Fishing for Science
LCA Meets Biodiversity
Galápagos as Classroom
Acting Dean’s Message

The end of 2008 saw the Bren School bid goodbye to Dean Ernst von Weizsäcker, sending him good wishes as he returned to Germany and welcoming me as acting dean once again. The new year arrived with enthusiasm and expectations generated by changes in Washington that we hope will result in serious efforts to address our pressing environmental concerns. While these hopes are tempered by the worldwide financial crisis, in our own spheres of influence, we remain fully engaged and optimistic that the research and teaching of the Bren School’s faculty, the commitment of our dedicated staff, the theses and projects of our students, and the careers of our graduates are making a difference. A look at some of the endeavors featured in this spring 2009 issue of Bren News provide compelling evidence that they are.

• CALobster (page 6), led by Associate Professor Hunter Lenihan, is a research program that involves scientists working in true collaboration with Santa Barbara lobster fishermen. It also provided an opportunity for Bren PhD student Matthew Kay to learn trapping techniques directly from local experts.

• As part of the Bren School’s collaboration with the Toyota International Teacher Program, Professor Arturo Keller led a group of U.S. secondary-school teachers on a trip to the Galápagos Islands (page 8), where they engaged in shared learning with local teachers.

• UCSB’s Laboratory Research and Teaching Staff (LabRATS), now co-led by Bren School Engineering Facility Manager Jeff Kirby, received national recognition recently for its efforts at making campus laboratories more sustainable (page 3).

• Summer internships, such as those served by Bren Doris Duke Conservation Fellows last summer (page 12), enrich students and benefit the sponsoring organizations. Alicia Glassco was in the Dominican Republic helping protect reef ecosystems, Julia Griffin developed stories on environmental issues at CNN headquarters in Atlanta, and Dave Panitz served with Conservation International’s Tropical Ecology Assessment and Monitoring Network in Chile.

Looking ahead in 2009 and seeing the Bren School assuming an increasingly important role throughout the multifaceted dimensions of environmental issues—at UCSB, in California, and beyond—I am impressed by our students’ talents, motivation, and innovation. I’m also gratified that ever more corporations, agencies, and organizations are coming to us for advice, counsel, and collaboration in addressing challenging issues.

— John Melack

Presenting Group Projects

The annual Bren School Group Project Final Presentation event will take place Friday, April 3 from 3:00 until 7:45 p.m. at Fess Parker’s DoubleTree Resort in downtown Santa Barbara. All of the 14 groups will present their research to an audience of Bren faculty, students, and staff; project clients; as well as interested members of the public. Question-and-answer sessions will follow the 15-minute presentations, and a poster session and reception will be held after all the groups have presented. For more information, go to www.bren.ucsb.edu/research/groupprojects.asp.

Commencement on the Calendar

The 2009 Bren Commencement Exercises will take place at 10:00 a.m. on Friday June 12 in the Bren Courtyard. A reception will follow on the grass adjacent to Bren Hall. Music will be provided by the 2008-2009 incarnation of Brengrass.
Rewards for LabRATS

Tireless efforts earn recognition for UCSB lab sustainability group

Sustainability efforts in UCSB laboratories and other campus facilities received national attention when the journal *Science* ran an article about the UCSB Laboratory Research and Teaching Staff (LabRATS), which is co-led by UC Bren Engineering Facility Manager Jeff Kirby. The all-volunteer group also received the Organization Award at the first-ever Go Beyond Awards at the Labs 21 2008 Annual Conference. Presented by the International Institute for Sustainable Laboratories and R&D Magazine, the awards recognize notable efforts to minimize the environmental impacts of laboratory work and equipment.

LabRATS was started in 2006 when Allen Doyle, then a lab manager at the Schimel Lab in the Department of Ecology, Evolution and Marine Biology, began looking into sustainability practices in campus labs as part of a request from the first UCSB Sustainability Working Group. Doyle left UCSB last year to take a position as sustainability manager at the UC Davis Office of Environmental Stewardship and Sustainability, leaving Kirby and UCSB Campus Sustainability Coordinator Katie Maynard, both LabRATS from the beginning, to lead the ongoing effort.

"It began as a small ad hoc group that got together occasionally and kept in touch by e-mail," says Kirby. "Then we got some grants to hire interns and the program took off. We had no idea it would become what it is now."

While most similar programs in the nation focus on energy, water, or some other specific aspect of sustainability, LabRATS addresses everything.

They collect donated surplus chemicals and supplies and redistribute them to UCSB scientists without charge. They have used grant funds to purchase 350 alcohol thermometers, which were distributed to labs in exchange for their mercury thermometers. They work with labs to promote the use of natural lighting and to remove unused fluorescent tubes. They provide advice on energy-efficient lab appliances and how to save energy on fume hoods, for instance, by closing them or turning them off when they are not in use. And they perform free comprehensive lab assessments on request, suggesting how to reduce, reuse, and recycle in the interest of sustainability.

Some labs approach the all-volunteer group for support, and LabRATS contacts others to propose an assessment. "But if someone says 'no,' we don't push," says Kirby. "The labs have responded positively, and we've been able to find out things we didn't know, for instance, that you can recycle lab plastic; if it's safe enough to throw away, it can be recycled. That opened a whole new realm of plastics recycling that didn't exist for us before."

Innovation has occurred often. For instance, when a chemical solvent still is turned off, the water that cools it remains on for safety, even after the machine has cooled. "Allen added a solenoid to shut it off after cooling," says Kirby. "We found the parts around campus and had access to lab tech people who could set it up with no effort. It saved hundreds of gallons of water per day."

Gas chromatographs are common, and the units are typically left on because they take time to warm up and cool down. "But with a little planning, they can be turned off," says Kirby.

Mechanical fixes come naturally to Kirby, who formerly worked as a marine engineer, a job, he says, that involved "making sure the right stuff was on board so you wouldn't be stuck if something broke in the middle of nowhere" and then applying a variety of skills to fix whatever broke.

The group has also developed a database with extensive energy-use information on all lab equipment, such as warm-up costs and Energy Star-like comparisons of the same equipment from different manufacturers. Recently, says Kirby, manufacturers have begun to look at this and see how they might improve their efficiency, and some manufacturers have even contributed new information.

All Bren wet labs have been assessed in the past couple of years, and the results were written up and submitted as "innovation credits" for Bren Hall's LEED recertification.

LabRATS staff, interns, and students have provided thousands of hours of support to campus labs, and they do it in a friendly way. As one professor said after LabRATS assessed his lab, "Wow, that was painless and useful."
Does the World Have Enough Resources?
UN panel addresses global sustainability

Members of a United Nations panel formed in 2007 to address global issues of natural resource efficiency and sustainability convened at UCSB last November for the two-day International Seminar on Energy and Resource Productivity. Hosted by the Bren School in collaboration with the College of Engineering and the Institute for Energy Efficiency (IEE), the event featured speakers from the UN Environment Programme’s International Panel for Sustainable Development, co-chaired by Ernst von Weizsäcker, who completed his tenure as Bren dean in December. Additional speakers included professors from the IEE and the Bren School, and representatives from industry. (For a complete list of speakers, please go to http://www.bren.ucsb.edu/events/UNEP_seminar.htm)

How to improve efficiency and productivity to “decouple” economic growth from increased resource use was the overarching theme.

“These panel members are world leaders in their fields,” said Dean von Weizsäcker prior to the event. “It is an extraordinary honor to have them here.”

The agenda was built around eight topics, with speakers addressing each from different perspectives, followed by audience questions and discussion.

In the first session, Mark Mwandosa, Tanzania’s minister of environment, explained the double-bind developing countries face. Keeping up with demand for their raw materials requires more water and energy for extraction, yet those resources are already strained by population growth. Mark Swilling, professor at Stellenbosch University in South Africa, emphasized the negative impacts of global insistence on low prices for African natural resources. He explained that Africa’s wars are resource wars, and that a low-price regime for primary resources is antithetical to global sustainable development.

In session 2, Yale professor Tom Graedel demonstrated the importance of gathering better data on material flows. He noted that supply cycles of many important “special-use” materials valuable in new technologies, are unclear. Marina Fischer-Kowalski, president of the International Society of Industrial Ecology, presented an empirical assessment of global resource use for both materials and energy during the past forty years. And Yuichi Moriguchi, director of Japan’s National Institute for Environmental Studies, underscored the importance of optimizing efficiency within the life cycle of resources.

Session 3, titled “Frontiers of Energy Efficiency,” featured relevant research presented by Jack Sahl, Director of Environment and Resource Sustainability for Southern California Edison, and professors Steve DenBaars and John Bowers, both of the UCSB IEE.

In the fourth session, Dr. Stefan Bringezu, of the Wuppertal Institute in Germany, and Dr. Lea Kauppi, of the Finnish Environment Institute, spoke on biofuels and Finnish climate and energy strategy, respectively.

The fifth session started with Mathis Wackernagel from the Global Footprint Network, who stressed the need for measuring countries’ ecological footprint as a proxy for sustainable use of resources. Bren professor Roland Geyer addressed another prominent theme—the need to reduce, reuse, and recycle—as did Professor Sangwon Suh of the University of Minnesota, who examined the dramatically different intensities of resource use between Japan and the U.S. Norwegian University of Science and Technology professor Edgar Hertwich used trade as a means of analyzing the carbon footprints of nations.

Session 6 featured two business perspectives on resource issues, one by Michael Wadden of Accenture; the other by Ashok Khosla, whose “mini-industries” are thought to have produced 2 million to 3 million sustainable local jobs in India.

In session 7, Bren professor Charles Kolstad addressed market forces and government policy as drivers of efficiency gains, while Dean von Weizsäcker mentioned the need to combine economics and policy to establish fair and stable prices that internalize the real environmental and social costs of resource use. Dr. Yong Ren, deputy director general of China’s Ministry of Environmental Protection, spoke about his country’s efforts to reconcile resource and environmental sustainability with the China’s rapid economic growth.

Session 8 included a presentation by Bren associate adjunct professor Robert Wilkinson, who addressed government sustainability policies in the areas of water and energy, particularly in California.

Jacqueline Louise Larderel, former director of the UNEP Division of Technology, Industry and Economics, concluded by addressing the question: “Why aren’t we doing better in achieving resource productivity and energy efficiency?” Indeed, she added, “That raises questions about how to ‘market’ what has been said in this room, how to communicate the benefits of decoupling and resource productivity.” If selling the concepts is important, she said, the key is also “to sell technologies, products, and the needed changes in behavior.”

“A low-price regime for primary resources is antithetical to global sustainable development.”
—Mark Swilling, Stellenbosch University
Core Conditioning

ESM 203 requires first-year MESM students to build intellectual muscle

For many Bren students, Earth System Science (ESM 203) provides an unaccustomed Oz-like moment of academic angst, when they suddenly realize, “I’m not in undergraduate science anymore.”

This often happens after the infamously challenging midterm, when brilliant students accustomed to getting only A’s receive something less. “I think I got my first ‘B’ since the sixth grade,” says Claire Early (MESM 2008). “It was humbling. The Bren School bashed my ego but then built it up again.”

Team-taught for the past 12 years by Bren professors Jeff Dozier and Tom Dunne, ESM 203, which combines with Ecology of Managed Ecosystems (ESM 201) and Biogeochemistry (ESM 202) to form the core of the core MESM science curriculum, is a class no one ever forgets.

It begins with a seemingly simple statement: We live on a planet that is changing. But as Dunne says, “This is a profound and new insight in society, and one that is useful to environmental managers. In designing 203, Dozier wanted to see if we could teach an introductory course on that subject at the graduate level. That’s not normal.”

“How you articulate a scientific principle and carry through a technical argument is really important.”

—Tom Dunne

It is ambitious, and by quarter’s end, students are expected to understand such global-scale processes as climate change, Earth’s radiation balance, the origins of persistent weather patterns, the hydrologic cycle, global tectonics as they relate to landscape types, variations in ocean circulation—and the value of each to environmental managers.

Because Bren is a professional school, Dozier and Dunne make sure students collaborate on written assignments so they can “relate what they learn to environmental problem solving in a coherent and precise manner and to a wide variety of people,” says Dunne. “How you articulate a scientific principle and carry through a technical argument is really important. Employers want their employees to be broadly trained, to understand real applications, to be able to communicate and work together. We try to give them all that in this course.”

Some students, primarily those who previously studied earth science, enjoy 203. Most suffer at some point, either from the quantity of material to master, the demands on rusty math and statistical skills, or, for those holding less science-intensive undergraduate degrees, the heavy emphasis on technical data.

Dozier agrees that the course is hard, saying, “It’s their first graduate-level course, there is no appropriate textbook, and it’s their first course where the reading is from the research literature.”

“I think the amount of work can be shocking for people who had a lighter undergraduate load,” says Scott Webb (2009), who majored in mechanical engineering. “It’s also a really technical course that can be intimidating for people who don’t have the knowledge base in that. It’s scary to see all those numbers come at them.”

Nor does an earth science background guarantee an advantage, as Rori Cowan (2010) explains. “I majored in Earth System Science and Policy as an undergrad. That gave me a big head, and then 203 kicked me to the curb.”

Students have been known to spend 30 or more hours writing the midterm, though Dunne says it can be done in “several hours” if you’re working smart.

The catch is that most students need to take the midterm to learn to work smart.

“They always panic when they hit the midterm and half the class scores lower than 70 percent,” says Dunne. “I tell them at the start of the course that it’s going to be hard and they’ll frequently be uncomfortable but we’ll work together to get them through. It does them good, and they carry away something new and different and useful.”

Dozier adds, “The midterm is a shock, but in the end very few students score less than 70 percent for the course—the cut-off for a B grade.”

Students attend two 75-minute lectures per week, and one of three hour-long weekly discussion sections. Group homework problems involving computation and communication are assigned every two weeks, and Dozier has students run a climate model. Everything is tied to the real world of the professional environmental manager.

“I talk to them about what it means to be a professional,” says Dunne. “It is simply that, faced with uncertainty in all aspects of life, society assigns responsibility for coming to conclusions and taking action to a specific stratum of people, whom we call professionals.”

For Bren students, 203 is an important rung on the way up.
Fishing for Science

An innovative project seeks better data by giving lobster fishermen a voice

As a kid in Berkeley during the 1960s, Hunter Lenihan grew up with the sounds of anti-war marches and “Power to the people” chants ringing in his ears. The lessons took, and a few decades later, Lenihan, now a Bren associate professor of marine ecology, is working to democratize scientific research to secure better data and, hopefully, better fisheries management.

His current proving ground is CALobster, a research program that involves working with local lobster fishermen in new ways to accomplish several objectives, including an assessment of the effects of government-established marine protected areas (MPAs) on the Santa Barbara lobster fishery. CALobster, Lenihan says, emanates from a perspective “in contrast to the traditional top-down control of management decisions, wherein fishermen have little input in processes that may lead to restrictions on their work.” We’re trying to design a program that involves all stakeholders to enhance management. We think this will help lead to the sustainability of fishes and fishermen.”

CALobster grew out of concerns raised between 1998 and 2003 about declining stocks of commercially fished species in the Santa Barbara Channel, lobster among them. Government agencies including the California Department of Fish and Game (DFG) responded by engaging local fishermen, conservationists, and community groups to collaborate in creating several “marine protected areas” (MPAs), to include no-take reserves.

Lobster fishermen, whose livelihoods would be impacted most by the new reserves, participated but had several reasons to be wary. They didn’t believe the fishery was overfished, and they questioned the validity of the data used to conclude that it was. They were in a bind: DFG itself admitted that there wasn’t enough data to accurately access lobster populations; they referred to the fishery as “data poor,” but that determination already requires the agency to manage the fishery with extreme caution. The new MPAs would close even more valuable fishing grounds.

A key objection of the fishermen was how the lobster counting was done. Until CALobster began, lobster populations had been assessed mainly by sending scuba divers down in daylight to count lobsters on the ocean floor. But fishermen know lobster as notoriously shy nocturnal animals found at a variety of depths, so they had reason to suspect that the daylight scuba method was producing artificially low estimates of lobster populations.

**Filling the Data Gap**

During that same time period, Lenihan spoke with DFG official John Ugoretz, who told him that the agency would be studying the lobster fishery in the near future to revise the management plan. He also suggested that the university work with fishermen on two fronts: to design a new management plan that would identify information gaps, and then to find ways to gather the required data.

Lenihan was intrigued by the possibility of a project that could prevent the fishery from being “crippled by management plans based on a lack of data.” When an opportunity arose to receive funding from the UC Coastal Environmental Quality Initiative (CEQI) for a pilot project on monitoring reserves, Lenihan and Bren PhD students Matthew Kay and Carla Guenther approached fishermen with a proposal to collaborate in designing such a program. They proposed using traps, not divers, to capture animals both inside and outside MPAs, then tag and release them to assess the effects of the reserves on lobster populations and fishery economics. Kay would monitor the MPAs’ biological effects, and Guenther would study their socio-economic impacts on the fishing community.

Fishermen greeted the idea with initial skepticism, but not long into the study, several of them began to see the benefits of the reserve monitoring program. Led by longtime local lobsterman Chris Miller, they began cooperating with CALobster. Since then, other fishermen have participated, and several innovative practices have been established.

One of them involved using GPS. For purposes of management, a fishery is typically treated as a single large entity, but fishermen know that a great deal of variability occurs across space and time within a single fishery. To better reflect that, fishermen working with CALobster use GPS to record catch sites precisely, along with times and dates of catches. Among the other innovations are a tagging program in which Kay tagged nearly 18,000 lobsters. The group also designed a simple device for trapping very young lobsters to determine “recruitment” rates—the number of larvae that grow to maturity each year. As part of a new port monitoring program, fishermen returning to port would call Kay, who would meet them at the dock to collect their data. Lenihan’s lab is currently developing an electronic logbook to make it easier for fishermen to enter the required data.

“That’s part of developing trust,” says Lenihan, “coming up with research tools that collect the right data for us but don’t interrupt the fishermen’s work.”

Trust was perhaps the biggest obstacle to success. As Miller said in a 2007 interview for California Lutheran College radio station KCLU, “I was raised with the belief that anything scientists find out will be used
against fishermen.” Scientists, for their part, have occasionally had reason to doubt the accuracy of fishermen’s catch data.

Lenihan explains that fishery management depends on two types of data: “fishery independent” data, gathered by management agencies; and “fishery-dependent” data, collected by fishermen. Fishermen claim that agency data doesn’t accurately reflect the fishery because agency people don’t have fishermen’s knowledge. Agencies, on the other hand, have trouble getting enough reliable fishery-dependent data from fishermen.

CALobster’s innovative solution was to develop a rare entity: the fishing scientist. Kay was that scientist, and Miller came up with the idea of teaching him to fish. That required a leap of faith, as Miller would be sharing a lifetime of hard-won knowledge and trade secrets with a scientist.

“Figuring out how to communicate those secrets to Matt was really interesting,” he says. “I coached him on how to set up a [UCSB] boat, I created maps for him, and I took him out to fish. We created a little ‘village elders of the fishing community’ committee to ride herd on him.” Looking back, Miller sees his decision to mentor Kay as the moment of truth.

“Having a guy apprentice under me and learn the fishery was a big deal,” he says. “It was the beginning of a complete reversal of my mindset, because I came in as a guy trying to make sure we weren’t getting screwed.”

Kay, a diver who has spent a lot of time on boats, describes the internship experience as “an honor and an adventure.” And after two years of conducting fieldwork, he is now synthesizing the data into what will become his PhD dissertation.

Carla Guenther’s part in CALobster also helped to build trust. Her study did show that reserves may cause short-term profit losses, but also that they may be recovered as fishermen learn to fish around reserves, where lobster populations appear to be growing. But it was the process more than the findings that served to develop the nascent relationship between scientists and fishermen.

Conducting individual fishery interviews, Guenther was the face of CALobster to the rest of the Channel Islands fleet in Ventura and Oxnard harbors. At Miller’s suggestion, she first conducted historical interviews with influential retired lobster fishermen. “By the time I was ready to interview active lobster fishermen, I had Miller’s endorsement, I was versed in fishing-speak, and I had garnered support within the fleet to measure the economic impacts of reserves,” she says. “But despite those advances, each fisherman still ran his own line of defense before agreeing to participate in my study.”

Her persistence paid off when fishermen from southern harbors invited her to jump-start similar projects in their region.

**The Way Forward**

Four years down the road, not every fisherman is as sanguine about CALobster as Miller, but Lenihan sees real progress. “Fishermen see that if they’re not part of the solution, they can be affected by highly precautionary management policies,” he explains. “They’re out there every day, so they give us the best possible understanding of the resource. When fishermen are included, they take an active role in managing the resource as opposed to resisting being policed by regulations. Involving them in gathering the data results in better data and creates buy-in to the management choices that result.”

Miller views the project as a watershed. “The fact that Hunter and his students were willing to come down to the harbor to do the port monitoring and conduct genetic surveys and an economic survey of the fishing community has had a very positive effect on our relationship with the university,” he says. “Trust has developed, and that came out of being included.”

Lenihan sees this goodwill as crucial to future success. “The purpose of the pilot study was to develop a relationship with the fishermen and to learn to trap lobsters,” he says. “The more trust and interaction there is between scientists and fishermen, the better our ideas for management reform are, and the better information we get to test those ideas. Better ideas and data should lead to better management, which should generate more trust.”

Kay describes the long-term goals as ensuring that the resource is sustainable, protecting working harbors so that there will always be a fishing industry, and reforming the centralized, top-down management structure to include stakeholders in research and management.

Adds Lenihan, “Now we’re beginning the larger task of working with SFG [the Sustainable Fisheries Group, a collaboration between the Bren School and the Marine Science Institute] and the fishery to design a fishery-wide population assessment, modeling, and management program.”

Last October, Lenihan’s group presented their findings to fishermen and the public. “The fishermen were glad they had worked with us and that we had stood by what we said we’d do,” he says. “Now we have a working structure, and as DFG told us previously, it has designated lobster as a primary species for better management. They’re calling a meeting of researchers and fishermen throughout Southern California to figure out how to proceed.”

As they move forward, Lenihan says, they’ll do so knowing “we have everything in place to get good data.”

Giving power to the people who fish for a living would seem to be an idea whose time has come.
In order for future generations to protect the planet, they’ll first need to understand it, connect with it, and care enough to act on its behalf. Informed teachers will be essential to the process. Now, thanks to Bren professor Arturo Keller and the Toyota International Teacher Program, a group of 29 secondary-school teachers who traveled to the Galápagos Islands in November are more prepared than ever to engage their students in environmentally related subject matter.

Toyota Motor Sales provided $400,000 to the Bren School in 2008 to establish an endowment supporting student fellowships, a summer internship, and the International Teacher Program, run in partnership with the Institute of International Education. The 29 teachers were the first to be selected to visit an environmentally important foreign location with a Bren faculty member serving as science facilitator. As Professor in Residence, Keller’s task was to connect the intellectual dots linking scientific research, the region of study, and relevant environmental issues.

After a stop at Everglades National Park, the group flew to the Galápagos for nine days of land and sea excursions. They encountered the creatures that had inspired Charles Darwin, planted trees as part of a carbon-cycle study, collaborated with local teachers to develop lesson plans,
and visited a volcanic lake, an organic coffee farm, and a state-of-the-art recycling facility. Along the way, Keller introduced environmental topics linking local and global environmental challenges.

"The teachers were great," says Keller. "They came with varying levels of knowledge about environmental issues, and the presentations helped to bring everyone up to the same level. I tried to hit the high points and then ask questions to stimulate discussion. It was also important to explain the science in language that didn’t need to be translated for students."

Keller covered sustainability and the environment by discussing carrying capacity, a concept easy to grasp on an island. "There’s only so much land, and you can only have so many people living there and using its resources," he explained to the group. Next, the islands’ sparse and brackish freshwater resources served as context for a general discussion of water management.

To address climate change, Keller discussed sea-level rise and biodiversity, localizing the topic by explaining how two major converging ocean currents drive the local climate. Variations in the currents have always caused fluctuations between years of heavy rain and others with little or no rain, he explained, but climate change will likely create larger, long-term changes that “could cause big shifts in terrestrial organisms.”

From there, the topic moved to greenhouse gases and renewable energy through an examination of wind power on San Cristóbal, one of the four main islands, which supplies roughly half of its own energy needs.

"Professor Keller was simply amazing," say Rhonda Glasscock, Toyota's corporate contributions manager and program developer. "His ability to connect with educators at all levels and to inspire and elevate their grasp of complex sustainability issues was extraordinary. His task was to examine the serious conservation issues facing the Galápagos, put it all in a global context, and make the material relevant to teachers from across the U.S. For him, it seemed easy. It was a privilege to have him on board as the first Bren Professor in Residence for the Toyota International Teacher Program."

While many on the trip taught science, others focused on fine arts, language arts, computer science, and even the performing arts.

One English teacher hoped to create an online publishing partnership with schools in the Galápagos and make the islands the starting point for a living lesson in the beauty, fragility, and uniqueness of all natural environments. A computer teacher from Boston planned to use newly acquired class software to create a Galápagos web site.

For Marsha Barton, who teaches environmental studies in New Mexico, the trip allowed her to renew her own appreciation for nature while providing her students a way to engage with subject matter. "As an educator, you hope students make a connection to what you’re trying to teach them, so if I’m teaching science, I want them to form connections with nature and animals before we introduce teaching materials," she says.

The trip created a larger context for her class’s LEED audit of school buildings. "I began the unit by showing photos of marine iguanas and sea lions," she explains. "The students connected to them, and now we’re asking, ‘What’s the connection between the energy we use in our school and the effect climate change has on these animals? And what steps can we take locally to do something about it?’ It made the unit more authentic."

A math teacher from a tiny island in Alaska returned with a renewed commitment to overcoming obstacles to establishing a recycling center on his home island, and a teacher who employs literature as a bridge between the language arts and science hoped to connect her students, many of whom live in degraded inner-city environments, to the natural environments of the Galápagos, which are also threatened by human activity.

As Keller said upon his return, "Everyone came back with something they didn’t have before they went.”

The next Bren Toyota Professor in Residence will be Tom Dunne will travel with teachers to Costa Rica in April.

Galápagas curriculum (clockwise from opposite): diving deep into learning, sharing a lesson-planning project, sea lion encounter, an Arturo Keller lecture, tree planter’s pleasure, and noting island iguanas.
LCA Matures at Bren
From auto steel to biodiversity Assistant Professor Roland Geyer is taking life-cycle assessment into new terrain.

When the California Environmental Protection Agency (Cal EPA) needed training for ten of its employees as it ramped up to become the first state agency to use life-cycle assessment (LCA), it contacted Bren assistant professor Roland Geyer. When the California Department of Recycling wanted to develop end-of-life management options for glass and plastic bottles that minimize environmental impact, Geyer did the LCA work. The North American and European glass packaging industries also selected him to help develop an end-of-life modeling methodology for glass containers. And when the world’s steel makers needed someone to help them integrate LCA into the automotive industry, they hired Geyer for the job.

Increasingly, Geyer and the Bren School are becoming go-to sources for expertise in LCA, the growing field that assesses the potential environmental impacts of product systems throughout their life cycle by quantifying all material and energy inputs and outputs and their associated impacts on the environment. Geyer’s LCA efforts have a lot to do with furthering the solution-seeking aspect of the Bren School mission.

A physicist by training, Geyer is a member of the advisory council of the American Center for LCA (ACLCA) and helped develop its certification exam for professional LCA practitioners. He has served for three years on the technical committee for the annual ACLCA conference, and is now involved in the development of the U.S. Life Cycle Inventory Database, the largest publicly available LCA database in the nation. He also works as a reviewer of LCA studies that require external review in accordance with ISO standards.

As a consultant for the past four years to WorldAutoSteel, a unit of the World Steel Association, Geyer conducted LCA studies for 16 member steel companies around the world that are involved in the “Future Steel Vehicle” (FSV) project. As part of that initiative, WorldAutoSteel has sought to demonstrate the benefits of lightweight steel (called “advanced high-strength steel,” or AHSS) compared to conventional steel or aluminum for use in automobiles equipped with alternative power trains. Geyer’s LCA work in that regard was cited in a major WorldAutoSteel announcement last August that revealed early styling images of cars that are being designed for production between 2015 and 2020. The announcement also mentioned lightweight steel’s favorable LCA ratings in terms of GHG emissions.

“LCA is absolutely critical to our interests at WorldAutoSteel and to the world for the sake of the planet,” says WorldAutoSteel Director Ed Opbroek. “We started into LCA looking for a neutral third-party academic expert who could help us survey and make sense of the wide variety of published studies and maybe, along the way, develop a parametric model to do LCA in a logical, mathematical way that would bring transparency to the inputs and methodology.”

WorldAutoSteel executives interviewed prospects from Canada, the U.S., Japan, and Europe, and selected Geyer after meeting with him in Washington, D.C.

“Everyone was wearing a suit and Roland arrived dressed in California casual with a backpack and a laptop,” Opbroek recalls. “He won the day. He was extremely knowledgeable, and the day after our first meeting, he showed up with a simplified model he had created overnight to illustrate the approach he’d take. Right then, we knew he was the guy.”

Since then, working with colleagues in Europe, Geyer has secured a pair of important database resources—GaBi 4.3 and Ecoinvent—that have dramatically expanded the Bren School’s LCA capacity in terms of both research and teaching. In fact, he says, “Our data resources for conducting LCA may now be unique in the U.S. Other places have GaBi or Ecoinvent, but rarely both. And having the two databases allows us to check the quality of the data we use, so that we’re going beyond simply conducting LCA to actually evaluating the robustness of the LCA tools themselves.”

LCAs have been key components of several recent Bren Group Projects. One provided Southern California Edison with an LCA analysis of the relative advantages of using overhead versus underground lines for power distribution in Southern California, and previous groups developed an assessment tool for the packaging systems of Toyota auto parts and performed LCAs for the Simple Shoes division of Deckers Outdoor Corp.

Last summer Christian Del Maestro (MESM 2009) completed an internship in which he worked remotely from Bren, conducting an internal LCA for the Henkel Corporation, a major global company that makes coatings and had developed a new anti-corrosion product for metals.

“We were delivering life-cycle thinking into their company,” says Del Maestro. “We showed them what can be done and recommended data they should be tracking if they want to do a full LCA down the line.”

“It ended up being a kind of reverse knowledge transfer from Christian to the company,” says Geyer.

Several Bren graduates have tapped their Bren LCA training in their post-Bren professional work.

“LCA comes in handy,” says Claire Early (MESM 2008), who works as an associate at ESA Consulting and was part of the Toyota Group Project. “I’ve been able to use it, and people liked that I’d worked on a Toyota LCA project. Life-cycle thinking is the foundation of sustainability.”

For Peter Canepa (MESM 2008), who worked on the Simple Shoes Group Project, his LCA training at Bren was key to landing his position as an analyst at PE International Americas, one of the world’s leading sustainability consultants. “The Group Project was absolutely what got me here,” he says. “My situation may be a little unique because I was hired to carry out LCAs – exactly what I did for the Group Project.”
Because it’s not spatial and not a typical use of LCA.

But for biodiversity, there’s no such thing as average acre," says Stoms, adding, "If you want to produce enough ethanol to substantially reduce the use of fossil fuels and lessen climate impacts, you’re going to have to cut some forest and plow some prairie.”

Therefore the question was how to model where the habitat would be changed by increased biofuel cropping and how to quantify the impact on biodiversity.

The researchers worked backward from the state’s published target levels of biofuel production to determine how many hectares would be needed, taking into account the fact that production varies from place to place, depending on soil quality. "If you move beyond the best soils into less productive areas to achieve higher and higher production levels, the area required increases in a non-linear fashion,” Stoms explains. "A higher production target means more area because poorer soils produce less per acre.

"Right there," he continues, "we had gone beyond traditional LCA because an average yield does not properly represent this relationship.”

GIS was employed to model scenarios of where crops might be grown to meet various ethanol targets and to translate those land-use scenarios into maps of 29 habitat types, including eight agricultural habitats. The researchers then adjusted how changes in land use would affect 443 terrestrial wildlife species.

The last piece was to develop alternative ways to summarize all that information on species and habitat into a single number to represent the overall impact on biodiversity. So far, the group has studied three biodiversity impact indicators, but there are many more possibilities for future research, Stoms explains.

"We’ve demonstrated how spatial analysis can enhance conventional LCA methodology and how biodiversity can be incorporated into its impact assessment.”

Geyer adds, “Just as there are flows of wastes and emissions that LCA routinely tracks, GIS can measure flows of habitat areas. And just as LCA uses standard coefficients to convert the emissions of greenhouse gases into a measure of their impact on global warming, our approach provides the corresponding coefficients for habitats.”

Stoms suggests that, given adequate data, many more inputs could be treated spatially, such as required amounts of fertilization and irrigation, to create more accurate estimates of their impacts. "Rather than using averages for these inputs, they could be modeled as spatially varying values,” he says.

Geyer concurs. "This project showed generally that we could couple GIS and LCA software,” he says. "In the long term, I think we'll see software development in that direction. We’re preparing the ground for development of such products because sooner or later, it’s going to happen.”
Students/Donors

Real-World Summer

Internship stipends allow Doris Duke Fellows to solidify career skills

Six Bren master’s students in the class of 2009 were named Doris Duke Conservation Fellowship Program (DDCF) Fellows last spring, each receiving a full year’s tuition and a $5,000 stipend for a summer internship. That support makes it easier for students to accept internships that align with their interests but may be unpaid. Here’s how the Bren School’s newest Doris Duke Fellows spent their summer—and their stipends.

Specializing in Conservation Planning, Bridget Dobrowski gained experience in the important area of land-use planning while working as a growth-management intern for the Sonoran Institute in Bozeman, Mont. While there, she contributed significantly to a training manual aimed primarily at regional county planners.

“I looked at about twelve different land-use planning tools, such as impact fees, density zoning, and wildlife review standards, that can be used to protect wildlife habitat,” she says. She then wrote synopses for them, and for each of the six tools considered most beneficial for the area, she wrote a case study of a northern-Rockies town that had implemented it. “The job exposed me to the land-use planning side of things and helped me develop new skills I needed,” she says.

Alicia Glassco traveled to the Dominican Republic for the Los Angeles-based Reef Check. Alicia, who spent three years working in marine science before coming to Bren, contributed to a water-quality monitoring plan for La Caleta, a marine protected area near the capital of Santo Domingo; wrote funding proposals for fishery conservation; and organized a children’s education camp.

“I wouldn’t have been able to help Reef Check without the fellowship, which paid my transport and living expenses,” she says. “The fellowship really eases the burden. Furthermore, it allows us to connect with other students not only at Bren but at other universities. At the [Fellows] retreat in September, it was inspiring to see the energy and education of other future environmental professionals.”

When CNN needed someone to dive with whale sharks, reef sharks, rays, and other undersea denizens for a piece about the Georgia Aquarium, Julia Griffin was ready. Her account on CNN’s SciTechBlog (http://scitech.blogs.cnn.com/2008/06/27/shark-bait/) was all in a day’s work during her 12-week summer internship at CNN headquarters in Atlanta. Julia is interested in an on-camera career in television news. At CNN, she produced stories and worked as a fact-checker for print and broadcast pieces about applying new ideas and technology to solve environmental problems.

“The fellowship’s stipend made it possible to take the internship,” she says, adding that it also demonstrated in the real world “how everything having do with the environment connects to other science disciplines and to politics, too.”

As an intern for Chicago-based Great Lakes and St. Lawrence Cities Initiative (GLSLCI), Edith Moreno engaged with mayors’ offices in 55 member cities that are seeking to implement best practices in sustainability. Preparing for the GLSLCI annual conference, held in Toronto in July, Edith worked with mayors’ offices to organize the event and help finalize the agenda and resolution statements. She also wrote a post-conference summary that was sent to all participating mayors. In other work, she synthesized available science to write a GLSLCI memo on the effect that fluctuating lake water levels have on local wetlands.

Speaking of Science

Doris Duke Fellows’ workshop aims to build communications skills

In addition to tuition and internship support, the Doris Duke Conservation Fellowship Program provides Fellows with group funding for an educational program at their home institution.

Bren Fellows will host a two-day workshop April 17-18 to support Bren students in communicating science to the public, journalists, and policy makers. The event is being developed and sponsored by Bren, COMPASS, the Doris Duke Charitable Foundation, and the UCSB Carsey-Wolf Center for Film, Television, and New Media.

The workshop will train students in writing, interviewing, and message development, with featured presentations by local journalists and Carsey-Wolf co-director Ron Rice, who will discuss the design and evaluation of communication campaigns. Students will have opportunities to apply communication skills in interactive modules, and to network with journalists to promote ongoing collaboration between the Bren School and the Santa Barbara community.
“Having come straight to Bren from undergraduate work in geology, it gave me the political experience I needed,” she says. “It was great to put a face to the people who influence local policy.”

Interning for Conservation International’s Tropical Ecology Assessment and Monitoring (TEAM) Network, Dave Panitz spent three months working with a group of ecologists in the Valdivian Eco-Region, one of Chile’s most important sources of biodiversity. The CI team examined the likely effects of climate change, the steps needed to allow species to adapt, and the cost of implementing those measures. “My focus was on determining the conservation cost of land selected by the biological model—a real challenge because rural-land-value data are scarce in Chile,” Dave says. “I had the opportunity to develop a land valuation technique for the region, collaborate with top Chilean scientists and economists, and present our work to federal agricultural and forestry agencies.”

Dave’s results became part of a case study that was integrated with other similar CI studies and presented at the IUCN Congress in Barcelona last October. “The collaborations and workshops proved extremely valuable,” he says, “and I left Chile with several great prospects for future projects.”

Lara Polansky spent the summer working on a green hospitality initiative for the U.S. EPA in New York City. “I was tasked with quantifying energy and water use and solid-waste generation in the hospitality sector for Region 2 [New York, New Jersey, Puerto Rico, and the U.S. Virgin Islands],” she says. “We tried to identify hot spots where the hospitality industry is drawing disproportionately on the resource base. The idea was that if we could identify what’s happening, we could better prioritize use of EPA’s voluntary partnership programs that may assist in greening hotel operations.”

Lara also collaborated with an environmental justice grant review committee and helped develop a green hospitality workshop held in January in Manhattan. She says that interacting daily with the government and private sectors enabled her to see federal government as a possible career choice.

New Corporate Partnerships

The following entities have become the newest Bren Corporate Partners, joining the school in seeking to integrate sound business practices and environmental sustainability while providing opportunities for Bren students and graduates.

Brownstein Hyatt Faberle Schreck

For four decades BHFS has provided superior legal services while serving as committed stewards to their community. From California to Washington, D.C., their employees follow the firm’s founding principle of giving back to the causes that make a difference. After merging with Hatch & Parent, a California-based law firm best known for its unprecedented work in public agency and water law, BHFS became the premier water law and policy practice in the West. Its clients include Nestle Waters North America, San Diego County Water Authority, South Tahoe Public Utility District, and the Cities of Fresno and Oxnard.

Gills Onions

In business for more than 20 years, Oxnard-based Gills Onions is the nation’s largest processor of fresh-cut onions. An environmental innovator, the company has voluntarily committed to measure, independently verify, and publicly report its greenhouse gas emissions (GHG) on an annual basis utilizing The Climate Registry General Reporting Protocol. The company is also constructing a system to convert onion waste to energy, reducing GHG emissions by 30,000 tons per year. And Gills continues to hold itself accountable in such environmentally important areas as energy efficiency, water conservation, packaging, recycling and waste prevention, and efficient land use.

Corporate Summit Set for May 7-8

The seventh annual Bren School Corporate Partners Summit will be held May 7 and 8 and focus on the theme “Environmental Applications and Implications of Nanomaterials.” The main event will be speaker presentations on May 8, followed by a lively discussion. This year’s speakers are Bren Professor Patricia Holden; Paul Smokler, Vice President, AECOM Environment (“Nanotechnology in Consumer Products: Challenges and Opportunities for Environmental Health and Safety”); and Frederick Klaessig, Pennsylvania Bio Nano Systems (“Nanomaterials: The Shape of Future Regulatory Frameworks and the Need for Interdisciplinary Approaches”). Corporate Partners chair Timothy Cohen, Vice President, URS, will again serve as Facilitator, and Bren professor Arturo Keller will assume the role of Technical Moderator. Both Holden and Keller are currently directing integrated research units as part of the five-year, $25-million UC Center for the Environmental Implications of Nanotechnology. Keller is the center’s Associate Director.

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For a complete list of Bren School Corporate Partners and/or more information about the Corporate Partners Program, please visit us on the Web at www.bren.ucsb.edu/supporting/corporate_giving.html

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Dee White
Dani & Mel Willis
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Alumni News

2000

Last November, Jamie Goldstein (MESM) accepted a new position as Community Development Director for the City of Capitola, Calif., a small town adjacent to Santa Cruz on Monterey Bay. In his new role, Jamie oversees the city’s planning, housing, and redevelopment efforts. Jamie and his wife, Amy, have a 15-month-old son named Bo.

2001

Shortly after the August birth of their second daughter, Carys Munro Hawkins, in August, Jacob Hawkins (MESM) and his wife, Anne, relocated from Tucson, Ariz., back to California. They have settled in Gilroy, where Jacob continues to work for the Aspen Environmental Group, his employer since he graduated from Bren. He is shown here with Carys and their older daughter, Rilyn.

2002

Last fall, Susie (Erickson) Anon (MESM) accepted a new position as a field ecologist with the Irvine Ranch Conservancy. IRC is a nonprofit organization dedicated to the preservation, management, and stewardship of nearly 40,000 acres of Orange County. Susie is involved in a variety of projects, including coastal sage scrub restoration, cactus planting for the coastal sage wren, invasive species control, and fire prevention. Susie also married Albert Anon in 2007.

Mark Kram (PhD) recently commercialized several key products for site characterization related to hazardous waste remediation design and monitoring strategies. The High-Resolution Piezocone enables practitioners to develop the most detailed groundwater and contaminant transport models to-date, while the Direct-Push Well Design System allows for rapid monitoring well design and installation. These inventions were the subject of two EPA sponsored workshops last summer and will be featured in new ASTM and ITRC guidance. Mark also invented a system to automatically generate contour maps using sensors and web applications that became the core product for Groundswell Technologies, Inc.

2003

Michael Jennings (PhD) is an adjunct faculty member in the University of Idaho Department of Geography. His co-authored papers that have either been published recently or are currently in press include: “Reconciling social and biological needs in an endangered ecosystem: the Palouse as a model for bioregional planning” (Ecology and Society); “Standards for associations and alliances of the U.S. National Vegetation Classification” (Ecological Monographs); “A comparative measure of biodiversity based on species composition” (Conservation and Biodiversity); and a global conservation atlas to be published by the University of California Press.

2005

Kate (Sanden) Gentles (MESM) gave birth to a daughter, Sierra Carolyn Gentles, on October 30, 2008.

2006

Douglas Varchol (MESM) has received funding to create a new “Earth Report” for BBC World News, to air during the spring 2009 season. The piece will cover the 2008 Montreal Protocol accelerated phase-out for hydrochlorofluorocarbons (HCFCs) and its impact on China and the Southeast Asia region. China produces more than 70 percent of the world’s residential air-conditioning units and more than 70 percent of the world’s HCFCs but has now agreed to phase them out over time. Douglas began shooting in Beijing and Shanghai in February and says he enlisted “a great Chinese rap artist” to do the music for the piece. Douglas also received funding to work a new film about black carbon, which he describes as “a quick fix in terms of climate change mitigation.”

2007

On Feb. 1, Colorado native Drew Beckwith (MESM) began a new job as a water policy analyst at Western Resource Advocates, a regional nonprofit based in Boulder, Colo. His responsibilities include researching progressive urban water conservation strategies and building relationships with local utilities to implement them. Drew and his wife, Melissa, moved to Boulder at the end of January after selling their surf gear to buy new ski gear. Drew mentioned that classmate Stacy Tellinghuisen also works at Western Resource Advocates.

2008

Sarah Nathan (MESM) recently took a new job as a business development manager at Ice Energy. The company provides smart grid and distributed-energy storage solutions that enable utility companies “to use cleaner, less-expensive off-peak power to produce and store energy for use during peak demand periods.” Sarah says she finds it “rewarding to feel like I am making a profound and immediate environmental difference.”

Environmental Incentives in South Lake Tahoe, Calif. The environmental consulting company works to inspire environmental improvement through economic incentives and performance-based programs. Maria is currently designing the Lake Clarity Crediting Program, which will be implemented in 2010 to reduce pollution reaching Lake Tahoe.

Erin Myers (MESM) and classmate and longtime partner Josh Madeira (MESM) married in September. Erin then left for Indonesia to continue research as a Fulbright Fellow and visiting scientist at the Center for International Forestry Research (CIFOR). Meanwhile, having returned from working with Erin in Indonesia, Josh began work as a Knauss Fellow in the Subcommittee on Fisheries, Wildlife and Oceans under Natural Resources Committee of the U.S. House of Representatives.

Marcy Pratteau (MESM) has joined Environmental Incentives in South Lake Tahoe, Calif. Marcy (second from right in photo at left) is developing the Tahoe Status and Trend Monitoring and Evaluation Program, which will streamline monitoring efforts in the Tahoe Basin and provide resource managers and the public with periodic reports of progress made toward environmental and socioeconomic goals.
Building on Science
Bryan Henson is constructing a green career—one structure at a time

Bryan Henson pauses near a parched pine in the Tea Fire burn area, which shows signs of greening after February rains.

Steering the white bio-diesel pickup truck around a curve on Coyote Canyon in the Tea Fire burn area, Bryan Henson (MESM 2003) points to a low-slung modern home standing intact and untouched amid an otherwise black and barren landscape. “That’s one of ours,” says Henson, an associate at Allen Associates, a local building firm and is one of the leading sustainable-building experts on the Central Coast. Standing in surreal contrast to the foundations of destroyed homes nearby, the undamaged residence underscores the importance of fire resistance as an aspect of sustainability.

The two-year-old home survived thanks to intelligent design, smart materials, and sensible landscaping. Henson’s boss, Dennis Allen, explains that when the flames swept across the property, they encountered no tall trees and a structure made of non-flammable surfaces. Some railroad ties used in the garden did burn furiously, and firemen estimate that the outside temperature approached 1,000 degrees Fahrenheit, but because the home was sealed and well-insulated, the indoor temperature, recorded by a sensor, never rose above 84 degrees.

For Henson, applying science to making buildings that are more efficient and, like this one, more fire-resistant, is the perfect job because it allows him to combine his two passions—building and science—“by bringing science into the built environment.”

Allen Associates does that particularly well. It has won every one of the 11 green building awards given annually by the Santa Barbara Contractors Association, and it regularly constructs buildings that are 90 percent more efficient than California’s Title 24 guidelines require.

With the green building sector currently one of the only bright spots in the construction industry, companies like Allen Associates, which entered the sustainability arena early and continue to push the envelope as the greening trend builds, stand to gain. “Half our work now comes to us because of our green expertise,” Henson says.

But he would prefer to see that number grow to 100 percent in a world where green structures have gone from being unusual to ubiquitous. “Green building should be the standard,” he says. “Getting from where we are now to where we need to be is a big job, but it’s a field that’s ripe for people to come in and be leaders.”

The son of a Santa Barbara home remodeler, Henson grew up learning the construction skills that would eventually put him through college. After earning a BS degree in environmental studies at Cal State University, Humboldt, he received his MESM degree at Bren, then went to work for AIG Insurance, where he used his science but missed building. After helping a friend start a construction company in Humboldt County, he returned to Santa Barbara, contacted Allen, who is a member of the Bren Dean’s Council, and was hired.

“Bryan brings a lot to the table,” Allen says. “Our associates are field managers for various projects, and he advanced to that position after just a year. We’re using him more in marketing and sales, and in management-level decisions. It’s a path we see him taking increasingly. He’s thoughtful and creative, and he loves the challenge of putting new things together. He’s good with people and goes the extra mile for clients. That’s something our industry often falls short on, but it heads off enormous problems. He has a lot of elements of the visionary.”

As an associate, says Henson, “I specialize in all the green building practices we do.” That includes heating and cooling, insulation, water-saving devices, and even determining the “aspect” of a building, which refers to orienting a structure on a site so that it requires less energy for heating and cooling. Last summer Henson worked with intern and Bren MESM student Jesse Fulton (MESM 2009) to write a green-guidelines manual for internal and external use, and he regularly collaborates with Bren alumnus Daniel Wilson (MESM 1998), who has his own landscaping company in Santa Barbara and designs and installs water-saving devices.
catchment systems for Allen Associates projects.

Just as his involvement in green construction and design allows Henson to combine his interests, so too, he says, did his Bren School education integrate elements important to his current work. Like many alumni operating in the real world of business and clients, he now appreciates classes he didn’t necessarily love while at Bren.

“I went to Bren as a scientist and was then introduced to negotiation, organizational management, and the policy aspects of sustainability,” he recalls. “It opened up a whole new world. I’m excited about business because it allows you to have a big impact on the environment and on people’s lives.”

Working for Allen Associates, he has also discovered a previously unrealized passion for the duties around conducting business, including making sales.

“Bren actually produces really good sales people,” he says. “We’re taught to look at problems from all sides and to see how a challenge can be turned into an opportunity through creative thinking and application. That’s a core tenet at Bren. Because we studied Earth sciences, I’m able to talk about things like vapor permeability in a way that most builders can’t, and to explain to a client that it’s not OK to use a low-vapor-permeability surface as an envelope on a house—and why. I’m able to apply that science to what we’re trying to do, so having that background is big.”

As a bonus, he’s discovered something else: “I get a real high closing a deal.”

Heading from the Tea Fire area back to the Allen Associates offices via an attractive residential street near the Santa Barbara Mission, Henson gestures at the homes we’re passing on both sides. “I see every one of them as an ‘Earth system,’” he says. “All the same elements are working—water, energy, air flow, convection, conduction, humidity—just at a much, much smaller scale.”

In February, 18 victims of the Tea Fire were considering hiring Allen Associates to rebuild. Henson hoped to collaborate with some of them as clients, and with architects, subcontractors, and his own project team to use science to build homes that will be green and stay that way, even if the land around them burns to black.