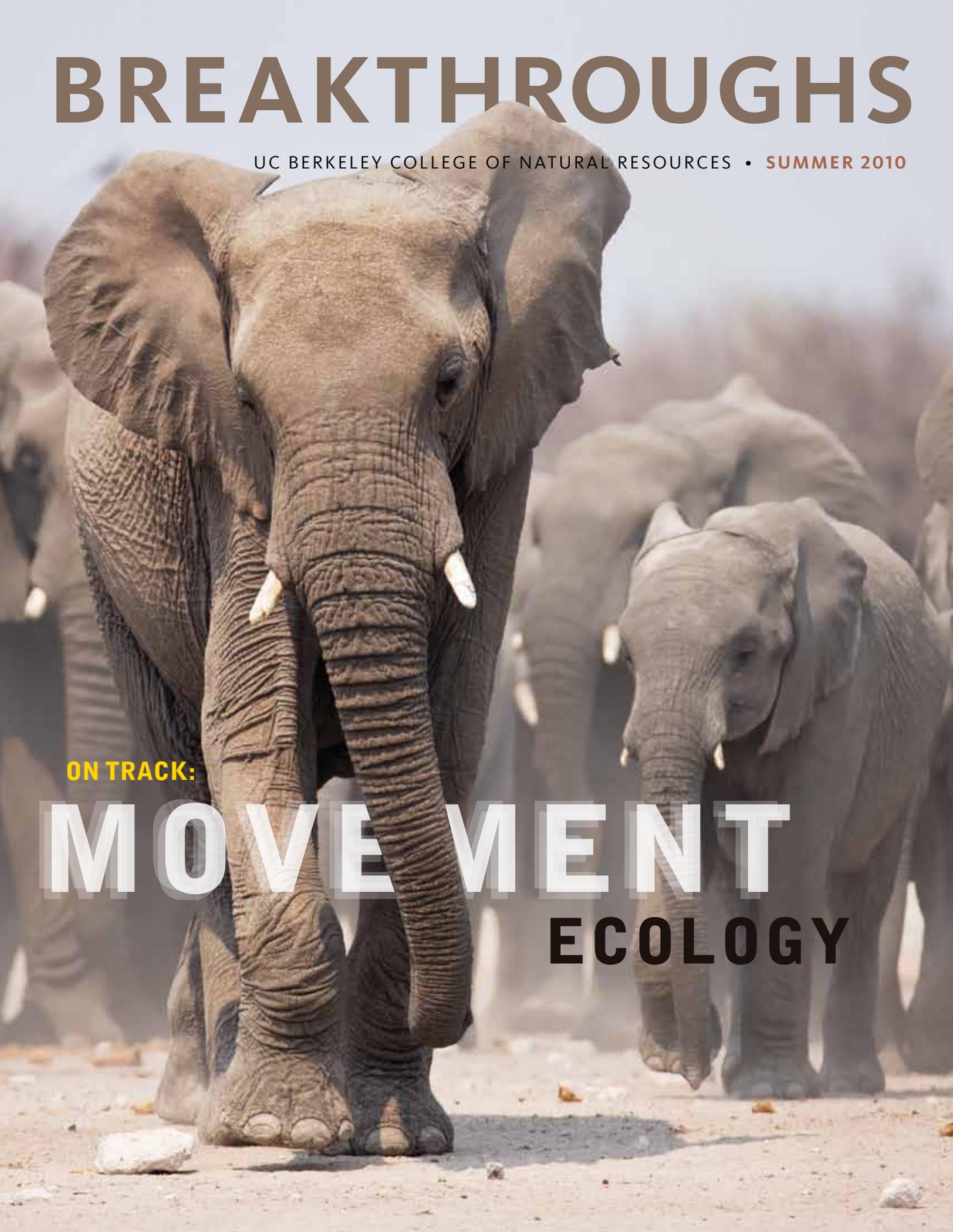


BREAKTHROUGHS



UC BERKELEY COLLEGE OF NATURAL RESOURCES • SUMMER 2010

ON TRACK:

MOVEMENT

ECOLOGY

LETTER FROM THE DEAN

Berkeley will remember 2009 as a time of financial crisis and uncertainty. The fall was the worst, as we implemented staff layoffs and campus-wide furloughs. However, 2009 was also a year in which the resiliency and dedication of the faculty and staff was demonstrated repeatedly.

The need to “do more with less” for our research, teaching, and extension programs forced us to make some big changes. We centralized administrative functions such as human resources, accounting, computing services, and undergraduate advising that have been traditionally performed within the departments. Along with the rest of the campus, we are engaged in an ambitious review and restructuring of our business practices that will result in significant savings over time.

As the College’s staff reorganization is finalized and new business procedures are implemented, I sense a lifting of the air of foreboding that gripped us last year. Through all of the changes, the creativity and willingness of our staff to accept the challenge of change is inspiring. It is an honor to work with them.

Here is the good news from Berkeley:

- We led the cross-campus coalition that secured an \$800,000 grant from the John D. and Catherine T. MacArthur Foundation to seed the start up of an interdisciplinary Global Masters in Development Practice focused on the global challenges of sustainable development – including poverty, population, health, conservation, climate change, and agricultural productivity. CNR will be the administrative home for the program, and many of its courses will be taught by our faculty. (See page 19)
- We have about 1,900 undergraduates enrolled in the College’s ten majors, and CNR is now the second most selective college at Berkeley (in terms of applicants versus admissions), second only to the College of Engineering.
- We have a new Strategic Facilities Plan for our major buildings. The plan reflects a lot of hard work by a committee comprised of faculty, college, and campus staff, CNR Advisory Board members, and architects from the firm of Noll and Tam. The plan will provide the basis for a major capital campaign to renovate and modernize our beautiful but aging buildings. The campaign’s success will depend upon the generosity of you – our community of supporters. You will hear more from us about this as the year progresses.

Thanks to all of you for helping deliver UC’s message to Sacramento that additional budget cuts will threaten our ability to remain intellectually competitive and accessible to the best and the brightest. I believe that message is being heard. It is important to California (and to the world) that Berkeley continues to be a place of discovery and innovation, as well as an agent for social change and economic development.

I welcome your comments at gilliss@berkeley.edu.



J. Keith Gilliss

PHOTO CREDIT

Cover and this spread: Shutterstock.com

BREAKTHROUGHS

SUMMER 2010

2 BRIEFS

Disappearing Fog

On the Ground in: LATIN AMERICA

Why I Do Science—Gordon Rausser

Green Light Your Future

...and more

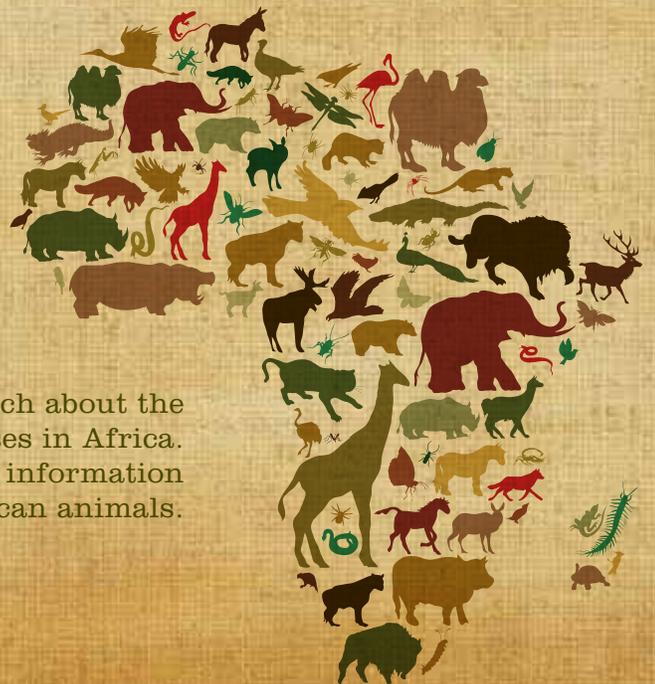
10 MOVEMENT ECOLOGY

14 SPOTLIGHT ON ALUMNI

20 COLLEGE SUPPORT

21 BACK STORY

The cover story is focused on research about the movement of animals and diseases in Africa. Throughout this issue, look for more information about the movements of African animals.



Green Grass versus Greenhouse Gas

Using compost to capture carbon



An hour north of the Golden Gate, the rolling grasslands of West Marin are dotted with bay laurels, gnarled oak trees, and cows. In this timeless landscape, locals are ranching an entirely modern commodity—carbon—alongside their livestock.

Whendee Silver, a professor of environmental science, policy and management, is helping ranchers employ their pastures to slow climate change through a project with the Marin Carbon Project, a consortium of researchers, landowners, government agencies and others. Her idea is to pull carbon dioxide out of the atmosphere, where it can warm global climate, and store it in plants and soils. Her secret weapon: compost.

Compost is both a rich source of carbon and a potent fertilizer. As it decays, it makes the nutrients locked in animal manure and vegetable matter available to growing plants. Silver is betting that compost spread over rangelands will turbocharge grass growth and slow atmospheric warming at the same time.

The trick, however, is to control how fast the compost decays. The soil microbes that break down compost into fertilizer also produce carbon dioxide. An ecosystem ecologist, Silver is tuning this process to favor plant production over greenhouse gas emissions.

At the Nicasio Native Grass Ranch, Silver has divided fields into experimental plots. Some have had a thin layer of compost spread on top. With chambers resembling upside-down buckets, Silver can measure how much carbon dioxide and other greenhouse gases each plot emits to the atmosphere.

So far, Silver's hunch has been right on target. The plots covered with compost absorb far more carbon, are topped with thicker, greener tufts of grass, and produce 50 percent more forage than compost-free control plots. In addition to being a source of fertilizer, the coating of compost helps cool the soil. The lower temperatures put a damper on microbial decomposition.

Rangelands are ideal places to stash carbon, according to Silver. Grasses in seasonally dry areas must grow deep roots in order to find water. For that reason, grasses must store proportionally more of their total biomass—and therefore more of their carbon—underground than plants in moister climates.

If the technique proves successful, ranchers who compost could make some extra money in the future. Polluters might be able to buy ranchers' carbon scrubbing services in so-called carbon markets.

—adapted from an article by Christopher Joyce, National Public Radio

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Disappearing Fog

Clear skies put coastal redwoods at risk

The thick blanket of fog that often swirls along the northern California coast envelops beaches, forests, and the streets of San Francisco in its moist grasp. Those fog-shrouded days, however, are growing fewer and farther between, according to a study by postdoctoral scholar **James A. Johnstone** and **Todd Dawson**, a professor of environmental science, policy and management. If the trend continues, the scientists say, the continued survival of another regional icon—the towering coastal redwoods known as *Sequoia sempervirens*—will be at risk.

“Fog prevents water loss from redwoods in summer, and is really important for both the tree and the forest. If the fog is gone, we might not have the redwood forests we do now,” Dawson says. Coastal redwoods grow from Big Sur to Oregon, along a 30-mile-wide strip that enjoys year-round cool temperatures and high humidity.

The researchers analyzed hourly weather reports recorded at two California airports, in Monterey and Arcata. When the researchers compared this data to temperatures collected all along the Pacific Coast, they found that coastal fog tends to occur when the coast is very cool while inland areas are baking. This temperature differential has decreased along the Pacific coastline from Seattle to San Diego. The

researchers calculate that since 1901, the number of hours of fog along the coast in summer has dropped by about three hours per day.

The pattern appears linked to an ocean cycle called the Pacific Decadal Oscillation that affects water temperatures in the northern Pacific Ocean. It is unclear whether these shifts are part of a natural cycle or the result of human activity. Whatever its cause, the change could impose drought stress on redwoods, which depend on fog for 25 to 40 percent of their water. “As fog decreases, the mature redwoods along the coast are not likely to die outright, but there may be less recruitment of new trees; they will look elsewhere for water, high humidity, and cooler temperatures,” Dawson said.

Eventually, Dawson and Johnstone hope to correlate fog frequency with climate data stored in redwood tree rings. Dawson has established a method to identify what percentage of the oxygen stored in tree ring tissues comes from rainwater versus fog. The new fog data will allow Dawson and Johnstone to calibrate their tree ring isotope data with actual coastal fog conditions in the past century, and then extrapolate to yield coastal climate conditions going back 1,000 years or more.

—adapted from an article by Robert Sanders

“Fog prevents water loss from redwoods in summer, and is really important for both the tree and the forest.”

CLIPPINGS

Melting polar ice caps and rising seas affect us all. But a recent report suggests that climate change hits people of color and the poor much harder. **Rachel Morello-Frosch**, associate professor of environmental science, policy and management, is one of the authors of “The Climate Gap” report, http://college.usc.edu/perc/documents/The_Climate_Gap_Full_Report_FINAL.pdf.

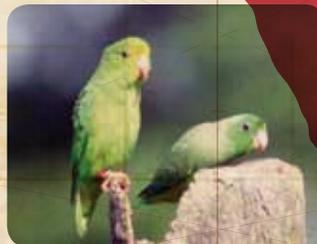
ON THE GROUND IN:

LATIN

Here are just a few CNR projects happening on the ground in Latin America

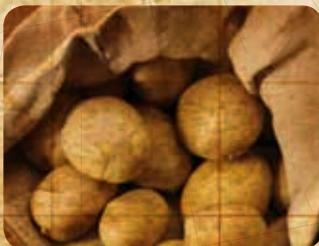
Parrot Trade

Jewel-bright plumage and a reputation for smarts have made parrots coveted pets for centuries. But with the international pet trade and habitat destruction, more than a third of New World parrots are at risk of extinction. Professor **Steve Beissinger**, a professor of environmental science, policy and management, has been conducting the first detailed study of these colorful birds with Venezuela's green-rumped parrotlet. Like house martins, parrotlets readily raise chicks in artificial nest boxes. Since 1985, Beissinger has followed over 2,000 nesting attempts and marked more than 8,000 individuals with colored bands. What he's discovered about their breeding, social system, and population dynamics will help establish sustainable harvesting of wild parrots for pets.



Credit Bureaus For Microfinance

Microfinance institutions provide loans to the poorest of the poor, transforming beggars, farmers, and others into entrepreneurs. Yet as microfinance has caught on, default rates have begun to rise. Borrowers can take out loans from different banks, while potential lenders are unable to assess their indebtedness. **Alain de Janvry** and **Elisabeth Sadoulet**, professors of agricultural and resource economics, have found that credit bureaus can help solve this problem. They show that a credit bureau launched by a Guatemalan microfinance lender helped its branches gauge actual debt levels, and helped induce borrowers to repay loans. The downside: as group lending declined, less solvent clients, such as women, lost access to loans.



Preserving Chile's Potatoes

The potatoes on your plate may have been grown in Idaho, but their ancestors likely hail from Chiloé Island, off southern Chile. Indigenous peoples there cultivated hundreds of varieties of potatoes over the centuries. But most of the local varieties disappeared after government policies promoted higher yield varieties. Now residents cannot afford the fertilizers and fungicides these spuds require. To reconnect farmers with their agricultural heritage, Professor **Miguel Altieri** and the Centro de Educación y Tecnología of Chiloé have established a community seed bank to preserve ancient potato varieties. The organization is also reintroducing traditional varieties of these tasty tubers to local farmers.

AMERICA

Hurricanes Kick Up Greenhouse Gases

Tropical forests have been called the lungs of the earth, but are also major sources of greenhouse gases. Their soils are the largest natural producers of nitrous oxide, carbon dioxide, and methane. By studying tropical forests in Puerto Rico, **Whendee Silver**, a professor of environmental science, policy and management, has found that hurricanes affect how soils release greenhouse gases. While these massive storms lower carbon dioxide emissions, they raise outputs of methane and nitrous oxide—gases that are 25 and 300 times more potent respectively at warming. This phenomenon bodes ill for the future, as hurricane frequency and intensity are projected to increase as the planet warms.



Covering for Herbicides

In southern Brazil, small farmers have ditched herbicides to control weeds. Instead, they sow combinations of naked oats, rye, hairy vetch, and fodder radish, then grow food crops directly atop the mulch. The result: fields that are nearly weed-free. Professor **Miguel Altieri**, a professor of environmental science, policy and management, and colleagues at the Universidade Federal de Santa Catarina have found that rye and radish produce natural chemicals that deter weed sprouting. The food crops are placed below this toxic chemical layer or are transplanted as hardy seedlings. These findings could help other farmers seeking to wean themselves from the high cost or toxic effects of herbicides.



Bonds of Trust

In the poor rural villages of Paraguay, formal sources of credit and insurance are few and far between. Lending and gift-giving within the community can be a viable substitute, but such informal finance methods seem to work better in some villages than in others. **Ethan Ligon**, an associate professor of agricultural and resource economics, and former student **Laura Schechter**, now at the University of Wisconsin, are investigating how such networks of trust function. Their surveys and experimental games are revealing how these systems help and hinder informal financial success.



Farm Field Trips

Experiencing Agriculture In Person

Farms and fields, soil and irrigation make rich fodder for classroom discussions, making it easy to forget that farms can be valuable classrooms on their own. That's why the agricultural field trips led for the past two years by **Howard**

Rosenberg, a cooperative extension specialist in the Department of Agricultural and Resource Economics, have proven so valuable to students.

It all started when two doctoral candidates approached Rosenberg in 2008, lamenting that they were about to finish their dissertations but had yet to set foot on a

farm. They weren't the only ones. Students, says Rosenberg, "have expressed a lot of interest in getting away from keyboards." Such trips were once de rigueur for agriculture students. But since the 1980s, he says, "the opportunities have been pretty rare."

Rosenberg arranged a farm tour for the third week of August, just before classes were to resume for the year. The first stop on the three-day, two-night trip was the office of a

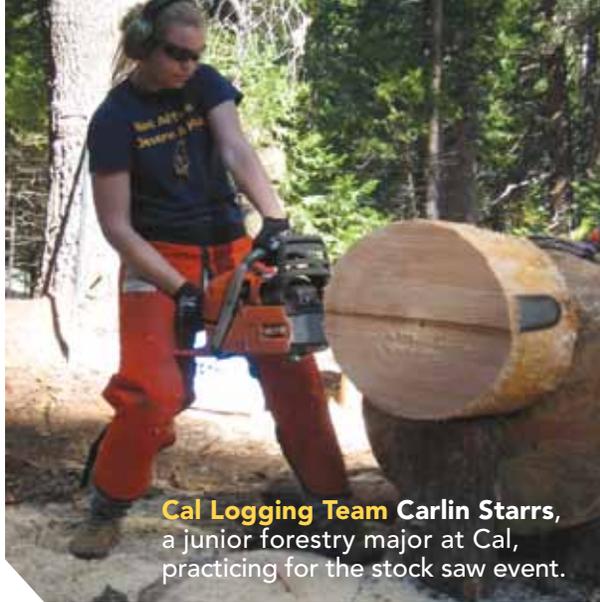
farm labor contractor in Firebaugh, 43 miles west of Fresno. From there, Rosenberg and five students drove to Mendota for a melon harvest, to Fowler for a raisin harvest, and to Caruthers for an almond plant that processes one-third of California's stock. In Fresno, they met with a farm worker union organizer. Driving west over the Coast Range, they visited a flower nursery in Watsonville, and then went south to experience a lettuce harvest in Gonzales.

Damian Bickett, an agriculture and resource economics doctoral candidate studying water rights, says the trip opened his eyes to the realities of farming. "I feel like I have better knowledge of what's going on in agriculture," he says. "The main thing I took from it was how innovative the farmers were. Almost all of them seemed to be trying something new to carve out their niche."

In 2009, Rosenberg teamed up with a colleague at UC Davis to conduct a pair of late-summer trips. Part one was a two-day, one-night tour of the Sacramento Valley, including a dairy operation in Orland and the Sierra Nevada Brewing Company in Chico. Part two was a longer trip that reversed the first year's itinerary. Of the six students that attended, most told Rosenberg they wished they'd done it earlier. "It's a big world of agriculture out there," he says. "I think anyone who participated got a whole new dimension of understanding."

—Nate Seltnerich





Cal Logging Team Carlin Starrs, a junior forestry major at Cal, practicing for the stock saw event.

Chipping Away **GENDER** Stereotypes

Among collegiate sports, football and basketball tend to be the big draws. But for a balance of utility and tradition, the Berkeley logging team is hard to beat.

Logging sports evolved from the work skills of lumberjacks of yore. Today's events range from historic techniques such as chopping and crosscut sawing, to the use of modern tools such as chainsaws, with some axe throwing and log rolling in between. It's all about speed: winners in most events are the fastest at each task.

"All of the skills we learn will come in really handy for the forestry jobs we'll hopefully have in the future," says forestry student **Allison Chambers**, one of the Berkeley team's two captains. On the job, professional foresters still need to remove the occasional hazardous tree in areas where machinery is not permitted, and to break down logs to clear blocked paths.

At Berkeley, logging has become women's work. Eight of the Bears' twelve most regular team members are female. This may be a reflection of the forestry major at Berkeley, also mostly female at present and the source of most team members. "It's more about skill than size and strength," Chambers says.

The team practices atop Grizzly Peak, where their chopping and bucking also benefit the environment. "We help out with invasive species removal by cutting eucalyptus trees, and in return, the University lets us use the wood we take out. Eventually we go back and plant redwood," Chambers says. "It's a good excuse to get out there in the woods."

—Kathleen M. Wong



SUBJECT:

Why I Do Science

ENTRY BY:

Gordon Rausser

ENTRY #:

004

Economics uses theory and empirical observations to draw inferences, explain behavior, and predict the consequences of major events and changes in public policy. However, in economics, conducting experiments is often difficult and sometimes impossible. Instead, economists frequently turn to natural experiments offered by history or design experiments with sample respondents.

A key part of my scientific research is the design and structuring of incentives that motivate individuals and organizations to change their behavior. The field of resource economics, which encompasses agricultural and environmental economics, exhaustible and renewable resources, and global economic development, has acquired new stature with increasing awareness of sustainability risks. It is an area of inquiry heavily dependent on the biological sciences (bioeconomy), physical sciences (ecosystem management) and nutritional and toxicological science (health economics). At the College of Natural Resources, the opportunity for research that integrates economics and natural sciences is arguably the best in the world.

In a search for complementarities between economic growth and environmental quality, my research focuses on the development of analytical approaches to setting creative and enlightened public policy. My work demonstrates the importance of combining four analytical dimensions: incidence, mechanism design, political economy, and governance structures.

What I love about the study of economics and public policy is that our societal landscape continues to evolve, as in the recent global financial crisis and the emergence of renewable energy technologies. These developments offer continual opportunities for original and creative research, especially in the design and implementation of public policies and collective action.

Green Light Your

Continuing education offers opportunities FOR CAREERS IN SUSTAINABILITY



Tough economic times can offer just the right moment to take stock of a career. Additional training can help those who've lost their jobs or who seek more marketable skills. Because sustainability has become the watchword in a growing number of fields, many are looking to add green skills to their resumes. UC Berkeley's continuing education division offers a variety of professional programs to prepare mid-career workers, recent graduates, and others for new careers or advanced positions in sustainability.

The yearlong Professional Program in Sustainable Design offers architects, designers, builders, developers, project managers, and others the skills to create innovative, eco-friendly solutions to legacy design challenges. Sustainable design involves applying forms and patterns from nature to the creation of built environments and consumer products. With three tracks to choose from—Architecture and Interior Design, Urban Sustainability and Community Design, and Landscape Architecture—students can choose the education focus that best meets their interests.

Sustainable principles can also apply to energy, construction, and infrastructure, and those interested in this growing field have a suite of course options to choose from. The

Professional Program in Solar Energy and Green Building offers an overview of the solar industry—including perspectives on policy, economics, technology, best practices, emerging market trends, opportunities, and threats—along with up-to-date training in green building design and construction, and LEED® (Leadership in Energy and Environmental Design) Rating Systems. The Professional Program in Sustainability and Energy, and the Professional Program in Sustainability and Transportation, are aimed at policy mavens and those interested in the planning, implementation, maintenance, and environmental impact of modern infrastructure. Finally, the new Professional Series in Smart Grid Technology offers a foundation in the emerging field of networked power. Course topics include transmission and distribution, demand shaping, statutory and regulatory requirements, theory, and more.

Municipal organizations and corporations alike are taking steps to become more sustainable—and are creating positions that have the power to make change. The Professional Program in Corporate Social Responsibility Reporting shows managers how to improve their companies' sustainable business practices with methods such as green purchasing and supply-chain management. Managers can also benefit from the Professional Program in Leadership in Sustainability and Environmental Management, which offers courses in environmental law and policy, compliance management systems, and climate change risk-mitigation strategies to help implement cost-effective sustainability practices in public and private sectors. And the Professional Program in Responsible Global Change Management explores the intersection of environmental quality, sustainability, and ecosystem health, and analyzes how these issues affect businesses and policy makers.

Whether in policy expertise, best practices, or technical know-how, UC Berkeley's continuing education programs in sustainability offer participants the skills to begin transforming both the public sector and private industry. Learn more at extension.berkeley.edu/sustainability.

Future

UC Berkeley's continuing education division is an official Educational Provider of the U.S. Green Building Council (USGBC), the nonprofit organization that developed the LEED® Green Building Rating System. The following advanced courses in solar, sustainable construction, energy, and design are USGBC-approved to offer Green Building Certification Institute (GBCI) continuing education credit:

- Building Commissioning for LEED® (30 GBCI CE Hours)
- The Building Envelope (30 GBCI CE Hours)
- HVAC Control and Energy Management Systems (30 GBCI CE Hours)
- Indoor Air Quality, HVAC, and Green Buildings (30 GBCI CE Hours)
- Investment Grade Solar System Feasibility Studies (30 GBCI CE Hours)
- Sustainable Construction Management and Field Practices (30 GBCI CE Hours)
- Zero Energy Homes (24 GBCI CE Hours)

Additional USGBC course approvals are ongoing. Please visit extension.berkeley.edu for the most current roster of approved courses. The USGBC Education Provider Program logo is a registered trademark owned by USGBC and is used by permission.

SUSTAINABILITY STUDIES PROGRAMS AT A GLANCE

- Corporate Social Responsibility Reporting
- Leadership in Sustainability and Environmental Management
- Responsible Global Change Management
- Smart Grid Technology
- Solar Energy and Green Building
- Sustainability and Energy
- Sustainability and Transportation
- Sustainable Design

Details at extension.berkeley.edu/sustainability

CLIPPINGS

The hot, dry hills of Southern California have long been magnets for wildfire. Yet not all areas face equal risk of burning. A new study by **Max Moritz**, professor of environmental science, policy and management, shows that local topography funnels the Santa Ana winds to whip up wildfires in Malibu, the Santa Monica Mountains, and eastern San Diego, while leaving the Los Angeles basin relatively sheltered.



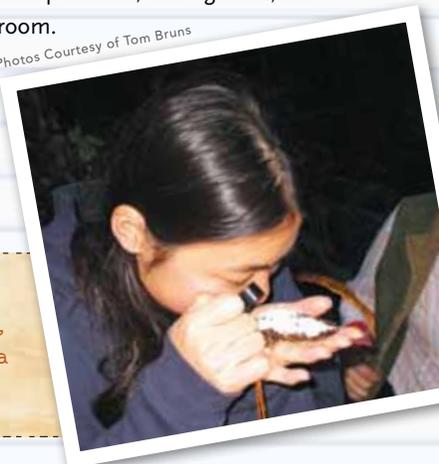
Five Key Lessons

FROM PMB 110: BIOLOGY OF FUNGI

Professors of plant and microbial biology **John Taylor** and **Tom Bruns** team up to teach the biology of fungi in a course that combines lectures, laboratories, and field trips. Over the course of the semester, students encounter hundreds of different fungal species ranging from toadstools to wobbly witches' butter. *Breakthroughs* asked the collaborators to share five key lessons they hope will stay with their students—and with you:

- 1** There are three parts to a fungus: the body, or mycelium, which is made up of tiny filamentous cells called hyphae; the reproductive structure that makes spores; and the spores themselves. The reproductive structure is often the most obvious, as with a mushroom, but the mycelium can have a mass greater than a whale and the spores can number in the trillions.
- 2** Fungi come in three body plans. These include single cells, as in the yeasts; the filaments of the mushrooms and molds; and the flagellated cells of water molds, which resemble animal sperm.
- 3** Fungi obtain their energy from other forms of life, either living or dead. They earn a living by decomposing tissues, parasitizing other organisms, or forming mutualisms. In these three roles, fungi are an integral part of all terrestrial ecosystems.
- 4** The fungi are most closely related to animals. This close relationship makes the fungi good models in animal biology. But because we share so much of our cellular biology, fungal infections such as diaper rash, vaginitis, or athlete's foot can be difficult to treat.
- 5** The most famous fungi are *Saccharomyces*, the yeast used in brewing and baking; *Penicillium*, whose members make Roquefort and Camembert cheeses, as well as the antibiotic penicillin; and *Agaricus*, the white button mushroom.

Photos Courtesy of Tom Bruns



ON

ECOLOGY AND



Photo courtesy of Wayne Getz



Photo courtesy of Wayne Getz



TRACK

EPIDEMIOLOGY IN THE AGE OF GPS

BY KATHLEEN M. WONG

It was 2002, and Wayne Getz stood in the midst of a modern-day roundup. A helicopter roared overhead, driving a wild-eyed herd of buffalo before it.

Getz watched as eight animals hit the ground one by one, felled by tranquilizer darts aimed from above. Almost before each black body hit the ground, a team of graduate students sprinted forward with sampling vials, radio collars, and clipboards in hand.

A professor of environmental science and policy management, Getz felt, if not exactly in his element, quite pleased. He was back home in South Africa, doing hands-on conservation work with African buffalo in the world-famous Kruger Park, and he was the principal investigator of a project studying the spread of bovine tuberculosis.

All in all, it was a very strange place for a mathematician to be.

A native of South Africa, Getz grew up at a time when laws governing the separation of races were rigidly enforced. Witnessing the numberless injustices of apartheid would shape his actions for years to come. It ignited in him a keen sense of ethics and a steely determination to stand up for underdogs. A desire to leave this poisonous social environment brought him to California in 1979. "My wife and I could see the apartheid government was heading toward catastrophe, and we didn't want to bring up our kids there," Getz says. He joined what was then UC Berkeley's Entomology Department, applying his mathematical skills to subjects such as pest management, insect sensory systems, and honeybee

biology. His science was respected, his family was prospering, and life was generally good.

Then in 1994, the dream shared by Getz and thousands of his compatriots finally came true. Nelson Mandela was elected President of South Africa in the country's first fully open democratic election, and apartheid was outlawed. Getz seized the moment to make changes of his own. He could now work in the country of his birth without associating with the racist regime he despised, and apply his grant money and professional influence as best he could to redress decades of social injustice.

With the decision to expand his science into wildlife conservation and Africa, "his research program went from being good to being great," says Stephen Welter, CNR's associate dean of instruction and student affairs. "I haven't seen anyone else's program change like this."

At the core of Getz's work is how and why animals move across the land. People have sought answers to these questions for time immemorial—at first to improve success in the hunt and harvest, and much later to understand animals in and of themselves. His approach combines a mathematician's genius for analysis with hands-on wildlife research. This unique perspective is revealing that animal travel patterns can provide a great number of insights into animal behavior, ecology, and epidemiology.

In recent years, the advent of global positioning system technologies, coupled with expanded telecommunications networks, have added up to a revolution in animal tracking. The modern version of the radio collar can map an animal's position to within a couple of meters every few minutes, upload the stored data automatically to a satellite or cell phone network, and allow biologists to track the beast from afar for many weeks.

Getz employs this flood of information to deduce an animal's inner motivations. "We try to put ourselves under the skin of the animal and think how the animal would think," Getz says.

To do this, he and his students superimpose the animal's path on satellite maps of topography, vegetation, soil types, watercourses, or other geographical features. Using mathematical tools they have developed, researchers can then identify significant shifts in turning angles, step sizes, and velocity. Together, these data layers can reveal changes in an animal's intentions. For example, a giraffe that veers off in a completely different direction may have spotted a tasty thorn tree, avoided a cliff, or wanted to rest in a bank of shade. Velocity data can reveal the last time an elephant paused to drink or fled from a predator. Each action then can be correlated to times of day, season, and features on the landscape to give unprecedented insights into an animal's life cycle.

Just as an animal's wanderings reveal its relationship with the landscape, they can also shed light on its social inter-

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WE TRY TO PUT OURSELVES UNDER THE SKIN OF THE ANIMAL AND THINK HOW THE ANIMAL WOULD THINK.

.....

actions, enabling scientists to study how herds merge and split, mates meet, and juveniles leave their parents for new groups. As it happens, this type of contact information is the same type of data needed to study the transmission of disease, or epidemiology.

Animal epidemiology is what led Getz to recreate the Wild West on the African veldt. By the early 1990s, a bovine tuberculosis outbreak in domestic cattle had leapt into herds of African buffalo at the southern boundary of Kruger National Park. It had spread to the heart of the 200-mile-long reserve and was now sickening predators such as lions and leopards.

Before controlling the disease, scientists needed to learn how it spread. Getz had both the movement ecology back-



GETZ AND HIS STUDENTS COLLAR A ZEBRA.

ground and the analytical modeling skills to get the job done. "The ecological factors that influence movement and the spread of the disease are all tied together," Getz says. He designed a study to randomly sample herds for positive cases of TB as well as to track the health and movements of individuals over time. With this information, Getz could model how the infection spreads and whether a vaccination program might help. He found that because more than half of all herds carry the disease, at least 70 percent of buffalo in the Kruger and neighboring parks would need inoculations to stem the outbreak. Such an undertaking would be impractical and expensive, particularly since TB does not appear to threaten the buffalo population.

Getz is applying the same approach to understand anthrax outbreaks in Namibia's Etosha National Park. Every year, this soil pathogen strikes down both zebra and elephants in different seasons. Getz's students are following individuals of both species to reconstruct their encounters with the microbe. Animals tend to ingest





Photo courtesy of Wayne Getz

anthrax spores by grazing on contaminated material. Dying victims bleed profusely into the soil due to an anticoagulant produced by the microbe. Getz's group is studying how these contaminated carcasses link seasonal outbreaks of the disease. Extra nutrients from the blood could literally make grasses greener and more attractive to eat after the start of the next rainy season. But these same areas might turn into infectious hotspots when herbivores graze infected vegetation.

In this project, Getz's students have even begun tracking the local scavengers. Vultures and jackals could be spreading anthrax by concentrating the spores in their dung. "We know enough about individual animals to begin to put a bigger story together," Getz says.

When Getz works in Africa, he doesn't just do science. He includes a social facet in every one of his programs. "He has come to believe that science has responsibilities to people and the natural environment," Welter says. "He's working hard to give back to Africa."

That's particularly true in education. Getz co-founded and secured international funding for a center in epidemiological modeling and analysis at South Africa's Stellenbosch University, and works alongside his wife Jennifer on eduWeavers, the nonprofit she founded to bring students and professionals from the United States to meet and partner with students and schools in South Africa. And instead of hiring field assistants for his projects, he recruits local conservation biology graduate students, paying their school fees, awarding them stipends for fieldwork, and covering the costs of their research. In Namibia, where the average per capita income is less than \$7,000 USD, Getz's support can mean the difference between a student leaving school to support her family, and advancing her education. "Each individual you train, their value is very high, as they might be one of only three masters' students in conservation graduating in Namibia that year," Getz says.

At Berkeley, the same degree of caring is just as evident. Though Getz' research group is among the largest in the college, he's still managed to foster a friendly atmosphere where students help one another. "Being part of his lab feels like being part of the family," says Karen Levy, a former Getz graduate student now with the Rollins School of Public Health at Emory University.

As a mentor, says former Getz graduate student George Wittemeyer, now a professor with Colorado State University, Getz is without peer. "Sometimes the mentor gets confused about who it benefits. But Wayne will tell the wholehearted, honest truth about what's best for me without that bias. That's very rare and a reason I feel so fortunate with Wayne."



Meanwhile, Getz's principled actions have earned him loyalty and respect around campus. When biologist Ignacio Chapela was denied tenure in 2003, Getz protested what he saw as a violation of the process. "Even though he wasn't invested in any of the individuals involved, Wayne took a stand and said this is not correct. It was very risky. But he knows the ethical lines, and if matters get beyond that, he's like a bulldog that refuses to give ground," Wittemeyer says. In the end, Berkeley granted Chapela tenure.

Getz watched as a student pushed a syringe of antidote into the haunch of the last buffalo, then scrambled for cover. The animal opened a bewildered eye, raised its U-horned head, and heaved its 1,700-pound body upright. It trotted off to follow its herd, a thick leather transmitter collar now buckled around its muscular neck. As it disappeared into the tall grass, Getz turned away, knowing that he would be watching over this cow and her kind for many months to come.

GPS TECHNOLOGY ALLOWS RESEARCHERS TO TRACK A TAGGED SPECIES ACROSS VAST AREAS OF LAND.

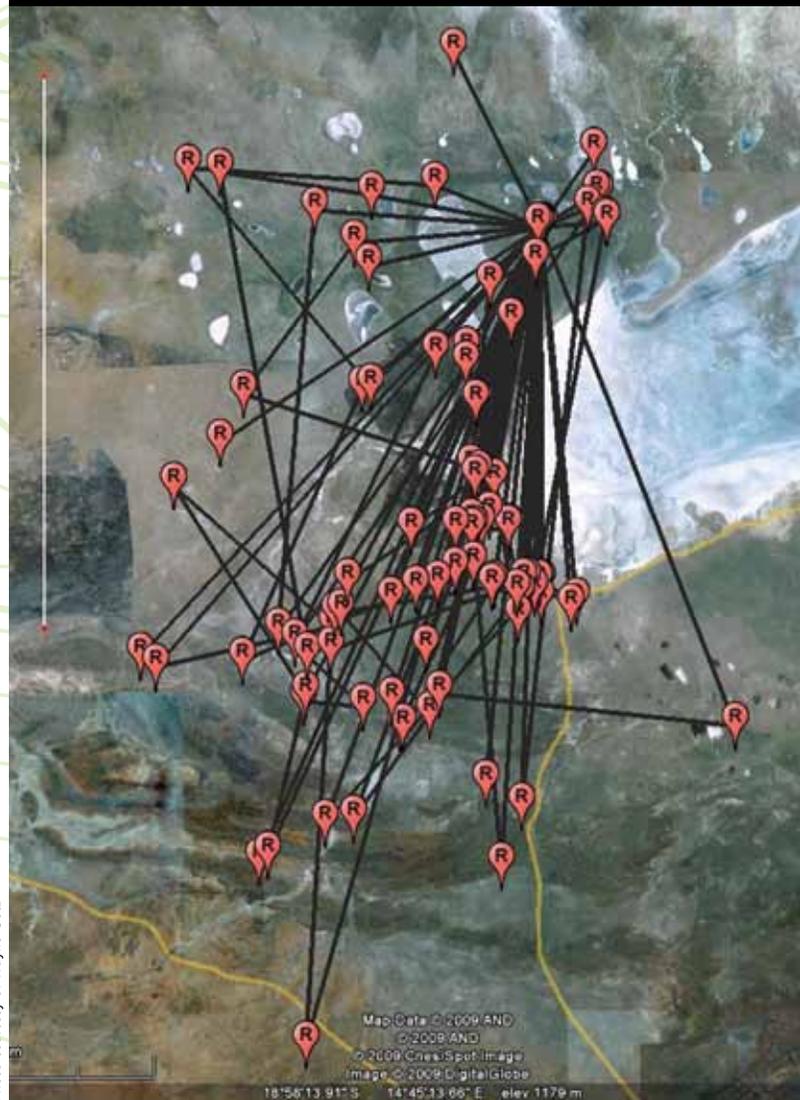


Photo courtesy of Wayne Getz



2008 MOLECULAR TOXICOLOGY

LUDMILLA ARISTILDE

"Level-headed" is the way Ludmilla Aristilde describes her father, someone she thinks she takes after. He was the one to resolve family conflicts, to choose being a teacher over a lawyer, to build a school, and to tell Aristilde and her three brothers that education was the way to become something. He also gave his young daughter this advice: "Don't let your friends choose you, choose them." And "Don't worry about what everyone else is doing."



Perhaps this man gave Aristilde the tools she needed to leave her home in Haiti at the age of 14, enroll in a tough Brooklyn high school, and then work her way through four academic degrees capped by a doctorate in molecular toxicology from UC Berkeley. Certainly the long journey through the sexism and racism of academic science required an unusually level head. Certainly her mother's strong will, or that of the Russian Olympian who is her namesake, may have played a part. But most of her success surely comes from her own drive and smarts. She's an environmental engineer who is serious and articulate enough to change business as usual on the planet, and who embodies America's multi-racial future.

Aristilde grew up on the outskirts of Port-au-Prince, witnessing scenes of devastation that long preceded the recent earthquake. During her childhood, people continued to chop down the tropical trees that once covered the mountainsides surrounding the town—a scene that Aristilde painted as a child. “The changes in the environment had an impact on me as an artist,” she recalls. It is to this deforestation, as well as to tree planting trips organized by her school in Haiti, that she attributes her first spark of interest in the environment. A cholera outbreak started her thinking about the connection between water and health that has permeated her work ever since. Though an extraordinary Jamaican teacher at her school in Brooklyn made her fall in love with chemistry a few years later, Aristilde kept building her art portfolio. By the time she graduated from Cornell University in 2003, she had degrees in both fine arts and earth sciences.

The transition from an urban all-black high school to the privileged halls of Cornell demanded adjustments. At times, students seemed reluctant to work with her because she looked different. A kindly professor called on her more often to make her aptitude more evident to her peers. Several professors served as mentors and provided encouragement. The university's Christian fellowship offered some refuge.

Aristilde found her professional path on an honors research trip to India. Heading up her own project, she sampled groundwater for contaminants in 14 villages and linked findings to local health problems. But it wasn't the science that presented the most challenges, it was the oddity of her work in a culture where most women married and settled into domestic life very young. “At that time I thought the experience was tough because of my race, but in retrospect, I believe it was because I was a woman in science, so young and yet in charge. I was only 20, and it was a minefield to navigate,” she reflects. Aristilde grew from the experience. **“All the pieces came together for me in India, my interest in environmental health and a sense of professional independence.”**

Leaving the cocoon of Cornell also helped focus Aristilde's ambitions. To better prepare for work on environmental health issues, she studied environmental chemistry and toxicology at Berkeley. Soon she was examining, on a molecular level, how pharmaceuticals interact with plants and soil. Drugs often aren't fully metabolized, and the remainder enters the sewage system. But wastewater treatment facilities aren't designed to remove such molecules, so they are discharged into the environment. Agricultural effluent can be an even greater source of pharmaceutical waste, as cows, chickens, and farmed fish get dosed with antibiotics to prevent infections from spreading in overcrowded conditions.

Aristilde's research suggests that the antibiotic Cipro can inhibit photosynthesis in an aquatic ecosystem. In a study with spinach, she found that Cipro impedes the process by which the chloroplasts in these plants turn light energy into chemical energy. Although low levels of the antibiotic over two weeks had minimal or “sub-lethal” effects, a stronger dose over a whole month resulted in plants with fewer leaves and shorter roots that soon died.

“Antibiotics are here to stay, but we need to do a better job of assessing the potential impacts of their release into the environment,” she says. “My research goal is to use knowledge of a pharmaceutical's chemistry to predict whether that pharmaceutical will persist, degrade, or be bad for the environment.”

Aristilde works on contaminants that trigger reverberations throughout the ecosystem. Pursuing a 2008-2009 Fulbright scholarship in France, she probed how clay particles may sequester tetracycline antibiotics and diminish their harmful effects on soil microbes. Over the past year, as a post-doctoral researcher at Princeton University, she has begun an investigation into stresses on marine phytoplankton. These tiny plantlike organisms provide up to 70 percent of our oxygen, but their survival is now threatened by an ocean chemistry altered by climate change.

“You can see the chemistry and environmental health threads in my work,” she says, some of which has been published in journals such as *Environmental Science and Technology* and *Environmental Toxicology and Chemistry*. Aristilde is in the midst of preparing more papers for publication, and the Discovery Channel reported on her Cipro and spinach findings this past spring. “I want to do policy-changing environmental research,” she says.

But that's not all Aristilde wants. Having inherited her parents' passion for teaching, she aims to be a professor at a major research university, where she wants to educate young minds about global environmental health issues, as well as be an example for students of every background. “It's just as important for non-minorities to be exposed to a minority professor as it is for minorities,” she says.

Written by: Ariel Rubissow-Okamoto | Photo by: Bethany Bandera

HOMECOMING 2010

SATURDAY, OCTOBER 9

9:30 A.M. Giannini Hall Lobby

Come back to campus and enjoy all of the festivities for CNR alumni, parents, friends, and students. Join us in the lovely Giannini Hall lobby and enjoy a continental breakfast with Peet's coffee, fresh pastries, and other refreshments.

State of the College Address

Dean J. Keith Gilles

Faculty Lecturers

A variety of faculty lectures will occur all across campus, including several by CNR faculty. This is a wonderful opportunity to learn about current research at the College. There will be a chance to ask questions during the interactive Q&A session following each lecture.

Professor Peggy Lemaux

Plant & Microbial Biology

"Food, Famine, and the Future of Farming"

Professor Andreas Stahl

Nutritional Sciences & Toxicology

"Fat Chance: How exploring the mechanisms of cellular lipid uptake may change the ways we treat obesity-related diseases"

Professor Kimberly Tallbear

Society & Environment

"Our DNA is Your Property?" Reconfiguring Ethics in Genome Research"

CNR Alumni Association Picnic

Giannini Hall Lawn

Noon

Enjoy the festivities on the Giannini Hall lawn and toast one another with the following spirits donated by CNR alumni:

Aetna Springs Cellars

With thanks to **Jim Watson**

B.S. '48, Forestry

Gundlach-Bundschu Winery

With thanks to **Jim Bundschu**

B.S. '66, Agricultural Sciences

Gordon Biersch Brewery

With thanks to **Dan Gordon**

B.S. '82, Political Economy of Natural Resources

Charles Spinetta Winery

With thanks to **Charles Spinetta**

B.S. '63, Forestry

Talley Vineyards

With thanks to **Brian Talley**

B.S. '88, Political Economy of Natural Resources

Casa Lola

With thanks to **John Casazza**

B.S. '77, Soil and Plant Nutrition

Kindly RSVP for the Picnic at
<http://nature.berkeley.edu/site/rsvp.php>

For more information on College of Natural Resources Homecoming festivities, please contact Donna Chan at 510-642-6707 or donnachan@berkeley.edu.

A New Masters in Development Practice

Building on campus leadership addressing climate change, extreme poverty, and public health, the John D. and Catherine T. MacArthur Foundation has awarded UC Berkeley an \$800,000 grant to launch a new master's degree program in development practice. Housed in the College of Natural Resources, and drawing upon faculty from engineering, business, public health, and public policy, the two-year program will provide professional training in sustainable development to 50 students at a time starting in 2011.

The grant was part of \$5.6 million awarded to 10 universities worldwide to develop MDP programs. UC Davis was the only other U.S. university to receive grant money for the program this year. Those selected join a global network of 20 schools offering advanced degrees in sustainable development practices.

The campus has a proven track record in developing programs that cut across diverse disciplines, including the Beahrs Environmental Leadership Program and the Blum Center for Developing Economies. These successes helped persuade the Foundation to support the program at UC Berkeley.

"The MDP will take advantage of campus resources and will provide an effective avenue to educate the environmental and development leaders of the future," said David Zilberman, a Berkeley professor of Agricultural and Resource Economics who helped spearhead the program on campus.

The program will arm students with managerial and leadership skills as well as the interdisciplinary knowledge needed to analyze problems such as malnutrition, infectious disease control, and climate change. Students will be able to collaborate with other schools in the network and participate in hands-on field projects worldwide. These include the Tropical Agricultural Research and Higher Education Center (Costa Rica), the Southeast Asian Regional Center for Graduate Study in Agriculture (the Philippines), and St. Petersburg State University (Russia).



Photo Credit: Sajal Shapit



CLIPPINGS

Frontman of The Byrds and Rock and Roll Hall of Fame inductee **Roger McGuinn** alighted in Ronald Amundson's environmental issues class this February to give a musical lecture. Earlier in the semester, the professor of ecosystem sciences had used the band's hit "Turn, Turn, Turn" to discuss the cycles of life. While discussing topics ranging from global warming to traditional music, McGuinn played an acoustic version on his seven-string guitar, followed by "Mr. Tambourine Man" and other songs.



Spotted hyenas may travel up to 80 kilometers round trip from their dens in a single night to find food. When they can, hyenas will follow the sight or sound of swarms of vultures descending from the sky to a kill.

Helping CNR Students Succeed



Given California's current financial circumstances, increased private support is the only way to uphold Berkeley's public education mission. In recognition of this fact, the University aims to double the number of scholarships it can offer by substantially growing its endowment. As educational costs escalate, the "self help" portion of a student's costs, paid through work or loans, is expected to more than double by 2016 to \$16,000 per year. The College of Natural Resources is participating in the endowment campaign to award more scholarships to students with financial need. These funds will increase the number of students able to accept admission to Berkeley regardless of their financial background.

Donor support is critical to attracting and retaining the best and brightest young people from a broad cross-section of California. CNR has a long tradition of such assistance through the Don Dahlsten Outreach Fund, which engages students who are traditionally underrepresented in environmental fields. This commitment to increased diversity is further echoed in the College's funding for scholarships and enrichment opportunities in careers that create a more sustainable world.

Since the start of the Campaign for Berkeley, CNR has developed new funds to benefit students in the College. These gifts have come in the form of endowments as well as funds for current use. Donors may also state a preference to support particular majors.

The campaign has increased the amount of annual fund gifts devoted to preserving the "small college" feel of CNR even as it grows. Philanthropy is supporting the Sponsored Projects for Undergraduate Research program created (SPUR). This program enables students to collaborate with faculty, completing research projects that may be proposed either by the student or the professor. This can be a decisive moment in a student's studies. For example, Veronica Dave worked in the health and nutrition research lab of Professor Chris Vulpe last summer, gaining skills and insights that will shape her career.

CNR has additional innovative ideas for unique giving opportunities. For example, students majoring in forestry have access to the transformative influences of Forestry Camp. A donation could create an equivalent "capstone experience" to inspire students in all College disciplines.

Photos Thanks to Berkeley, Photo Booth Project.

"In Professor Chris Vulpe's lab, I investigated the toxicity of trichloroethanol, a metabolite of a solvent that is used widely for metal degreasing. I stated in my SPUR application my hope to become a medical doctor. Since working on my research project, I have reconsidered my plans, and I am beginning to feel better suited to environmental research. Now I can see that there is a wealth of information yet to be collected on chemicals that we encounter every day without giving them a second thought."

—Veronica Dave, *Molecular Environmental Biology*

Make your gift today at <http://nature.berkeley.edu/give>

For further information on how to support students like Veronica, please contact the Office of College Relations at 510-643-8860.



Nearly 90 years after wolverines were considered extinct in California, researchers at UC Berkeley's Sagehen Creek Field Station in the Sierra Nevada snapped a photo of a wolverine at their bait station in 2008. Thought to be the only one of its kind in California, this male's solitary plight was highlighted this year when Sierra Pacific Industries, which owns land nearby, released video footage and these photographs suggesting that the lone wolverine is searching for a mate.



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