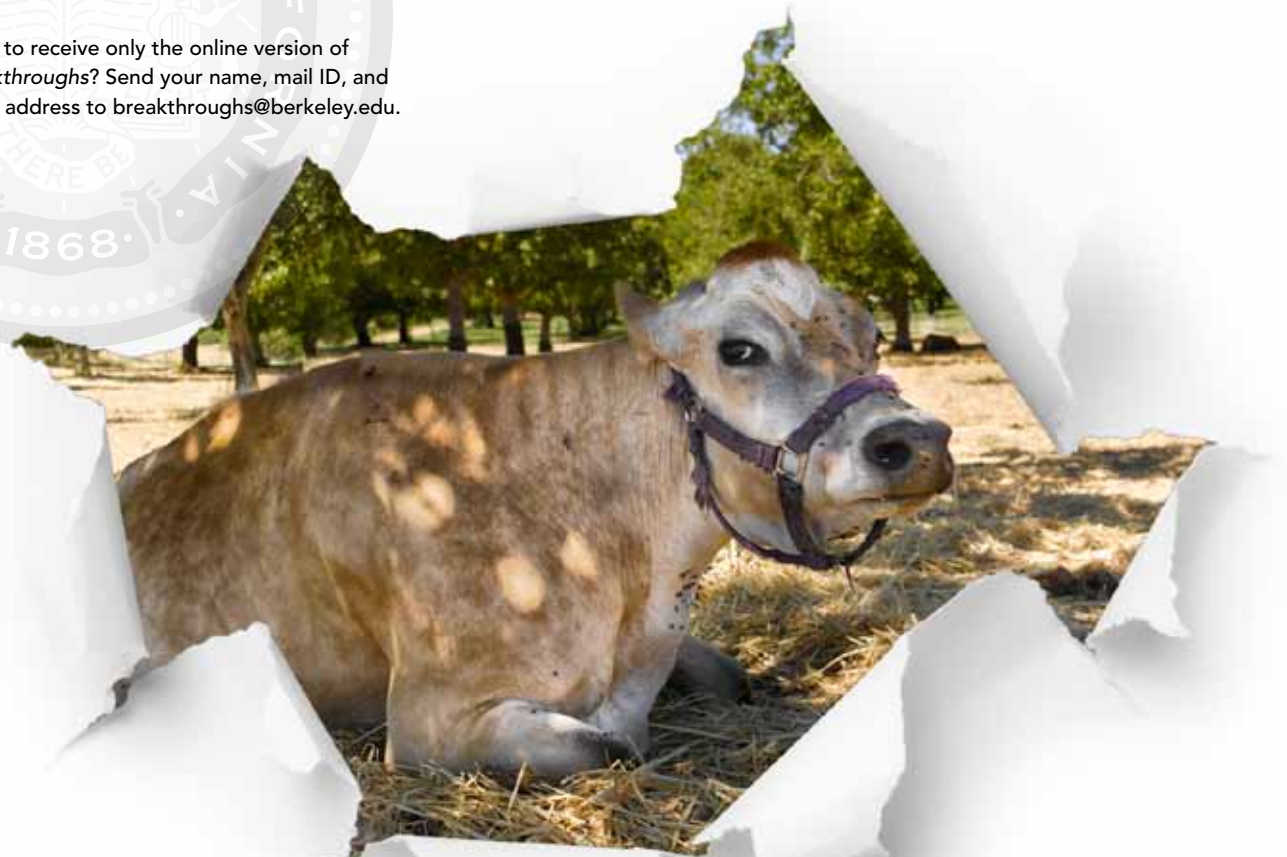




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# How to Feed the World

start small

**DIVERSIFIED FARMING SYSTEMS: A SPECIAL ISSUE**

Arnica the cow rests in a walnut orchard at Full Belly Farm, which employs diversified farming methods. Story on page 8.

**PLUS** CNR PEACE  
CORPS  
VETERANS





Fall is always a time of rejuvenation for the College's missions of teaching, research, and extension. For this special issue, all three of those missions converge. Several UC Berkeley faculty and their graduate students, mainly from CNR, are coalescing around nothing short of a paradigm shift in the way the world produces food. Research related to an integrated agriculture and land-management approach they are calling "diversified farming systems" challenges the long-held convention that large-scale industrial monoculture, with its attendant environmental and ecosystem impacts, is the only way to feed the world's expected population surge. In fact, they contend, continuation of the status quo in agriculture is exactly what the world's hungry billions cannot afford (page 8).

With our focus on agriculture, conservation, and economic development, the College has always been a place for global thinking. Scratch a professor and she'll rattle off the names of past students who served in one of the nation's most venerable organizations with a similar global perspective: The Peace Corps. This year Cal has been helping the Peace Corps celebrate its 50th anniversary, and *Breakthroughs* joins in with remembrances and advice from a few of CNR's many Peace Corps veterans (page 20).

In addition to service, our alumni give back through philanthropy. With the state's ever-decreasing support of its public universities, we at UC Berkeley are fortunate to have a generous, passionate, and engaged alumni base to help keep us strong. David Knutson, '53, an Agricultural Science alumnus and a good friend of the College, has made the most of a very innovative giving vehicle (page 24).

One last note on global thinking, and it's a note of welcome. I am pleased to announce that the University's internationally renowned Energy and Resources Group is now an affiliate of the College. With well-aligned missions and researchers who are already collaborators, we look forward to a rich and fruitful relationship (page 6). I welcome your comments at [gilliss@berkeley.edu](mailto:gilliss@berkeley.edu).

J. Keith Gilliss

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Cover and this page:  
 Paul Kirchner Studios

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The sun sets on a mixed-crop field of amaranth, sunflowers, and broom corn at Full Belly Farm in Guinda, Calif. Story on page 8.



## Pollan, Glickman to Headline CNR Farm Bill Panel

Food writer **Michael Pollan**, the John S. and James L. Knight Professor of Journalism, and **Dan Glickman**, former Secretary of Agriculture and currently a senior fellow at the Bipartisan Policy Center, will participate in the

**Spring 2012 Albright Lecture**, a panel discussion on the United States Farm Bill, to be held Thursday, April 5, 2012. Location and additional panelists will be announced. Check <http://nature.berkeley.edu> closer to the event.

## Nitrate Contamination Higher in Latino Communities' Drinking Water

Researchers already know that, across the nation, small water systems have some of the biggest water-quality problems. Now a study in the San Joaquin Valley has found that size isn't the only issue when it comes to drinking-water contamination.

Valley communities with large Latino populations are exposed to disproportionately high levels of the agricultural chemical nitrate through their drinking water, UC Berkeley researchers reported in a study published in the June issue of *Environmental Health Perspectives*.

When ingested via drinking water, nitrate can harm women's reproductive systems and cause the often fatal "blue baby syndrome," among other health effects.

The study explored demographics-related inequalities in the nitrate exposure of residents in 327 drinking-water

systems throughout the San Joaquin Valley's eight counties, home to some of the highest rates of poverty and largest Latino populations in California. It was the first peer-reviewed study in the United States to directly analyze the relationship between nitrate contamination, race, and class.

Researchers found that the correlation between demographics and contamination was strongest in smaller water systems, which generally serve some of the most remote and economically disadvantaged populations.

"This means that some of the most economically and socially vulnerable residents in the Valley face some of the worst drinking-water threats," said **Carolina Balazs**, a doctoral candidate in the Energy and Resources Group (ERG) and lead author on the study.

**Isha Ray**, also of ERG, **Rachel Morello-Frosch** of the Department of Environmental Science, Policy, and Management (ESPM), and **Alan Hubbard** of the School of Public Health were coauthors on the study.

— ANN BRODY GUY

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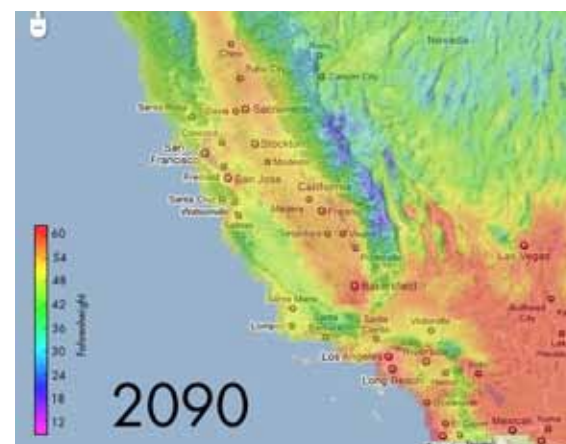
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## Party Like It's 2099

Climate change research from universities and research centers across California is now openly available through <http://caladapt.org>, a public website developed by CNR's **Geospatial Innovation Facility** (GIF) for the Public Interest Energy Research program operated by the California Energy Commission. Users can generate a variety of map-based climate change-related scenarios, including changes to snowpack, wildfire risk, low and high temperatures, and the degree of temperature change from now through the end of the century.



## A Slight Tick for Urban Gardeners



Some folks might not appreciate being known as "the tick guy," but ESPM's **Robert Lane** relishes the appellation. For nearly four decades Lane has studied ticks, particularly those that attach to humans. His work has been seminal in the field, growing the knowledge base about these pesky — and worse — disease-bearing critters.

Lane, a professor emeritus, recently shed yet more light on ticks. In the first study of its kind in North America, Lane moved his tick research from rural woods to urban gardens.

"Until this study, most of our research was conducted in undisturbed natural habitats, such as dense woodlands," Lane said. He and his research team shifted their attention to public gardens in the Bay Area to learn about human-biting tick populations closer to home, and to discover what, if any, risks they might pose to gardeners.

"To our surprise, we identified transmission cycles of Lyme disease spirochetes — spiral-shaped bacteria — similar to those in undisturbed wildland areas of Northern California," he said.

In an article in the July-August-September issue of *Pacific Horticulture* coauthored by Natalia Fedorova, Lane was careful not to cause undue alarm, noting that tick abundance doesn't necessarily translate to higher risk for gardeners.

"Not all ticks bite humans," said Lane. "Only the adult females and the poppy seed-sized nymphs normally attach to people."

Some basic vigilance can help to neutralize the added risk factor. "Gardeners working where ticks abound should seriously consider wearing a pair of white overalls treated periodically with a tick repellent containing permethrin," Lane said, referring to the repellent ingredient that studies have found to be most effective. The light-colored clothing makes ticks more visible.

What about ordinary garden visitors? "If they stay on the trails and away from the beds, the risk is virtually nil," he said.

Lane also tamps down any undue alarm by noting that his study was limited to two public gardens: the University of California Botanical Garden and the Regional Parks Botanic Garden, both adjacent to wildlands in the Berkeley Hills. Further study is needed to determine whether tick populations are present in other metropolitan gardens, he said.

— GUY

**EUROPEAN TOURISTS:** Another landmark study coauthored by Lane and **Fedorova** found evidence that a spirochete that was previously associated only with Lyme disease cases in Europe occasionally infects humans in California. Of approximately 18 described species of Lyme disease-group spirochetes worldwide, this is only the second known to infect people in North America. The study was spearheaded by **Yvette Girard**, a former Lane postdoc, and published in the March 2011 *Journal of Clinical Microbiology*.

## Top Predators Impact Entire Ecosystems

Declines at the top of the food chain over the last several thousand years have been well documented. Now researchers have found that these declines in predators and large herbivores may have profound impacts on ecosystem function, resilience, and health throughout the world.

In a paper published in the July 15 issue of the journal *Science*, an international team of 24 researchers presented evidence highlighting the reverberating — and often unexpected — effects caused by the loss of these "apex consumers," not only on immediate prey species, but also on the dynamics of fire, disease, vegetation growth, and soil and water quality.

For example, research by ESPM associate professor **Justin Brashares** linked the decline of apex predators such as lions

to the increase in baboon populations in sub-Saharan Africa. As baboon numbers swelled, there was an increase of intestinal parasite transmission from baboons to humans.

"This is the first paper to bring together studies that present strong empirical evidence of what naturalists and ecologists have long suspected," said Brashares, who with **Mary Power**, UC Berkeley professor of integrative biology, worked closely on the study with lead author **James Estes**, adjunct professor of ecology and evolutionary biology at UC Santa Cruz.

Based on their findings, the researchers recommend that the health of apex predators should be taken into account in conservation and management decisions.

— ADAPTED FROM AN ARTICLE BY SARAH YANG AND ROBERT SANDERS



## Native Bee Habitats Key to Farming, Conservation, Nutrition

Honeybees are getting too much credit, it seems. Wild bee species pollinate more than a third of California's crops — to the tune of \$889 million to \$2.2 billion\* per year, according to a study published in the June 2011 issue of *Rangelands*. And many of those crop-pollinating wild bees live in rangelands — chiefly ranches that graze cattle.

"This means that preserving rangelands has significant economic value, not only to the ranchers who graze their cattle there, but also to farmers who need the pollinators," said **Claire Kremen**, UC Berkeley associate professor of environmental science, policy, and management (ESPM), and senior author of the study.

Kremen said that if California is to sustain its agricultural output of pollinator-dependent crops, worth an estimated \$11.7 billion per year to the state's economy, diversifying sources of pollination is critical — like diversifying a stock portfolio. "This will become even more important with climate change, as some species will thrive in changed conditions and others won't," she said.

And while it's common sense that healthy crops result in a healthy food supply, a separate study led by Kremen, published the same month in the international online journal *PLoS ONE*, put a number on the human health benefits of animal pollination. The researchers estimated that up to 40 percent of some essential vitamins, minerals, and dietary lipids provided by fruits and vegetables could be lost if there were no pollinators around to do the job.



The study notes that cancer-fighting vitamins in bright red, yellow, and orange fruits and vegetables come from animal pollinator-dependent crops, as do other important antioxidants. "The yield increase attributable to animal-dependent pollination of these crops is significant and could have a potentially drastic effect on human nutrition if jeopardized," Kremen said.

Kremen says one solution to preserving wild bee habitats is for farmers to pay ranchers to maintain rangelands, just as they pay beekeepers to bring honeybee colonies to their farms. On a larger scale, a sea change that includes decreased use of pesticides and monoculture agriculture, together with thoughtful, integrated land use policies would help increase native bee populations and diversify pollination sources. (See "How to Feed the World: Start Small," page 8.) — *cuy*

*\*These numbers reflect a minor adjustment from those published in the original study. An erratum will be published in an upcoming issue of Rangelands.*

**CROWD-SOURCING BEE DATA:** ESPM professor **Gordon Frankie** led the first annual Sonoma Bee Count in July 2011, launching an endeavor that is expected to continue for at least 10 years. The Sonoma Ecology Center invited Frankie's group to spearhead the citizen-initiated, citizen-conducted count, one of the first quantitative bee counts by citizens in the United States.

## California a Top Suspect in Tree-Killing Mystery

Using genetic detective work, UC Berkeley and Italian researchers have traced back to California the origins of a fungus that has killed cypress trees on six of the world's seven continents. Their findings, published Sept. 1, 2011, in *Phytopathology*, spotlight the hazards of planting trees and other vegetation in regions where they are not native.

Study co-author **Matteo Garbelotto**, Cooperative Extension specialist in ecosystem sciences, said Monterey cypress became very popular in Europe because they grow fast, and grow really well along the shore. "This popularity may have inadvertently led to the devastating spread of a deadly fungus throughout the world," Garbelotto said. — ADAPTED FROM AN ARTICLE BY SARAH YANG

## Safety Is for the Birds



Mist netting is the most common method scientists use to capture birds for research, yet until recently there had been no study of the risks these nets pose to birds. Good news: The first large-scale study of bird netting found minimal risk — injury and mortality occurred in only a fraction of one percent of well over a half-million captures.

Researchers led by ESPM graduate student **Erica Spotswood** used a dataset of more than 345,000 records from across the United States and Canada to assess the risk factors that could increase rates of injury or mortality, including bird size, age, frequency of capture, and the role of predators. The data spanned 20 years of research and 188 species of birds.

The results revealed that birds are rarely injured or killed by mist nets. Of 620,997 captures, incidents of injury amounted to 0.59 percent, while only 0.23 percent of captures resulted in mortality.

Spotswood discovered the lack of mist net research when she was denied a research permit by officials in French Polynesia, who cited safety concerns. She found that there was no comprehensive study quantifying the frequency of mist net-related bird injuries.

"What began as an inquiry for a permit application ended up evolving into something we feel will be of value to the scientific community," she said.

The study was published online in July 2011 by *Methods in Ecology and Evolution*.

— ADAPTED FROM A STORY PUBLISHED BY WILEY-BLACKWELL

**WE'LL CALL HIM JUNIOR:** Parrot parents appear to "name" their offspring. This and related findings are the first field data to identify the factors involved in the parent-to-child transmission of a socially acquired trait in free-ranging parrots. The study, led by ESPM professor **Steve Beissenger**, the A. Starker Leopold Chair in Wildlife Biology, was published in the July 13, 2011, *Proceedings of the Royal Society B*.

## SUBJECT: Why I Do Science



ENTRY BY:  
**W. Michael Hanemann**

ENTRY #:  
**006**

Economics is a social science. While macroeconomics focuses on the aggregate interactions among individuals functioning through a market economy, microeconomics, the area in which I work, focuses on understanding how individuals make choices and what those choices reveal about their preferences. Much of my work answers those questions in the particular context of the environment, water, and climate change. I find them endlessly fascinating.

I decided to become an economist while I was an undergraduate in England because of my concern about alleviating rural poverty in developing countries. My professor had a distinctive approach to development economics. The most common approach was to do empirical research based on data collected by others — by census bureaus, for example. My professor felt that, to gain a realistic understanding of the choices confronting peasant farmers, his students should visit the country and actually live in the field for the duration of the growing season, observing farming practices on the ground.

He was starting a project that covered three remote parts of India. One day he informed me that he was deselectioning me for the project because he had concluded that I was unsuited for roughing it in an isolated hamlet. He was absolutely correct, of course, but I was devastated.

So I migrated to Harvard and switched my field to public finance and the cost-benefit analysis of government programs. I soon became interested in applying this to the brand-new topic of government programs for environmental protection. But I have continued to embrace my old professor's philosophy: Before formulating a theory of behavior, one should first observe what people actually do — how they function, what choices they confront, how they see those choices — and then frame the theory around the observations.

I now do my fieldwork mainly in Sacramento and Washington, D.C., which accommodates my need to be within easy reach of a coffee shop or a bookstore, a need correctly identified by my professor in England. But fieldwork is a continuing source of interesting new questions regarding human behavior.

Professor Emeritus **W. Michael Hanemann**, a member of the National Academy of Sciences, was on the Agriculture and Resource Economics faculty from 1968 to 2011.



## ERG Joins the CNR Family

Sustainability and Climate Change Issues Top the Agenda

The **Energy and Resources Group** (ERG) has held a unique position on campus for 38 years. Led by distinguished core faculty, ERG's independent, interdisciplinary approach to its titular issues has garnered the world's top prizes, provided a source of expertise for national media and the government, and consistently drawn top students from around the world.

ERG and the College of Natural Resources are pleased to announce that ERG is now part of the CNR family. The new association allows ERG to maintain its unique status as an "augmented graduate group," while its students, faculty, staff, programs, and alumni can now receive a broad range of services from the College.

"ERG needs to expand in order to address growing issues of sustainability," said **Daniel Farber**, the Sato Sho Professor of Law and current ERG chair. Farber said that ERG aims to cover such topics as global food security, managing energy demand, sustainable consumption, and global environmental governance. "We think this partnership will strengthen ERG, providing a foundation for our growth and the valuable perspectives of colleagues with related interests."

Growth means a need for more administrative and physical resources. "Simply because of lack of space and resources, ERG must turn away brilliant graduate students — students who could make major contributions to energy and sustainability issues," Farber said.

A tiny sampling of current Ph.D. students reflects ERG's academic diversity:

After years of working solely on the technical issues related to a Superfund site, **Deborah Cheng** came to ERG to connect critical technical work to the communities of people it is meant to serve.

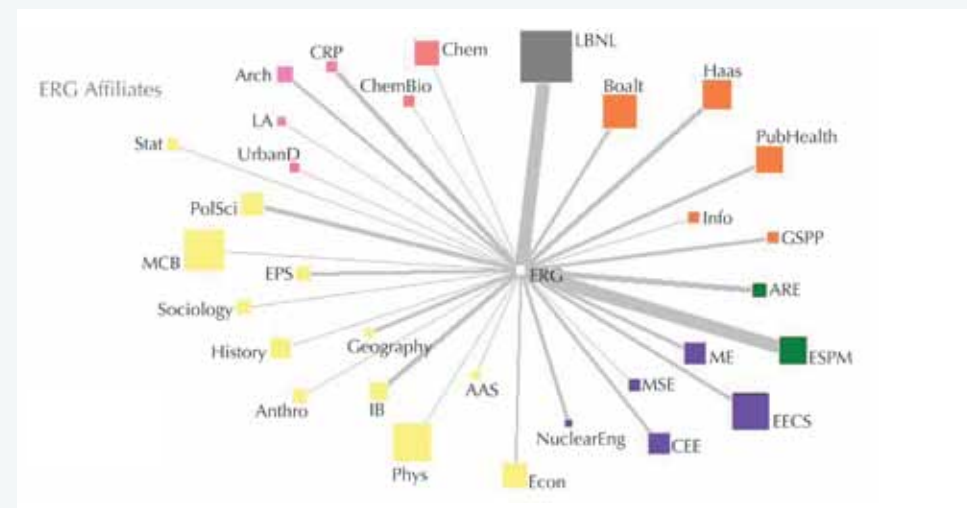
**Joshua Apte's** research explores the air quality, health, and climate change implications of the current rapid adoption of motor vehicles in developing-world cities.

**Christian Casillas** is interested in improving the reliability of diesel-powered electricity grids in rural communities through integrating renewable energy technologies, efficiency measures, and different models of management.

**Sam Borgeson** left his position as founding partner of a software consulting firm to pursue his passion for reducing the environmental impacts of our built environment.

The College is greeting its new students and colleagues with open arms.

"I am enormously pleased to welcome the Energy and Resources Group to the College of Natural Resources," said Dean J. Keith Gilles. "This new relationship will allow both ERG and CNR to reach our respective but closely aligned goals — goals that look outward to work on some of the world's greatest challenges." — ANN BRODY GUY



Eight core ERG faculty are complemented by more than 100 affiliate faculty from across campus and the Lawrence Berkeley National Laboratory. Node size corresponds to the total number of faculty in the department or school and colors indicate college affiliation.

**WEB EXTRA: TEACHING SCIENCE AND THE IMAGINATION**  
 Visit a mind-expanding Environmental Studies class with former U.S. poet laureate **Robert Hass** and ESPM professor **Garrison Sposito**.  
<http://nature.berkeley.edu/breakthroughs/imagination.php>

## We Are the Champions of Computational Genomics



## Five Key Lessons

FROM NST 160

It pays to stand up for something you believe in. Plant and microbial biology professors **Brian Staskawicz** and **John Taylor** saw a need to bring the tools of genomics to the campus's multifarious biology researchers, who had questions ready-made for genomics but lacked the computational expertise to make use of the new, inexpensive data.

"It's a special kind of data — researchers need to understand where it came from and how it was created," said **Donna Hendrix**, chief administrator for the Department of Plant and Microbial Biology (PMB).

"Berkeley was in a very strange position," said Taylor. "Many of the world's top developers of computational methods for next-generation genomic sequence data were in the statistics, mathematics, and bioengineering departments, but there were very few faculty in biology departments — among them PMB; Environmental Science, Policy, and Management; and Integrative Biology — with the computational expertise to use the methods."

Staskawicz and Taylor wrote grants and garnered support from campus upper management, offered PMB space for a center, and coordinated with **Susan Marqusee**, Berkeley director of the California Institute for Quantitative Biosciences, or QB3, who shared their vision. Hendrix worked the balance-sheet magic. The result is the new **QB3 Computational Genomics Resource Lab**, launched in June 2011 and housed in Koshland Hall.

"There was a lot of synergy with QB3, since they already had two genomics labs," said Staskawicz. "They wanted it to be compatible with their existing labs, and they provided the funds to allow that to happen." The result is a resource for the entire campus — equipment, classes and workshops, and support for researchers.

"The new lab will allow scientists to spend more time focusing on extracting meaning from genomics data, and less time struggling with the complex logistics of building computer systems and installing software to analyze the data," said Staskawicz, who is co-director with Taylor.

"Our aim is to put the infrastructure in place that allows knowledgeable users to teach novices, creating a self-sustaining and self-perpetuating exchange of expertise," said Taylor. — GUY

**SOCIETY NEWS:** Cooperative Extension specialist **Peggy Lemaux** has been elected president of the 5,000-member **American Society of Plant Biologists**.

Nutritional Sciences and Toxicology professor **Andreas Stahl's** class "Metabolic Bases of Human Diseases" focuses on recent developments in basic science to illuminate the causes and treatment options of metabolic disorders. The recently revamped class is now roughly divided between disorders caused by overnutrition (excessive food intake), such as heart disease, diabetes, and cancer, and those caused by undernutrition, such as rickets.

*Breakthroughs* asked Stahl to share five key lessons that he hopes will resonate with students — and with you.

- 1 The body senses nutrients.** It detects which nutrients are present — and which are not — and then compensates to try to maintain homeostasis, i.e., relatively steady levels. This happens on the level of the body as a whole organism as well as within individual organs and cells.
- 2 Nutrient sensing gone wrong can cause disease.** Disruptions in the nutrient sensing pathways — due to genetic mutations, overloading the sensing mechanism with too many nutrients, or other factors — can cause severe diseases.
- 3 There are different kinds of diabetes: inherited and acquired.** Type 2, the most common, is tightly linked to overnutrition. Too many nutrients coming in causes cellular stress that interferes with the normal response to insulin. Inappropriate storage of fat in organs like the pancreas and liver also interferes with insulin release and sensing, as do other stresses, such as inflammation, environmental factors, and genetic predisposition.
- 4 The brain regulates your urges to eat and expend energy.** Your brain receives nutrient-related signals from different organs telling it whether your stomach is full, if the food you are eating is tasty, what you are digesting at the moment, how full your fat stores are, etc. The brain's hypothalamus region integrates all these signals and generates the feelings of hungry versus full.
- 5 Your cells remember.** Changes in diet can affect the disease susceptibility of following generations. These environmental effects change which parts of your DNA can be activated (though not the DNA sequence itself). So, a mother's diet during gestation can impact the development of obesity and diseases in her children. A more surprising transgenerational effect: Your chances of developing diabetes may hinge on whether your grandfather was starving during his boyhood.



A group of CNR researchers say that to be sustainable, agriculture needs a paradigm shift ... to diversified farming systems



# HOW TO FEED THE WORLD

start small

By Eileen Ecklund  
Farm photography by Paul Kirchner Studios

**W**hen American families sit down to dinner, often the concern is to avoid eating too much. Yet in 2010, the United Nations' Food and Agriculture Organization (FAO) estimated that more than 900 million people around the world were undernourished. By 2050, the world's population is projected to rise to somewhere around 9 billion — and more people will likely be eating more meat, which takes more resources and energy to produce than most crops.

How on earth will our agricultural systems feed all those mouths, especially while coping with climate change, soil degradation and erosion, water shortages, and rising energy prices? And can it be done without increasing the environmental damage attributed to industrial farming practices?

Maybe, if we can learn to see landscapes through the eyes of a bee. That may seem a tall order for such a tiny insect, but **Claire Kremen** believes that understanding what is good for bees is a first step toward shaping agricultural ecosystems, or "agroecosystems," that can sustain both humans and natural biodiversity, without the need for the huge inputs of chemicals and energy that have

made industrial farming practices so damaging.

Kremen, a conservation biologist and associate professor in the Department of Environmental Science, Policy, and Management (ESPM), was studying the effects of natural habitat on the crop pollination services of wild bees when she made an observation that would alter the focus of her research. The farms in her study that were more biodiverse, growing multiple crops with organic techniques, interspersed with natural habitat, seemed able to "grow their own bees," providing sufficient food and nesting resources to act as oases for wild pollinators in the midst of otherwise intensively farmed landscapes. These farms could rely to a large degree on wild bees to pollinate their crops, while farms growing only one crop had to import European honeybees for pollination.

This discovery put Kremen on the road to realizing that most or even all of the inputs that modern commercial farms require — chemical pesticides and fertilizers, wasteful amounts of water and energy, imported pollinators — were needed only because the monoculture-dominated landscapes created by industrial agriculture lacked biodiversity.

Claire Kremen visits a field of mixed pepper varieties at Full Belly Farm in Guinda, Calif.



**For all their potential benefits, the question remains: Can diversified farming systems feed a growing, changing world? Perhaps a better question might be, can we feed the world without them?**



Animals such as sheep and llamas clear cover crops and weeds, and also produce wool. "These guys are very much our workers — they clean the fields for us," said Full Belly Farm's Judith Redmond, one of four partners.

"From studying the pollinators, I realized that the way we conduct agriculture has basically required us to replace all of the ecosystem services that used to be in the agricultural ecosystem with substitutes," she says. If farmers could bring back many of the traditional practices that supported biodiversity, enhanced by the application of modern ecological science, Kremen believes that the world could produce more food while reducing agriculture's harmful effects, making it more sustainable over the long term.

A growing number of policy-makers and researchers are thinking along the same lines. A 2008 report released by the International Assessment of Agricultural Science and Technology for Development, a multinational effort spearheaded by the World Bank and the FAO, concluded that modern agriculture would have to shift rapidly away from industrialized systems and toward sustainable, small-scale, diversified farming systems in order to meet the challenges of population growth, hunger, environmental degradation, and climate change.

And in March of this year, the UN Special Rapporteur on the Right to Food, Olivier De Schutter, issued

a report asserting that small-scale farmers in the poorest regions could double their food production within 10 years by applying agroecological principles (see "The Agroecological Revolution," page 12). He made this assertion based on the work of a number of agroecological researchers, including ESPM professor **Miguel Altieri**, and cited as evidence several recent studies of sustainable agriculture projects in poor countries that found substantial increases in crop yields — in some cases more than double — as well as improvements in the farms' environmental services. De Schutter urged countries and philanthropic groups to invest in research and adopt policies to help scale up agroecological practices.

Kremen and a group of UC Berkeley colleagues from a variety of disciplines are leading the charge, establishing a new **Berkeley Center for Diversified Farming Systems** (<http://dfs.berkeley.edu>) to bring together researchers, writers, and practitioners from many fields to focus on feeding the world's growing population through diversified, multifunctional agriculture that also addresses the poverty and lack of access to land that are the root causes of hunger. Thanks to support from the Neckowitz Family Foundation,

the Berkeley Institute of the Environment has already hosted a series of roundtables and presentations on topics related to diversified farming systems, with more to come.

In addition to Kremen, affiliated faculty include Altieri, **Lynn Huntsinger** (ESPM), **Nathan Sayre** (Geography), **Alastair Iles** (ESPM), **Christy Getz** (a Cooperative Extension specialist in the College of Natural Resources), **David Zilberman** (Agriculture and Resource Economics), and **Justin Brashares** (ESPM).

Berkeley is uniquely positioned to host this interdisciplinary research and education center, Kremen says, because of its world-renowned faculty in the fields of agroecology, science, technology, society, agricultural economics, and rural sociology. Notes Huntsinger: "That's the beauty of our College, that we can bring all these things together."

### **PROMOTING BIODIVERSITY ACROSS SCALES**

Generally speaking, a diversified farming system is one that promotes biodiversity across spatial scales, from plot to field to landscape. Crops are planted and livestock raised in combination, resulting in

interactions that sponsor the functioning of the farming systems in ways that replenish natural ecosystems. Methods employed within a diversified farm may include minimal soil tillage, growing multiple crops together, planting cover crops, and interspersing trees and shrubs with crops and livestock.

These practices also provide pollination, pest and disease control, water purification, and erosion control. They help to build healthy, productive soil and reduce water use, as demonstrated by research conducted in both the Altieri and Kremen labs on farms in Napa, Sonoma, and Yolo counties (see *On the Ground*, page 17).

"Diversified farming systems produce and regenerate the ecosystem services that the agricultural system needs," Kremen says. This allows farmers to forgo the harmful inputs and practices required in industrial farming, which is beneficial for the biodiversity that in turn produces the services. "I see it as a cycle."

At the landscape scale, diversified farming practices include coordination among land managers to protect wildlands in and around agricultural areas, and the support of ecological practices on rangelands and in



# The Agroecological Revolution



**‘By their nature, small-scale agroecosystems or small farms conserve natural resources and help reduce rural poverty.’**

In the debate over the future of agriculture, one school of thought holds that only industrial farming, enhanced and made less polluting by technologies such as genetically engineered crop varieties, can produce enough food to feed future populations. But many agricultural analysts and scholars argue that this reasoning is fundamentally flawed — that industrialized farming and its associated technologies not only degrade natural resources and accelerate climate change, they also exacerbate and in many cases create the poverty and unequal distribution of land, water, and seeds that are the primary causes of hunger around the world.

Among the latter group is ESPM professor **Miguel Altieri** (above), who argues that food systems should be transitioned away from fossil fuel-based industrial, large-scale production of commercial crops for export, toward small family farms designed to be biodiverse, climate-change resilient, and highly productive.

“By their nature, small-scale agroecosystems or small farms conserve natural resources and help reduce rural poverty by allowing small farmers and rural communities to become more self-sufficient,” says Altieri, who has served as an advisor to the United Nations and partnered with academic research institutions and nongovernmental organizations to facilitate the spread of these farming systems worldwide.

Agroecology is rooted in traditional peasant agricultures, which make multiple uses of natural resources, creating landscape mosaics of rich biological diversity. Agroecologists combine knowledge gleaned from these traditional practices with modern ecological science to design farming systems that produce a variety of crops, trees, and livestock.

“These polycultures result in synergisms that create optimized ecological processes or services, such as

natural pest control, pollination, and soil biological activity, which sponsor the functioning of farming systems without the need for external inputs,” Altieri explains.

Studies have shown that agroecological farms produce more food overall than monocultures — from 20 to 60 percent more food per hectare, according to Altieri. Not only do they free small farmers from dependence on inputs like chemical pesticides, fertilizers, and transgenic crop varieties; because the inherent biodiversity increases resilience, farmers are less vulnerable to losses from drought, flooding, or the failure of any one crop.

Altieri has documented many existing sustainable agroecosystems, from heritage systems like Peru’s Andean agriculture and the Maasai pastoral systems of Kenya and Tanzania, to Cuba’s urban farms and the complex coffee and cacao agroforests maintained by farmers in Meso-America. There are thousands of such examples throughout the developing world, he says.

And, in Latin America in particular, Altieri says, small farmers have joined forces with nongovernmental organizations and some academic institutions to spearhead what amounts to an agroecological revolution — for improving food security and health as well as the environment — a development he says is spreading around the world.

“In the future there will be less land, water, and nitrogen available to produce crops, and in a context of climate, food, and energy crises, it is now largely proven that agroecology is the only path to significantly increase production and improve farmers’ income and livelihoods,” Altieri says. “It is imperative that institutions like CNR invest heavily in educating the agricultural professionals of the future, so they are well versed in agroecology and can tackle the challenges that lie ahead.”

PHOTO: Courtesy of Dirt! The Movie ([www.dirtthemovie.org](http://www.dirtthemovie.org))

forests. “In California, 35 million acres of rangelands are providing all kinds of services, from habitat for pollinators to livestock products to viewsheds,” says Huntsinger, a range ecologist and manager (see “Preserving Rangeland Biodiversity,” this page).

Some heritage systems, like the Ifugao rice terraces of the Philippines, maximize the use of mountainous terrain for rice production while incorporating stands of managed forest and a variety of aquatic and terrestrial wildlife. Other systems combine traditional farming techniques with modern ecological science and innovative marketing and distribution methods; Kremen points to Full Belly Farm in California’s Capay Valley, which successfully raises more than 80 different crops, wresting a huge amount of produce from a small area.

Even industrial farms can become more biodiverse through the application of improved techniques. Monocrops such as vineyards, for example, can be broken up with flowering cover crops, hedgerows, and corridors that help control pests without chemical inputs.

## HOW TO FEED 9 BILLION?

For all their potential benefits, the question remains: Can diversified farming systems feed a growing, changing world? Perhaps a better question might be, can we feed the world without them? Despite the tremendous crop yields made possible by industrial farming and the technologies of the Green Revolution of the 1960s and ‘70s, 900 million people still do not get enough to eat, and starvation has become a recurrent feature of life in sub-Saharan Africa. Increasing the food supply is not enough; that food needs to get to those who can least afford it.

“The Green Revolution didn’t solve world hunger; it solved the number of calories,” Kremen says.

Most of the food consumed in developing nations is produced by small farmers, many of them still using subsistence methods. Their farms are where the productivity gains must come from, and the question, Kremen says, is whether countries will adopt policies that favor industrial intensification, or sustainable intensification based on agroecological principles.

One of the key reasons that the Green Revolution bypassed the world’s poorest farmers is that they couldn’t afford its technologies. In his report to the UN, De Schutter pointed to evidence that



## Preserving Rangeland Biodiversity

“Ranching isn’t the first thing that leaps to people’s mind as diversified farming,” says ESPM professor **Lynn Huntsinger** (left), who specializes in rangeland conservation and management. Yet “privately owned rangeland is perhaps the most biodiverse undeveloped land in California,” she says, because early settlers chose the most productive, best-watered land, and because grazing alters native ecosystems less than other uses, such as crop agriculture. This biodiversity supports a host of ecosystem services, including the pollination provided to farmers by wild bees (see Briefs, page 4).

Both Huntsinger and **Nathan Sayre** (left), an associate professor in the Geography Department who also studies rangeland management and ecology, collaborate with ranchers to devise land management practices that promote biodiversity and preserve their land from development.



Huntsinger has just begun a study of how California ranchers manage their wetlands. Many have man-made stock ponds that are important habitat for some of the more rare vernal pool species, including California tiger salamanders and red-legged frogs, because most of the state’s natural wetlands have been drained. Sayre is currently collaborating with scientists and ranchers in Arizona and New Mexico, learning about historical range management practices and how they have interacted with climate to change the land’s ecology, with the goal of integrating those insights into current ecological research.

Today, Huntsinger says, “many ranchers manage their land for a high-quality environment.” Restoring grasslands and controlling erosion can improve forage production for livestock as well as promote biodiversity. New markets are developing for ecosystem services and niche products such as grass-fed and organic meats, augmenting income for ranchers who are able to diversify to take advantage of them. But the challenges are many, including low profit margins, difficulties in accessing new markets, limited funds for supporting ecosystem services, regulatory costs, and uncertainty.

The greatest threat to rangelands today, both Sayre and Huntsinger say, is land-use conversion. Hundreds of millions of rangeland acres across the western United States have been fragmented for residential developments, although the recent housing bust has slowed the trend. Still, private land is so much more valuable for development that “urbanization is a constant background threat,” Sayre says.

PHOTO of Nathan Sayre: James Block





## The People Behind Our Food

Diversified farming systems aren't just about providing food and protecting the environment; to be truly sustainable, they must also provide a livelihood to farmers and farm laborers, and help support the communities that depend on them. That's where the work of **Christy Getz** (above), an ESPM-based Cooperative Extension specialist, comes in.

"My research is about diversified food systems," says Getz, who has studied farm labor conditions, food security among agricultural workers, and the challenges facing economically disadvantaged farmers. In one project, her team developed a program to help Southeast Asian refugee farmers in California scale up their operations, connect to alternative distribution systems, and access new markets for their produce, such as local schools.

In another project, Getz studied labor conditions on a spectrum of California farms, from small to large, organic to conventional. She discovered that mid-size and large diversified organic farms can employ workers year-round instead of seasonally, an important benefit to laborers. However, only the larger organic farms can typically afford more farmworker benefits, and many organic farmers across the spectrum are opposed to worker unionization.

"The more ideologically driven organic farmers tend to treat their workers well, but for the most part any perks or benefits they might receive are not institutionalized," she says. She has helped to pilot "beyond organic" social certification programs on organic farms, but says that farmers have vigorously opposed making social justice components a part of organic certification.

"There are clearly economic constraints on organic and small farmers," Getz says, "which is why we need to take a closer look at distribution systems and the whole food dollar. As a society we're based on very cheap food, and at some point, something's got to give."

"In order for things to change, we [as a society] have to talk about things like immigration policy as well as ecology. My piece is to bring the social, structural, and economic issues to the table."



On this field at Full Belly Farm, an irrigation line crosses a field where Sudan grass is used as a cover crop to add organic matter to the soil. Below, a native-species hedgerow borders an artichoke field.

agroecological methods outperform chemical fertilizers in boosting the amount of food produced by subsistence farmers. Many of these methods are inexpensive but require more labor — which could create more rural jobs and help to alleviate poverty.

"We won't solve hunger and stop climate change with industrial farming on large plantations," De Schutter said in a statement accompanying the report's release. "The solution lies in supporting small-scale farmers' knowledge and experimentation, and in raising incomes of smallholders so as to contribute to rural development."

Industrial agriculture isn't likely to disappear any time soon, and many experts believe that any solution to the twinned problems of hunger and resource depletion will require some combination of industrial and sustainable methods. Some, like agricultural economist Zilberman, argue that modern industrial technologies, particularly genetic engineering, could have a crucial role to play in helping agriculture to wean itself from the worst of its chemical abuses, through pest-resistant crop varieties, and to adapt to climate change by developing heat- and drought-tolerant varieties.

"Diversified farming systems are crucial to the future of the University, California, and even to global food production, but the concept really has to be inclusive of modern biotechnologies," Zilberman says. "It has to

take the best of science that's sustainable and combine it with environmentalism."

Kremen says that, while the economics perspective is a key one for this growing interdisciplinary group, she is skeptical about the ultimate value of genetic engineering, arguing that genetically modified organisms are just another variety of the reductionist, high-tech approach that has led to

so many of industrial agriculture's worst abuses.

"People love technological fixes," she says. "But spending so much effort to produce these engineered varieties that then have severe vulnerabilities or cause new problems is not, I think, a very good strategy. I'd rather see that effort put into coming up with agroecologically designed communities that do the same thing — that use water and nutrients really efficiently."



PHOTO of Christy Getz, Jen Guyron





## Getting the Policies Right

How much do tools like sustainable seafood campaigns affect consumers' choices? Are subsidies or regulations more useful in encouraging farmers to improve their farms' diversity? How can we preserve knowledge of traditional farming practices in areas where it is dying out? These are the kinds of questions that ESPM professor **Alastair Iles** (above) asks in his research.

"I focus on the public policy, science policy, and sociological dimensions of making a switch back to diversified systems from industrial agriculture in developed countries," Iles says. This focus has led him to compare the sustainability policies and actions of supermarkets in the United States and Britain; study the importance of innovative learning tools that promote sustainable agriculture by educating consumers about such issues as "food miles," the distance that food travels from farm to table; and evaluate the effectiveness of tools like sustainable seafood wallet cards versus more robust certification programs.

In a current project, Iles and former ESPM graduate student **Elizabeth Havice**, now a professor at the University of North Carolina, are looking at how global sustainable aquaculture standards are being set. They have found major differences between standards that are industry-led as opposed to those led by nonprofits, but nonetheless, "both still encourage industrialized fish farming over smaller-scale, less intensive production in developing countries, which are great examples of diversified farming systems," Iles says.

Looking ahead, he says, "I'm very interested in policies for creating or retaining the knowledge stock needed to practice diversified farming, which is very knowledge-intensive compared to industrial agriculture." He cites as an example the Appalachia region, where many fruit-growing practices and varieties are quickly being lost as older generations of farmers die out. Policies to reverse this trend "could include developing knowledge banks to preserve existing knowledge, developing tools and training processes around peer-to-peer networks, and promoting what's known as citizen science," Iles says.

## Small-scale farmers could double their food production within 10 years by applying agroecological principles, says the UN Special Rapporteur on the Right to Food.

Altieri, who calls agroecology "the antithesis of transgenic technology," says that "there is not one acre of transgenics that feeds the one billion poor people. Transgenic corn and soybean are produced to feed cattle that the poor cannot afford, and for biofuels, canola, and cotton that don't feed anybody."

### INVESTING IN RESEARCH

Creating and supporting diversified agricultural systems, both in developing and developed countries, will require a substantial investment in research, and not just in the natural sciences. Work in fields like economics, sociology, and public policy can help societies grow a sustainable, biodiverse system of food production and distribution that allows farmers to not merely survive, but thrive.

"Structurally, one of the biggest challenges to truly sustainable agriculture is the push to do everything as cheaply as possible," says Christy Getz, who studies farm labor conditions and other societal factors (see "The People Behind Our Food," page 14). "Most profits in the organic sector go to the largest players in the food chain; very few small organic farmers make significant profits. Continued industrialization, concentration, and consolidation are changing the face of organic agriculture."

Another challenge is to identify the best methods for encouraging farmers in developed countries to switch from industrial to diversified farming practices, research that Iles, whose field is environmental law and policy, is pursuing (see "Getting the Policies Right," this page). Among the questions he's investigating are: How can farmer motivations be better linked to the science of agroecology? Through setting rules, or through creating economic incentives, or by creating peer pressure? How can we evaluate the effectiveness of different types of policies?

The goal of establishing the Center for Diversified Farming Systems is to close some of these research gaps — by providing a venue where scholars can share their work, and by helping to train future leaders in the field who in turn will translate agroecological scientific advances into practice. Ultimately, the aim of Kremen and her Berkeley colleagues is to create a place where ideas about how to create a sustainable future for human agriculture can be debated, and the best winnowed from the crop. **31**

PHOTO: James Block

# ON THE GROUND: Diversified Farming Systems



Rangelands are the dominant land use worldwide and store about one-third of the global soil carbon. There is considerable potential in these ecosystems for increasing the levels of carbon storage in soil, thereby reducing the amount of carbon in the atmosphere while also improving soil fertility. **Becca Ryals**, an ESPM graduate student in the **Silver** lab, is researching strategies for soil carbon

management in California rangelands. At her research sites in Marin County and at the UC Sierra Foothills Research and Extension Center in Yuba County, she is finding that a one-time application of compost can have a lasting effect on the rangeland carbon cycle by enhancing forage production, root growth, and soil carbon storage.

ESPM professor **Whendee Silver** studies how to lower atmospheric CO<sub>2</sub> through land management. Silver and her students and postdocs are part of the larger Marin Carbon Project, which looks at land management practices that remove carbon from the atmosphere and store, or sequester, it in soils. Their research is providing promising approaches that show that farming and ranching can be part of the solution to climate change.



\* The intensification of California viticulture has created large-scale monocultures and reduced non-crop habitat. With increasing consumer and grower demand, interest in ecologically based pest management (EBPM) has grown steadily. To fill key research gaps, **Albie Miles** and **Houston Wilson**, graduate students in ESPM professor **Miguel Altieri's** lab, are measuring the effect of flowering cover crops and landscape heterogeneity — the quantity and quality of surrounding natural habitats — on biological control of key arthropod pests. The study includes research sites in Napa, Sonoma, San Joaquin, and Fresno counties and will serve to advance scientific knowledge of EBPM strategies that meet organic production standards.



The rare California black rail is found primarily in the large coastal marshes of San Francisco Bay, but was recently discovered living in the Sierra foothills north of Sacramento, in small wetlands created by leaking irrigation ditches and natural springs. Studies by ESPM professor **Steve Beissinger** and

his graduate students have found that two-thirds of the foothill wetlands supporting these birds are on private lands. Now, as part of a \$1.25 million National Science Foundation grant led by Beissinger, ESPM professor **Lynn Huntsinger** is studying how ranchers and land managers make decisions that affect these small marshes. The project includes working with the ranching community to develop management recommendations that support both wetlands and ranching.



**Hillary Sardiñas**, a graduate student in ESPM professor **Claire Kremen's** lab, is studying the contribution of on-farm habitat enhancement to crop pollination. Many native bee species are efficient pollinators, and could act as insurance against fluctuations in honeybee supply.

Using research sites in Yolo County, Sardiñas is examining the ability of hedgerows, or field borders, composed of native shrubs to provide floral and nesting resources sufficient to support sustainable native bee populations. She measures increases in crop production associated with heightened pollination. Her work will provide farmers with a cost-benefit analysis of hedgerow adoption.

PHOTOS: California black-rail, Orien Richmond; field of soil, Daniel Canollo; sunflower, Hillary Sardiñas





1988 NUTRITION AND CLINICAL DIETETICS

## ARNELL JHINKLE

Arnell Josephine Hinkle grew up eating canned and overcooked vegetables. Since then, she has become a gourmet chef and learned organic farming, and is now an internationally recognized leader in the movement to promote better nutrition and physical activity as the path to health. Her current mission is helping adolescents in low-income and ethnic communities to improve their own health and that of their communities by embracing healthy eating practices and exercise.

By Rebecca Jones Ulrich | Photos by James Block

As the founding executive director of Community Adolescent Nutrition and Fitness (CANFIT), an 18-year-old national non-profit, Hinkle works with community-based organizations and private and government agencies, in the United States and abroad, to provide training and technical assistance for nutrition and fitness programs. She also advocates for better public policies to support the health of low-income communities of color.

CANFIT works to instill the importance of good nutrition and physical activity, using everything from participatory research to workshops to social media, and engages youth and community members every step of the way.

Hinkle's own interest in food started early and was born of necessity. In her hometown of St. Louis, Missouri, her immediate family was small — just her father, a Teamster truck driver, and her mother, a garment worker. “My mom worked, so when I came home, I started dinner,” Hinkle says.

“Growing up in St. Louis, meat was in every meal,” she recalls. “If vegetables were fresh they were cooked to death, but they were usually canned.”

She cooked the traditional African American fare she had learned from her mother and grandmother — that is, until she participated in a citywide after-school program that mixed children of all backgrounds and income levels. In that program she met a vegetarian who shared his cucumber sandwich with her.

“It was one of the things that changed my life. It was the first time I'd ever seen a cucumber used that way, and it was my first exposure to vegetarianism. I started baking bread and stopped overcooking vegetables.”

A scholarship led her to Princeton University, where she majored in geology. Although most geology majors went on to get Ph.D.s or work in the petrochemical industry, Hinkle knew she wasn't interested in pursuing the field any further. Needing to make a living until she found her calling, she fell back on her old interest: Now a Princeton graduate, she was cooking again. “Of course my family was horrified,” she laughs.

A weekend visit to Martha's Vineyard led to a three-year sojourn in which she apprenticed with a European-trained chef, cooked in the trendiest venues, and landed a brief gig as Diana Ross's personal chef — which, besides being a lot of fun, earned her credibility with her previously skeptical parents.

After another restaurant stint in Ecuador, Hinkle accepted a position managing an experimental cross-cultural community development center in New Hampshire, which included a 10-acre property complete with organic gardens and a solar greenhouse.

“I began to understand that if you nurture the soil organically, you get healthier vegetables,” Hinkle says. “For me, there was starting to be a disconnect with the restaurant food I had learned to prepare — the heavy creams and sauces — and what I was learning about health. This is when I started getting interested in nutrition.”

So she designed a unique master's program in nutritional horticulture at Leslie College in Boston. New degree in hand, she came to the Bay Area to start a “nutritional gardening” business. She designed organic gardens based on her clients' nutritional needs and provided them with personalized cookbooks to guide them in preparing their harvests.

But landscaping took a heavy physical toll, so Hinkle decided to focus on nutrition, obtaining a second bachelor's, in nutrition and clinical dietetics, at the College of Natural Resources, while simultaneously becoming a registered dietitian (RD).

“I appreciated CNR's programming and the fact that they had really strong female mentors, like **Mary Anne Burkman**, **Pat Booth**, and **Sharon Fleming**,” Hinkle says.

During her RD clinical internship at renal clinics and San Francisco General Hospital, “it really struck me that by the time folks get to the hospital with poor health it can be too late for them to make significant lifestyle changes.” Wanting to work on preventing chronic disease, she ended up staying at Cal to get a master's in public health.

“The education I got in nutrition was great in terms of the science background, but the curricula only paid lip service to the health aspects of ethnic cuisine.” At that time, Hinkle says, the assumption was that to be healthy, people had to completely change their cultural food practices.

That's when she realized that she needed to develop “culturally appropriate interventions.” “You have to work within people's cultural experience to promote healthier behaviors. Every culture has a tradition that includes healthy food and activity.”

Much of Hinkle's work at CANFIT is getting past the perception that healthy eating is elitist and not ethnic. “Low-income, ethnic people were the original proponents of ‘slow food,’ because that's all they traditionally had.”

CANFIT designs programs to educate and expose adolescents to new ways of thinking about their health and that of their community, Hinkle says — much like the after-school program did for her back in St. Louis.

Now, at family gatherings in St. Louis, Hinkle is known for bringing the vegetable kebabs. And in a full-circle moment, on her last trip back home she supplemented a family dinner of barbecued ribs with a cucumber salad, fresh from a relative's garden.



Hinkle shops for fresh produce at Berkeley Bowl West. Opposite page: Hinkle visits Berkeley Youth Alternatives, a local after-school program that CANFIT has worked with since 1995.



# The Peace Corps at 50

## CNR VOLUNTEERS LOOK BACK

In honor of the Peace Corps' 50th anniversary this year, and Cal's role as one of the biggest feeders of that program, *Breakthroughs* asked some of the College's many Peace Corps (PC) veterans to share their stories, memories, thoughts, and photos. Experiences were as diverse as the CNR alumni who served.

Read full interviews and see more photos online at <http://nature.berkeley.edu/breakthroughs/peacecorps.php>.

**Alice Kelly**, Ph.D. Candidate, Environmental Science, Policy, and Management

Service: Mozogo, Extreme North Province, Cameroon, 2004-06

**Lasting impact, there:** The park I helped the community get started is still open, their park organization is still running, and people still like to tell the story about the time I biked three kittens 12 kilometers down the road in a box strapped to my back.

**Lasting impact, here:** In a lot of ways the things that frustrated me the most during the Peace Corps, the things that I felt powerless to change while I was a volunteer, pushed me to do the research that I am currently doing. It changed my life.

**Vivid memory:** Trying to get a cotton mattress across the mountains on a motorcycle taxi in the pouring rain. That thing swelled up like a huge sponge. Wow, that taxi man hated me.

**Advice for new volunteers:** Two things: (1) Pride is a luxury that you cannot afford; (2) Let people be generous, no matter how poor they are.



**Andrew Wallace**, Environmental Science '06

Service: Dialafara, Mali, 2007-09

**Most surprising:** The lack of misery. By and large everyone was pretty content, even without all the amenities that we find so essential, like vegetables. That's not to say that there were no problems, just that the ability of humans to be satisfied with the status quo is both amazing and frustrating.

**Vivid memory:** I stepped off the plane and was hit by the moist, hot air and a smell of galvanized rubber. As we drove through the outskirts of the city, cramped in the back of a 4x4 stuffed with sweaty trainees and luggage, we watched the Malians move around ghost-like through their tin-roofed shacks and lean-tos under the orange glow of the sodium lights. The exhaust from all of the vehicles overpowered my senses. *I'm really here. This is it*, I thought.... As we pulled into the training site and disgorged from the 4x4s, we were welcomed by our training coordinator: "Aw bora aw ka so, aw nana aw ka so. You left your home. You have come home." He was right.



**Fortune Zuckerman**, Home Economics '61

Service: Colombia — Cartagena, 1974 and 1976; Santa Marta, 1975; Bogota, 1977 (volunteer leader) and 1978-80 (associate Peace Corps director)

**Most surprising:** How much Colombia changed me for the better. I learned to be more sincere in greeting people initially, rather than a quick American, "How are you?" Sometimes it would take five minutes to say hello. *¿Como esta Usted? ¿Que has hecho? ¿Que hay de nuevo? ¿Que me cuentas?*

**Lasting impact, here:** Hugel! In Colombia I met two children who were blind, and assisted them in reaching their school in Bogota. When I left, I decided to earn my master's degree in the field of peripatology at Boston College. This would allow me to train people who were blind to travel about safely, efficiently, and with confidence. Upon completing my degree in 1981, I took a job at Braille Institute in Los Angeles, and stayed with that organization for 22 years.

**Maryam Talakoob**, Political Economy of Natural Resources '83

Service: Gbarma (Lofa County) and Yekepa (Nimba County), Liberia, 1983-85

**Most surprising:** Poverty! I saw a level of poverty I had never seen before when I arrived at Roberts Field Airport in Liberia. I had never seen children running amok in the streets, without clothes and shoes, and with huge bellies. The feeling of shame I experienced surprised me the most.

**Lasting impact, there:** I have kept close contact with a Liberian friend, arranging to get him and his family out of Liberia

**David Shen**, Environmental Sciences '07

Service: Solwezi (Northwestern Province), Zambia, 2008-10

**Most surprising:** Learning the local language is an absolute must in order to get (almost) anything done. My local language was a Bantu one that was really challenging to learn, but with patience and perseverance, I became proficient enough to feel like a responsible and respected member of my community.

**Vivid memory:** When I experienced the wet/rainy season for the first time. I had never been tormented by such thunder, lightning, and rain — it shook and soaked me to the core; it was a total body experience, to say the least!

**Advice for new volunteers:** Strap on the seatbelt, because Peace Corps service is like a roller coaster ride. It has highs and lows, goes fast and slow, turns here and there (and even loops), but ends before you know it or want it to. Most of all, you won't be the same afterward.



during the civil war so they could come to the U.S. He is now going back to Liberia to start a water and latrine sanitation program [much like Talakoob's PC project] with the help of his family members.

**Lasting impact, here:** It increased my awareness of waste and reuse of material tremendously. Personally, I developed more tolerance for differences that I experience in my surroundings. I am a more patient and giving person than I used to be. I try not to take life for granted.

**Advice for new volunteers:** Observe everything, and never judge. Keep a journal, even if you write one line a day.



PHOTOS: Bottom left, Jen Guyton. Other photos, left to right, courtesy of Andrew Wallace, Fortune Zuckerman, David Shen, and Maryam Talakoob





1993 POLITICAL ECONOMY OF NATURAL RESOURCES

# JKEVINCARROLL

Ask J. Kevin Carroll how he wound up in the midst of White House energy policy and he'll point to the value of persistence, and to a lesson he learned as a teenager. His father, a World War II Navy veteran, often listened with some exasperation as his son complained about pollution, society, and the environment. "You don't like it?" the senior Carroll finally retorted. "Change it."

"And that's been the motivation ever since," Carroll says.

By Greg Weatherford | Photos by Jay Paul

These days, Carroll, 54, is energy branch chief for the federal Office of Management and Budget (OMB), overseeing policy analysis and development for \$17 billion a year in budgets carried out by the Department of Energy. The position is a powerful one, albeit in classic bureaucratic Washington, D.C., fashion. It sits at the intersection of politics, money, and research, allowing Carroll and his staff to support the best energy policies that science and politics can shape.

"One way to think about it is, we write the menu that the policy people choose from," he explains. For example, his endorsement of better automobile gas mileage wound up as part of a legislative package supporting biofuels. But he's quick to divert any suggestion that he is a force in energy policy.

"Nothing – *nothing* – happens in Washington because one person wants it."

Carroll's job has its advantages. His office faces the White House. His first date with the woman who would become his wife was to watch Fourth of July fireworks from the South Lawn. The office gym allows him a quick shower between his bike ride to work and suiting up for the workday.

His office makes recommendations to the White House about how to fund non-military Energy Department proposals, and oversees a \$100 billion loan program that supports energy investments.

Not bad for a guy who began his studies in the College of Natural Resources' Political Economy of Natural Resources program at the age of 28.

Carroll's road to a White House job was a winding one. Born and raised in Connecticut to a devoutly Catholic father from Quincy, Mass., and a "southern belle" mother from Shelby, N.C., he traces his interest in the environment to a high school course in ecology. In that class, "I got an understanding of the interconnectedness of the natural system," he recalls.

After high school, that understanding, and an inclination for activism, led him to answer a newspaper ad that read "Activists Wanted." The job turned out to be door-to-door fundraising for various environmental and social causes. While he acknowledges that his fundraising skills were a bit hit-and-miss ("They called me 'the Ultimatum Kid' because I was always this close to missing my quota," he says, laughing), the 18 months he spent doing it taught him persistence and gave him a good grasp of environmental policy.

Eventually Carroll received a promotion to run a branch office in New Haven, Conn. But when he examined its records, he discovered that the branch lost money all year except in summer, when college students came to work. His recommendation that the branch be closed the rest of the year was accepted, and Carroll found himself out of a job.

Around the same time, his girlfriend, who had moved to Mountain View, Calif., invited him to join her. Carroll —

out of work and without prospects — decided to move west. In California he got a number of jobs, including one with an air-conditioning company, and over time he learned to work on HVAC systems. At night he attended classes at community college, doing well.

One day Carroll, now on his own, noticed a UC Berkeley catalog entry on the Political Economy of Natural Resources major. The subject encompassed all he found interesting in ecology, political science, and economics, which he'd found he excelled in. "My God," he remembers thinking, "It's like they designed it for me!"

True, sophomores like him were not allowed to apply. But after his application was returned, Carroll, using the persistence he'd learned going door to door, talked his way into an interview and convinced the administrators that he was worth taking a chance on. In 1985 he joined the UC Berkeley student body.

For the next eight years, Carroll worked part- or full-time as a lab assistant, barback, bartender, air-conditioning technician, and barista, all the while taking classes toward his degree, which he received in 1993. He went on to earn a master's in public policy from Duke.

An internship with the OMB's Water and Power branch (for which he was initially turned down) led him to Washington and a job analyzing fossil-energy policy for OMB. After that, Carroll spent three educational and exhausting years at the House of Representatives, working on energy legislation and policy for the Committee on Science. When his old boss at OMB was promoted, Carroll applied for the position and returned to the executive branch.

Now, when the White House supports projects from solar cells to fuel economy to nuclear power, Carroll knows he's played a role.

"With these investments alongside private sector development, the government is stimulating thousands of jobs, and we're also moving the ball forward on technology and cleaning up the environment in the process," he says.

Carroll acknowledges that he took a long and peripatetic road to success — but he persisted.

Most important, he says, was that he followed his father's advice: He didn't like something, so he changed it.



Official agency seals grace Carroll's office. And the dart board? "It's left over from an employee party but I suspect that some of the agency personnel think that is how we make our decisions."



## Knutson Gives Back to Agriculture Students



Erstwhile farmer David Knutson, '53, has made gifts totaling \$45,000 for his endowed scholarship fund.

David Knutson, '53, always wanted to be a farmer, but once he got there, he found it wasn't for him. A decade after graduating from the College of Natural Resources with a degree in agricultural science, Knutson bought 600 acres of sod farmland outside Riverside. "I wasn't having too much fun," he decided three or four years later, and sold the farm.

The experience was a brief but meaningful interlude in Knutson's life; without it,

he wouldn't be able to say today that he'd met all his goals. But he has, and then some. As president of Stover Seed Company, which he's owned since 1972, Knutson is practicing just what his CNR classes prepared him to do. Now he is supporting some of today's Agriculture and Resource Economics students as they do the same.

"I wanted to help students who have an interest in agriculture," he said. "I felt that the College of Natural Resources

really helped me focus my attention on what I wanted to be in agriculture and in business." Knutson himself attended Cal with some financial support, motivating him to establish the *David Knutson Scholarship Fund* in 2005. "I want students to have the same opportunities that I had."

Knutson was raised in the Central Valley farming town of Patterson, where his uncles grew beans, tomatoes, and alfalfa. He worked with them throughout high school and college, but after graduating he was drafted, and served two years in the Army. Upon his return he found work in the field seed business, and four jobs later made the move to Stover, which he built into an international company selling lawn, flower, vegetable, and native plant seeds.

Knutson's most recent gift to augment the *David Knutson Scholarship Fund* was through an IRA Charitable Rollover. Legislation on the rollover, which has been repeatedly extended and is in place for 2011, allows individuals 70½ and older to make income tax-free contributions from retirement funds to 501(c)(3) organizations such as UC Berkeley.

Knutson, who has made gifts totaling \$45,000 for his endowed scholarship fund, also gives to intercollegiate athletics, the California Alumni Association, and other Cal programs. "I have a great fondness for UC Berkeley," he said.

— NATE SELTENRICH

### Making the Most of Charitable Rollovers

The **IRA Charitable Rollover** allows individuals age 70½ and older to make direct transfers totaling up to \$100,000 per year (\$200,000 for federally recognized married couples if each spouse has his or her own plan) to 501(c)(3) charities, without having to count the transfers as income for federal income tax purposes. A donor can name a fund and choose its purpose with a gift of \$50,000.

Transfers must be made directly from a traditional or Roth IRA account by your plan provider to the charity and can be used to satisfy your Minimum Required Distribution. Funds that are withdrawn by you and then contributed do not qualify.

For more details contact Kathryn Moriarty Baldwin: [moriartyk@berkeley.edu](mailto:moriartyk@berkeley.edu) or (510) 643-6641.

### Photo by Jen Guyton, '10

Jen Guyton majored in conservation and resource studies with an emphasis in communicating conservation in a developing world. She recently placed first in a field of more than 13,000 entries in a photo contest co-hosted by *Outdoor Photographer* and *Digital Photo* magazines, and she has just launched a conservation-oriented media service ([www.sunbirdmedia.com](http://www.sunbirdmedia.com)).

Guyton spent a year as a research intern with the Kalahari Meerkat Project, based in the Kalahari Desert in South Africa. Below, an intern weighs meerkats after they emerge from their burrow in the morning.

