello-Frosch says. One of her recent California studies documented a corresponding 2 percent decrease in preterm-birth rates within two years of nearby power plant closures. "To put that in perspective, if we invented a drug that reduced preterm-birth rates by 2 percent, it would be considered a blockbuster."

CLEARING THE AIR

As the country struggles to get back to normal, Morello-Frosch hears more conversations about the intersection of social and environmental justice. The phrase "I can't breathe" has become connective tissue, she notes. George Floyd's tragic plea is a metaphor for police violence against Black and Brown people, but it also conjures the hallmark symptom of the sickest COVID-19 patients and evokes the respiratory impacts of living in polluted areas—even without the smoky air of climate-change-driven, high-intensity fire seasons.

"Our country needs to keep making these connections between justice, sustainability, and equity as we forge our economic recovery," she says. "A recovery strategy has to provide economic and climate-mitigation opportunities that protect the most vulnerable among us."

Vasquez, whose Obama administration work led up to the Paris climate agreement, has participated in such policy deals on a global scale. She says that as researchers develop policy recommendations, human factors like popular will and empathy are just as important as the science.

"As scientists, we sometimes think, 'I just need to explain it better.' But with COVID-19, we're seeing the need to tap into empathy, into people's willingness to care about others," she says. "You have to meet people where they are, in the contexts in which they have lived their lives."

The Sequestration Solution

Whendee Silver's research shows that compost doesn't just benefit farmers—it captures carbon

By Nate Seltenrich

PHOTOS: Adobe Stock (left), Jim Block (right)

Guido Frosini reaches down and wraps his fingers around a clump of orchard grass. He tugs at the foot-tall stalks, snapping them a few inches from the surface and leaving a tidy clump of green stubble. He's not trying to kill the plant. Rather, Frosini is demonstrating how his cows—currently dining elsewhere—benefit the pasture by grazing it under careful management.

Though not technically a native variety, perennial orchard grass is a welcome sight on this hundred-acre patch of rural West Marin known as True Grass Farms. Cows love the nutritious plant but, more important, it's also a clear sign that Frosini's soil is getting healthier. For that, he owes a small debt of gratitude to **Whendee Silver.**

Since 2018, Frosini, whose family's ties to the land date to 1867, has overseen the application of thin layers of compost on 12 of his acres. He hopes this will reverse soil compaction, improve water retention, increase grass and tree productivity, and draw atmospheric carbon into the soil.

Though Frosini has never met Silver—a professor in the Rausser College of Natural Resources' Department of Environmental Science, Policy, and Management (ESPM)—her research has not only informed his soil treatment but also, more indirectly, helped to fund it. By establishing through rigorous science that applying compost to actively grazed rangelands helps sequester atmospheric carbon in the soil, Silver has provided a foundation for programs across the country that pay people like Frosini to spread compost.

"When you add compost to soils, it increases plant growth, helps maintain water-holding capacity and nutrient supply, and reduces erosion," Silver explains. "You end up with more organically rich soil and more nutrients, so the plants grow better, and those plants are pulling carbon dioxide out of the atmosphere and helping to slow climate change."

"You can see the direct benefits"

True Grass Farms, which, among other products, sells "grassland-fed and -finished" beef, proves Silver's point. Frosini received a grant in 2018 from California's Healthy Soils Program, a four-year-old initiative directly informed by Silver's work, that helped cover the cost of buying two years' worth of compost for his first five acres.

"It's such a long process to build soil, and it takes so little to take it away," Frosini says. "The function of the carbon farm plan allows us as ranchers to take on certain tasks that may not seem profitable but are necessary if we're going to sustain food production in a more holistic, continuous way, and not just on a generation-to-generation basis."

Frosini is already seeing a return on the compost applications—even beyond the arrival of scattered perennial grasses. "From a producer's standpoint, you can see the direct benefits," he says, noting that where compost has been spread, he's seen more-uniform cattle grazing and a general increase in plant productivity and crop production.

Below the surface, there are even more benefits. Petaluma-based nonprofit Point Blue, which is helping to monitor some less-obvious changes resulting from compost applications through the Healthy Soils Program, has already reported less soil compaction compared with untreated plots. It is also measuring increases in carbon levels in Frosini's soil, but as of press time results were not yet available. Frosini says he plans to continue spreading compost—now produced on-site—across his entire ranch, a quarter inch deep and five acres at a time.

The potential for huge impact

According to a 2018 study in the journal *Science Advances* by Silver and her colleagues at UC Berkeley and the Lawrence Berkeley National Laboratory, carbon sequestration on agricultural lands through organic soil amendments and other practices—for example, reduced tillage and use of cover crops—could have an appreciable impact on global surface temperatures.

Silver's team used a combination of climate and ecosystem modeling to determine that, by helping to store new carbon, such agricultural practices could reduce global temperatures by up to a quarter of a degree Celsius by 2100. The greatest cooling effect was achieved when enhanced soil carbon storage was combined with greenhouse gas emissions reductions in other sectors.

A previous study of Silver's in 2013 found that adding compost to just 5 percent of California's rangelands could sequester the equivalent of 28 million tons of carbon dioxide over a three-year period, offsetting nearly one year of emissions from the state's agriculture and forestry sectors.

In recent years, Silver's work has earned her the attention of such media outlets as the *New York Times, Slate,* and *NOVA*. Most articles on her research and the broader practice of "carbon farming," a concept she has helped to popularize, reference these impressive figures. And inevitably, as in a *New York Times* headline, the question is raised: Can compost save our planet?

Tempting as it may be to sell it as the solution to what remains humanity's greatest challenge, Silver herself is more circumspect. "Combined with emissions reduction, it's part of a portfolio to help

slow climate change," she says. "We need to come up with multiple ways in which we can do that, and this is just one. But it's one that makes really good sense and has a lot of benefits."

Compost vs. manure

Coincidentally, the research behind the policies that helped fund the compost applications that are now sequestering atmospheric carbon at True Grass Farms and elsewhere all began about 20 miles from Frosini's ranch. In 2007, a landowner named John Wick and a rangeland ecologist named Jeff Creque—whom Wick had hired to help him rehabilitate his ranch at the southern end of Marin's Nicasio Reservoir—reached out to Silver. At the time, she was already established as an expert in soil biogeochemistry: the study of physical, chemical, and biological processes in the soils of different landforms and ecosystems.

Wick wanted to know if Silver could determine whether the carefully managed cattle-grazing program he'd recently implemented on his 540-acre ranch, which appeared to be improving productivity and biodiversity, was also putting carbon in the ground—and if so, how much? Silver agreed to investigate, and the rest is history.

Preliminary research throughout Marin and Sonoma Counties indicated that ranches using organic soil amendments (primarily manure

"Emissions reduction alone is no longer sufficient to solve the climate crisis. We have to combine emissions reduction with carbon dioxide removal."

— Whendee Silver

Informed by Whendee Silver's research and with start-up funding from California's Healthy Soils Program, Guido Frosini (left) has been applying thin layers of compost to his land at True Grass Farms since 2018.

PHOTOS: Courtesy of True Grass Farms

but also compost) had higher levels of carbon in their soil. Spreading manure isn't attractive as a sequestration tool because it releases lots of nitrous oxide as it decomposes. But compost doesn't pose that problem.

In 2008, Wick, Creque, and Silver formed the Marin Carbon Project to further study soil carbon and its sequestration through compost applications, with Silver serving as lead scientist. The first applications began that year on two grassland study sites: one on Wick's coastal ranch and another in the Sierra foothills.

Five years later, early data indicated that it had worked, paving the way for new incentives for composting and carbon farming through both California's Healthy Soils Program and the federal Environmental Quality Incentives Program.

Subsequent research led by Silver through the Marin Carbon Project has also proved influential. It has informed policies that will help California develop adequate supplies of compost. It convinced the state to include rangeland soil carbon sequestration in its climate change mitigation activities for the first time, implementing concrete targets for emissions reductions from natural and working lands. And it has supported initiatives similar to the Healthy Soils Program in other states.

"Whendee's research opened the window on an understanding that there was real potential to sequester significant quantities of carbon on working landscapes through management," Creque says. "While the original research focused on compost, once we saw the potential, we realized there are many, many ways to increase carbon capture on working landscapes."

"Once we saw the potential, we realized there are many, many ways to increase carbon capture on working landscapes."

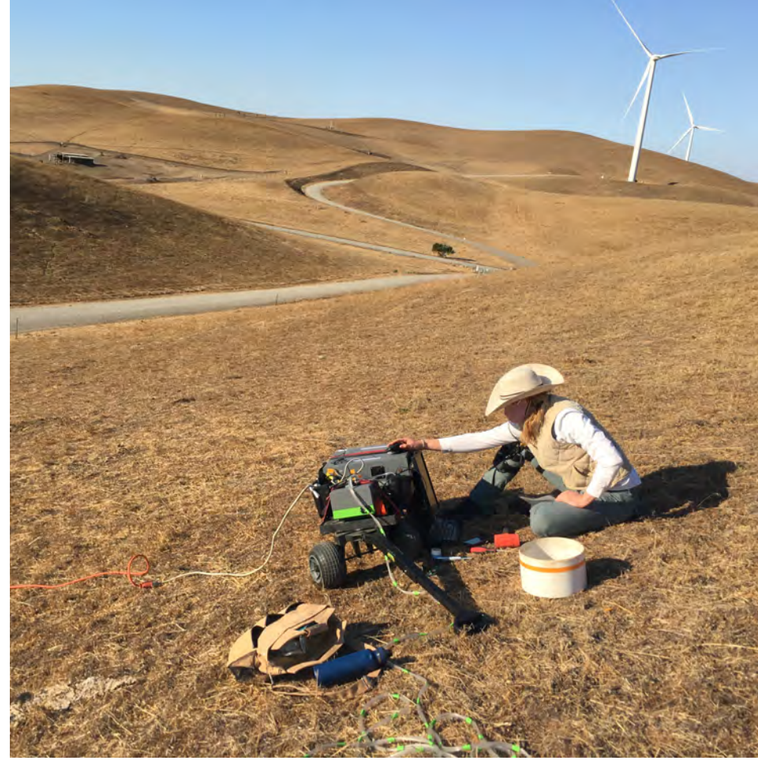
— Jeff Creque

The Silver group's research involves measuring the amount and stability of soil carbon, determining water content and soil mass, analyzing carbon storage mechanisms, and more.

PHOTOS (clockwise from top left): Tyler Anthony, Yuan Lin, Allegra Mayer

"When we first started, we got a lot of skepticism about the use of soil carbon as a climate strategy. Now that project has shown that it's possible."

— Rebecca Ryals



Alexia Cooper, a student working with Rebecca Ryals, PhD '12 ESPM, samples soil greenhouse gas emissions from a composted grassland.

PHOTO: Courtesy of Rebecca Ryals

Understanding other untapped solutions

While completing her PhD, **Rebecca Ryals**, PhD '12 ESPM, worked closely with Silver on field experiments, reviews of existing scientific literature, and five published articles. This early work laid a foundation for ongoing research in Silver's lab as well as Ryals's early career as a faculty member at UC Merced. She now teaches agroecology and continues to study innovative ways of mitigating climate change through soil and nutrient management. "When we first started [working together], we got a lot of skepticism about the use of soil carbon as a climate strategy," Ryals says. "Now that project has shown that it's possible."

More recently, she says, it's been gratifying to see so many people (and media outlets) talking about compost application and climate change—an evolution that has given her hope for other unconventional ideas that may also play a role. "I've been trying to use that model to understand other untapped, unstudied solutions," she says—for instance, using biochar or sanitized human waste to improve soil health and reduce atmospheric carbon, or applying compost on steep slopes and in Central Valley orchards.

In 2015, Silver began collaborating with graduate student and lab member **Allegra Mayer**, now in the final year of her PhD. Mayer served as lead author of the 2018 *Science Advances* paper modeling global temperature decreases and is currently working on a follow-up project with a focus on California.

She is also collaborating with Silver and researchers at the Lawrence Livermore National Laboratory on a study that will use carbon isotopes and a process called accelerator mass spectrometry to gain insight into a central question about which little is known: "Once you sequester carbon in soil, how long will it stay there, assuming that you're not specifically disturbing it?" Mayer says.

Finally, results from Silver's 10-year resurvey of the original study plots on Wick's ranch and in the Sierra foothills are also pending. Originally set to be submitted for publication earlier this year, the paper has been delayed by lab closures associated with COVID-19. Preliminary results, however, are promising. Silver says she can't discuss the findings publicly until they are released.

"We need to do something about this"

In the meantime, she has plenty to keep herself and her lab of 18 members occupied. For one, Silver also serves as co–principal investigator of the UC Working Lands Innovation Center, a multicampus program established in late 2018 with a three-year, $4.7 million grant from the state of California. Its charge is to research and deliver scalable, "shovel ready" methods of using soil amendments—including compost, ground rock, and biochar—on agricultural lands to capture carbon in soil and reduce emissions of carbon dioxide and other greenhouse gases. This in turn supports the state's official goal of bringing net carbon emissions to zero by 2045.

Along with her high-profile work on soil carbon sequestration, Silver has long led research into many other areas of biogeochemistry and ecology, in both the U.S. and tropical regions.

Over the past three decades, she has written or coauthored more than 170 papers. The complex interactions between soil and ecosystem dynamics, greenhouse gas emissions, land-management decisions, weather events like hurricanes and droughts, and climate change have long been on Silver's mind. But about 15 years ago, she says, she came to the sudden realization that simply studying and measuring climate change wasn't enough.

"I looked up and said, 'You know, we need to do something about this. We need to dedicate some of our research to figuring out ways in which we can slow climate change,'" says Silver. "So we added that into our research program, to begin looking at what lowers greenhouse gas emissions in natural and managed ecosystems. Can we understand that thoroughly enough to have it become standard management practice?"

In this sense, it's not compost or even soil that motivates Silver. What drives her is something bigger, something she mentions again and again: solving the climate crisis. Her urgent yet holistic perspective is reflected in her teaching at Berkeley, particularly a class called Bending the Curve. Offered at several UC campuses, this completely online course about climate change solutions may eventually be brought to Rausser College as a regular offering. For her work in both the field and the classroom, Silver was recognized as UC Berkeley's first Faculty Climate Action Champion in 2015.

"We have to realize that emissions reduction alone—just driving less or keeping the lights off or other forms of emissions reduction—is no longer sufficient to solve the climate crisis," Silver says. "We have to combine emissions reduction with carbon dioxide removal."

Compost holds promise as a sequestration tool and offers a host of other benefits to boot. "This is one of those no-brainers that we should be doing anyway."

Q&A

Isha Ray: Water and Environmental Justice Scholar, Associate Dean for Equity and Inclusion

By Kirsten Mickelwait

A professor in the Energy and Resources Group and a former co-director of the Berkeley Water Center, **Isha Ray** pursues research on access to safe, affordable water and sanitation for the rural and urban poor as well as the role technology plays in advancing sustainable development and social equity. She and her students work with low-income communities across the developing world and in California's Central Valley.

In July, Ray became the inaugural associate dean for equity and inclusion at Rausser College, but her work in social equity and inclusive activism began decades ago. We spoke with Ray recently about how her research and her new role intersect at this particular cultural moment.

Isha Ray's research is focused on social justice for marginalized communities. PHOTO: Christopher Irion

You took this role on in the immediate aftermath of George Floyd's murder and the nationwide Black Lives Matter protests. How has that context shaped your approach to the work?

Those historic events telescoped a lot of existing concerns among students and faculty. Despite some progress, there have been key exclusions in the way that academia has traditionally done business, particularly with respect to African American scholars and scholarship. It quickly brought to the forefront how much room there is to improve at Berkeley.

After the Floyd murder, there was a serious need for reflection and open dialogue. I began having conversations with all of the College's equity advisers about specific challenges and where they need the most guidance and immediate changes.

Much of your research involves the intersection of gender bias with water, sanitation, technology, and development. How does that work dovetail with your new role?

Equity and inclusion have always motivated me, in both research and teaching, and I've served as an equity adviser in my department for many years. My field research has always focused on social justice, particularly in communities that are neglected and marginalized and with people struggling to be included as full citizens. You would think that, in this century, clean, affordable drinking water wouldn't be such a huge ask, but apparently it is.

Common top-down rationales from governments are that these services are not affordable or feasible. For instance, the cheapest way to get pit latrines in rural—and even some parts of urban—India is to get extremely poor people, overwhelmingly women, to manually clean out the waste. Such conditions are unacceptable, and activists on behalf of toilet cleaners have fought long and hard for more-humane conditions and protections. In that sense, I'm very familiar with the voices demanding inclusion, the anger and hopelessness that comes from not feeling recognized as a full human being. The demand for equity is always a destabilizing factor—in any country—because it requires a power shift within the system.

In addition to her research, Ray has collaborated with alum **CS Sharada Prasad,** PhD '18 Energy and Resources, on photo essays covering water and sanitation for the rural and urban poor. This photo, originally published in a piece about toilet cleaners in Lucknow, India, on World Toilet Day in 2017, depicts a woman named Vasumati cleaning a household latrine. PHOTO: CS Sharada Prasad

What excites you most about this new role, and how do you see it calling upon your experience?

It was an important gesture for the College to elevate this concern and create this position. Even though I'm very familiar with issues of exclusion and lack of recognition, I'm still on a learning curve about how to translate those learnings into an academic administrative context. This has to be a collaborative community effort—it's not something I alone can own. Still, every great collective effort needs someone to fully engage and become accountable. My style is not top-down; it's more to be the hub around which people can learn, strive, and build an improved system.

What are some of the issues you're already seeing that need to be addressed?

We need to be making much greater efforts not only to recruit BIPOC (Black, Indigenous, and people of color) faculty, staff, students, and postdocs, but also to support and retain them once they're here. That's as big a priority for me as bringing a more diverse group into academia: creating a supportive environment that helps them to become the best scholars and teachers they can be.

In addition, as a college, we haven't been as progressive as we could be in looking at the wide range of outlets in which BIPOC scholars express themselves or publish their works. We've fallen back on a kind of canon for training our students that hasn't embraced diversity. How students recognize various modes of scholarship is an important aspect of equity and inclusion.

We now understand that inclusion isn't only about the demographics of the people we attract, but also about breaking the mold and opening our perspectives to see excellent pedagogy and scholarship in a wide range of forums. These aren't simple issues, and there's no silver bullet, but the effort needs to begin now. Not just to be more inclusive, but to be more excellent.

PHOTO: Piotr Naskrecki

AN EYE FOR CONSERVATION

BS 2010 CONSERVATION AND RESOURCE STUDIES

JEN GUYTON

As a researcher and photographer, **Jen Guyton** has followed wildlife across four continents. For nearly a decade, her photography has depicted wildlife, communities, and natural disasters in Africa. Her photographs have appeared in such publications as *BBC Wildlife* and *National Geographic,* and she has won numerous awards for her work.

By Jacob Shea | Photos by Jen Guyton

In 2015, Guyton found herself in Mozambique's Gorongosa National Park with a pangolin and its infant in her lap. The scaly mammal, resembling a cross between an anteater and a fish, had a pungent smell and a formidable weight. Park rangers had rescued the pair from poachers, and Guyton, deeply moved by the animals' release, later recalled the moment on her blog. "In Chinese mythology, pangolins are wayfarers. It's said that they travel the world by digging through the core of it, tying the earth together with a vast underground labyrinth," she wrote. "I'd like to think she's safely reached the Alps by now."

Since her undergraduate years at the College of Natural Resources, Guyton's photography has reached millions and brought to life the world of wildlife conservation. She has also documented resilient communities: In northern Mozambique, she happened upon an orphanage accidentally set ablaze and photographed the response. After Cyclone Idai prompted massive flooding in 2019, Guyton joined Gorongosa National Park staff as they launched a rapid-response aid operation in surrounding villages. On quieter assignments, she has observed pelican-eating crocodiles and chased bats through caves.

For Guyton, a Fulbright fellow and a two-time National Geographic Society grant recipient, photography raises crucial awareness about conservation. She is a fellow of the International League of Conservation Photographers, and in 2016, *National Geographic* named her one of its "20 under 30: The Next Generation of National Park Leaders." She has been honored in photo competitions including Wildlife Photographer of the Year and Nature's Best.

Off to Africa

Guyton aspired to be a photographer from a young age. Visiting Berkeley during her second year at the University of Southern California, she was blown away by a wildlife ecology lecture by **Justin Brashares,** a professor in the Department of Environmental Science, Policy, and Management. She decided to transfer to Berkeley and was accepted into the conservation and resource studies (CRS) major.

At Berkeley, Guyton delved into research, assisting a graduate student with data analysis and social surveys on human-wildlife interactions in Ghana. She welcomed CRS's interdisciplinary nature, which offered her the freedom to take classes in poetry, photography, and nonfiction writing before designing a focus in communicating conservation in the developing world. In her spare time, she volunteered with two conservation organizations, campaigned for the College to bring conservationist speakers to campus, and wrote for the undergraduate publication *Theory*.

After graduation, Guyton joined the Kalahari Meerkat Project in South Africa as a research technician. "I think I spent more time taking pictures than doing actual science," she remembers. "That was when I realized I still really wanted to do photography." A year later, Brashares invited her to join him on a hippopotamus ecology project in Kenya. After it ended,

"Knowing how to read the savanna and understand animal behavior—these things offer the potential for much better photographs."

Guyton enrolled in doctoral studies at Princeton, which led her to spend five years at Gorongosa. In 2014, she received a National Geographic Young Explorers Grant. "Suddenly I was meeting photographers at *National Geographic,* and I started seeing firsthand how they worked," she says.

Guyton's doctoral project examined ecological restoration in the aftermath of the Mozambican Civil War, a conflict that had decimated wildlife populations and plunged the country into poverty. In the early 2000s, the Mozambican government partnered with philanthropists to restore Gorongosa's denuded ecosystem while bolstering research and law enforcement capacity. "When a completely degraded ecosystem gets restored," she says, "it offers a unique chance for scientists to better understand how ecosystems assemble."

A ranger in Gorongosa National Park holds a rescued pangolin.

As a research technician at the Kalahari Meerkat Project in South Africa, alumna Jen Guyton captured this image of a colleague weighing meerkats.

In 2019, Guyton took photos as Mozambicans displaced by Cyclone Idai waited for Gorongosa National Park staff to distribute emergency aid.

After completing her PhD, Guyton was awarded a Fulbright–National Geographic Storytelling Fellowship to remain in Gorongosa for another nine months to focus full-time on photography.

Picturing change

Though Guyton ultimately chose photography over research, she knows that her scientific background enriches her work. "Knowing how to read the savanna and understand animal behavior—these things offer the potential for much better photographs," she says. "In addition, that background knowledge really helps me understand the bigger picture and identify the most significant stories." Now she works as a freelance photographer and is contributing to two books: an overview of park and reserve ecosystems and a field guide to the bats of Gorongosa.

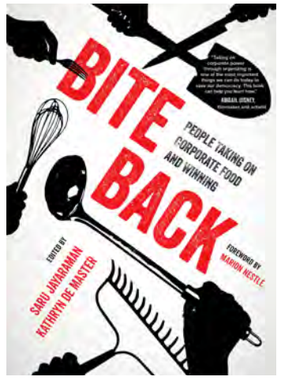
Guyton holds no illusions about the challenges conservationists face, but she remains hopeful that nature can rebound, if people let it. "We can still intervene and make decisions that can save natural spaces for future generations," she says. Guyton is equally passionate about supporting women's and girls' education and reproductive freedom. "We should think about it as the moral thing to do, which also happens to have many benefits for the planet." In rural communities, she has seen how women in leadership positions can improve conservation dynamics.

Earlier this year, the Cal Alumni Association granted Guyton the Mark Bingham Award for Excellence in Achievement by Young Alumni, in recognition of her outstanding work, global impact, and embodiment of Berkeley values. In August, she won the American Society of Mammalogists Murie Family Conservation Award.

In what little spare time she can muster, Guyton gives presentations, seminars, and talks to student groups. She always takes time to advise the aspiring conservationists and photographers who contact her—in particular, young women and girls. "I didn't have a particular role model in photography early on," she says. "I definitely want to pay it forward."

Social Change on the Shelves

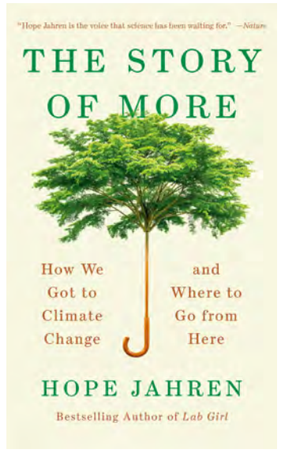
By Jacob Shea



Bite Back: People Taking On Corporate Food and Winning (University of California Press, 2020), edited by Kathryn De Master and Saru Jayaraman

"Our food system is broken, but a revolution is underway to repair it." So contends *Bite Back: People Taking On Corporate Food and Winning*, a collection of essays and case studies co-edited by associate professor of environmental science, policy, and management (ESPM) **Kathryn De Master** with UC Berkeley Food Labor Research Center director **Saru Jayaraman.** *Bite Back* draws upon the cumulative wisdom of food experts and activists to explain the fundamental problems and inequities of our corporate food systems. The book examines food system sectors—the control of seeds, pesticides, labor dynamics, diet and public health, international trade, and much more—drawing clear connections to environmental destruction and numerous societal problems.

In addition to an academic analysis, *Bite Back* presents a road map for activists and changemakers. In each thematic chapter, the editors pair an explanation of a problem with a story about successful change. The book is a call to action, urging readers "to rebel against the corporate status quo and to fight for equity, sustainability, and collective prosperity."



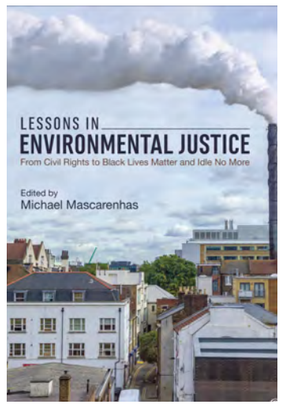
The Story of More: How We Got to Climate Change and Where to Go from Here (Vintage Books, 2020), by Hope Jahren

Human history is, at its core, a story of consumption. In *The Story of More*, **Hope Jahren,** PhD '96 Soil Science, a geosciences professor at the University of Oslo, explains how technological advances, demographic trends, and industrialization have brought humanity to the current climate crisis. Jahren weaves in personal anecdotes to create an approachable narrative that is at once hopeful, compelling, and alarming.

Whether exploring urbanization, electricity, transportation, fossil fuels, plastic production, or agriculture, *The Story of More* centers on civilization's ever-growing resource usage. Jahren illustrates the scale of global change with mind-boggling statistics and metaphors—noting, for instance, that the coal burned globally since 1969 would fill a grave the size of Texas.

Beyond explaining how society arrived at this dangerous crossroads, the book breaks down complex science and provides practical ideas for reducing consumption. Throughout, Jahren returns to the theme of global inequality: "All of the want and suffering in the world—all of it—arises not from the earth's inability to produce, but from our inability to share."

Jahren's first book, *Lab Girl* (2008), is an award-winning national best seller.



Lessons in Environmental Justice: From Civil Rights to Black Lives Matter and Idle No More (Sage Publications, 2020), edited by Michael Mascarenhas

As calls to address structural racism become more prominent in public conversation, ESPM associate professor **Michael Mascarenhas**'s new book is a timely and definitive look at the field of environmental justice.

Published in August, the text offers an introduction for unfamiliar readers while bringing together diverse scholars "helping to cultivate a new and vibrant wave of environmental justice scholarship, methods, and activism." Contributors consider how conducting research and engaging within vulnerable communities requires collaborative rather than top-down research.

The book first gives a history of the environmental justice movement, then explores the methodology, epistemology, and ethics of environmental justice studies. Other sections analyze the complex intersections between state agencies, policy, and the field as well as environments of injustice and activism. Contributing scholars include ESPM professors **Rachel Morello-Frosch** and **Elizabeth Hoover** as well as **Carolina L. Balazs,** PhD '12 Energy and Resources Group, and **Beth Rose Middleton Manning,** PhD '08 ESPM.

PHOTO: Courtesy of Mary Yang

Where the Acorns Become the Oaks

Couple supports graduate education and the fight against the climate crisis

As the Rausser College of Natural Resources joins the university-wide 150 Years of Women at Berkeley celebration this year, we honor many remarkable female students and faculty from the past century and a half at the College. However, another extraordinary group is just as critical to our culture of excellence: our female alumnae and donors.

Mary Yang, BS '84 Chemistry, has devoted her generous philanthropy to Rausser College. With her partner, Bill Kuni, she created the Mary M. Yang and H. William Kuni Environmental Stewardship Fund to benefit graduate students in the Department of Environmental Science, Policy, and Management (ESPM). Established in 2017, the fund currently supports one to two graduate students each year.

"I really appreciate the education I received from the College of Chemistry, but as I evolved, I recognized that the world's biggest problems—such as sustainability, preserving biodiversity, and combating the climate emergency—cannot be solved by science alone," Yang says. "Science, economics, social and political understanding—all of these disciplines must be synergistically applied to inform practice, policy, advocacy, and action. That's what Rausser College, and particularly ESPM, hopes to achieve."

Yang co-founded and led an innovative biotechnology company that developed products for the fields of digital-imaging spectroscopy and protein engineering. Kuni is a former corporate CEO, entrepreneur, and management consultant. They have both been forceful advocates for and supporters of environmental causes and organizations in the San Diego area. For her civic engagement, Yang was recognized in 2019 by the state senate's president pro tem, Toni Atkins, as one of California's Women of the Year.

The Yang and Kuni fund specifically aids graduate students whose scholarship focuses on applied science or policy research that promotes conservation- and sustainability-oriented solutions. Though much of the couple's philanthropy supports the full educational pipeline, graduate study is "where the acorns become the oaks," Kuni says.

Yang comes from a family that has always valued education. "I had a great-aunt who was born in China in the late 1800s," she remembers. "Her father wouldn't let her go to university, so she worked to put herself through college. She later became principal of a high school." Yang's mother, now 94, got her college degree in agriculture—the same major as Berkeley's first female graduate.

Funding graduate study in ESPM allows Yang and Kuni to continue learning about the environmental and social causes they care about so deeply. "One of the treasured aspects of our gift is the interaction with students and faculty," Yang says. "When I look at the world's many problems, it's difficult not to get depressed. But when I'm able to have lunch with a bunch of students, learn about what they're doing and what they hope to accomplish, their excitement, intelligence, and energy inspire me. And I think, 'Yes, we will win this fight!'"

— KIRSTEN MICKELWAIT

Resilience in Research

This year's tumultuous events have precipitated significant changes in plans across academia. Still, the Rausser College community has pulled together safely and persevered despite challenges caused by the pandemic and the wildfires. Here are a few images that depict how we are continuing our research mission. Clockwise from top left: **Max Lambert,** a postdoctoral fellow in the Rosenblum lab, checks in with this western pond turtle (*Emys marmorata*) near Santa Cruz. Graduate student **Rachel Weinberg** of the Tsutsui lab sets out a pheromone lure used to collect male kidnapper ants in the genus *Polyergus* in Tahoe National Forest. **Thien Crisanto,** a PhD candidate in the Niyogi lab, is continuing her research into altering the photosynthetic efficiency of the microalga *Nannochloropsis oceanica*. **Yvonne Socolar** (left) and **Kenzo Esquivel,** members of the Bowles lab, harvest research tomatoes at a field site in Esparto, California, under smoke from the LNU Lightning Fire Complex. Photos by Jessie Bushell, Elizabeth Cash, Tim Jeffers, and Paige Stanley