

# grow

Wisconsin's Magazine for the Life Sciences • Summer 2013

food & agriculture • environment • energy • health



## Protecting *our* Pollinators

*Bees are crucial to our food supply.  
How can we keep them healthy  
and productive?*



College of Agricultural & Life Sciences  
UNIVERSITY OF WISCONSIN-MADISON

MAKING SCIENCE ED MORE GLOBAL • ORGANIC SEEDS FOR ALL • A HEART DISEASE GENE







# grow

Wisconsin's Magazine for the Life Sciences

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*Cover photo by Wolfgang Hoffmann BS'75 MS'79*

Inside the Wisconsin Energy Institute, a new, state-of-the-art facility that brings together energy researchers from across campus, including many from CALS

PHOTO BY MATT WISNIEWSKI/GLBRC

Dean Kate VandenBosch

## Not Your Father's Classroom

It's the Year of Innovation at the University of Wisconsin–Madison—and a big part of innovation concerns how we teach our students.

Our college already is home to highly innovative teaching that includes hands-on experience in labs and in the field, independent research opportunities for undergraduates, effective use of distance learning, international experiences of every size and scope, and growing opportunities for cross-disciplinary study (examples: agroecology, global health, environmental science).

But there are no limits on innovation, and we are looking at ways to keep it flourishing at CALS.

I had the good fortune of experiencing some new teaching models as a professor of plant biology at the University of Minnesota when I taught in what is called an active learning space. Rather than have a lecture with all attention directed at the professor—"the sage on the stage"—students worked together in small groups at tables around the room on everything from problem sets and case studies to web-based research, with multiple screens providing elements (PowerPoints, data, drafts of student projects) that everyone needed to see. In that setting the professor becomes a facilitator, visiting groups and talking with students about their work.

I often had as many as 100 students, but rather than feeling overwhelmed by competing discussions, what I noticed most was how much more I could engage with each student individually and how much more actively each of them participated. Their excitement about learning was much more palpable than it would be in an ordinary setting.

In addition to active learning, we've been hearing about such innovations as flipped classrooms and MOOCs. In the flipped classroom—already being introduced at CALS—lectures are made available online for home viewing and class time is used for the kind of active work described above. The intention is to save in-person class time for higher impact interactions that further a student's learning.

And Massive Open Online Courses, or MOOCs, which are now being piloted at UW–Madison, could offer CALS several advantages. First, they could serve as a showcase for the excellent quality of our programs and attract more students to come here. They would allow access to our expertise to people who otherwise might not be exposed to it. In addition, we could repurpose the high quality materials prepared for a MOOC for teaching in all kinds of settings. A number of our faculty members have expressed interest in preparing a MOOC for the second pilot round at UW–Madison.

That such innovations will come to CALS is not a question of if but how. And the concept we'll be thinking about a lot is "blended learning," which draws from all of these modes of content delivery. They each have valuable components. What offers the best experience for students in a given situation? What will best enhance their learning?

These are the questions we'll be asking as we continue to grow innovation at CALS.

*For additional information on MOOCs at UW–Madison, visit: [edinnovation.wisc.edu/MOOCs/](http://edinnovation.wisc.edu/MOOCs/)*



“There are no limits on innovation, and we are looking at ways to keep it flourishing at CALS.”

grow

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## Wisconsin's "Brown Gold" Rush

Transforming manure to energy in America's Dairyland

Earth's petroleum stores are dwindling, but a Wisconsin project aims to produce energy from a resource that's in little danger of running low: cow manure, or "brown gold."

The University of Wisconsin–Madison and several state companies, funded by a \$7 million grant from the USDA Biomass Research and Development Initiative (BRDI), have partnered to pilot the conversion of dairy farm manure into useful product streams—a project that is expected to have significant environmental and economic benefits.

The Accelerated Renewable Energy (ARE) project is in progress at the 5,000-cow Maple Leaf Dairy in Manitowoc County, where animal waste is separated into different streams, or fractions, of processed manure.

After small plant fibers in the manure are separated and anaerobically digested to biogas, liquids from the digestion process are used to fertilize crops, while solids can be converted into useful chemicals and bio-plastics. Larger plant fibers make great animal bedding and mulch, not to mention a starting material for ethanol fermentation.

Meanwhile, at the new Wisconsin Energy Institute at UW–Madison, project co-investigator Troy Runge, a CALS professor of biological systems engineering, is analyzing the ARE project's separation techniques to improve their efficiency. "We are performing many of the same separations that occur on the farm, but in the controlled environment of the lab to both measure and optimize the system," says Runge.

Tom Cox, a project collaborator and a CALS professor of agricultural economics, sees great potential for the initiative. "This is a triple-win situation; we would like to make money by doing the right thing by the environment and society," he says.

Aicardo Roa-Espinosa MS'85 PhD'89, president of partner SoilNet LLC and an adjunct faculty member in biological systems engineering, developed the manure separation technology behind the project. Roa-Espinosa and Runge will monitor the quality,

quantity and composition of biogas produced and analyze processed manure streams to identify chemical constituents. Student researchers will conduct life cycle assessments to evaluate the project's environmental impact.

The goal for the four-year grant, researchers say, is to improve these manure separation technologies until their sustainability benefits can be realized on a broader commercial scale.

Runge notes that the public-private, multidisciplinary project exemplifies what the university hopes to do with the Wisconsin Energy Institute. "It's also an example of a project that's important to Wisconsin," he says.

Indeed, the project may help farmers manage manure with benefits for both the environment and human health. A 5,000-cow dairy farm like Maple Leaf produces approximately 25 tons of manure per day, which require millions of gallons of water to manage. Although some manure may be used as fertilizer, nutrient imbalances and runoff can create environmental problems. However, manure processed using SoilNet's technology yields concentrated, homogenized fertilizer that can be applied with greater control over nutrient content.

In addition to its environmental benefits, the cellulosic—or non-food—plant biomass derived from dairy manure avoids the conflict of "food versus fuel."

That's a promising basis for exciting innovations at dairy farms. For ARE project leaders, farms are not only the heart of agriculture. They also have the potential to serve as foundations for cellulosic biorefineries that could prove key in supporting a local green economy and a sustainable energy system throughout the region.



**Farmers and researchers are working together to separate components of manure into biofuels and other valuable products.**

—CELIA LUTEBACHER



# Getting to the heart of a problem

Research sheds light on a deadly condition

When Marion Greaser set out to study titin, the largest natural protein known to man, his goal was to answer some basic questions about its role in the body. A major protein of skeletal muscle that's also found in heart tissue, titin gives muscle its elasticity and is known for its massive size, which ranges from around 27,000 to 33,000 amino acid residues in length.

"Initially we were just going to look at whether titin was related to muscle growth in animals," says Greaser, a CALS professor of animal sciences.

Working in rats, his team looked at changes in the size of the titin protein over the course of animal development—and immediately came across something strange. In most cases the titin protein shifted from a larger form to a smaller form during development due to natural changes in protein processing known as alternative splicing. But in some rats the titin didn't change. It stayed big.

The team wondered if they'd mixed up the samples. "But we'd kept good track of things and,

in fact, all of the weird samples were from the same litter of rats," says Greaser. "Then the light bulb went off: There must be some genetic reason why these samples are different. These rats had a genetic mutation affecting the alternative splicing of the titin."

But where was the mutation? They first checked the titin gene itself, but it was fine. With hard work, they were able to pinpoint the mutation to a little-studied gene called RBM20, which had been previously linked to dilated cardiomyopathy and sudden death in humans.

Dilated cardiomyopathy affects approximately one in 2,500 people. Sufferers have enlarged hearts, with thin walls, that don't pump blood very well. People with the RBM20 mutation need heart transplants and, without them, tend to die quite early: between ages 25 and 30.

Scientists first linked RBM20 to hereditary dilated cardiomyopathy in 2009, but they hadn't yet figured out how a faulty RBM20 gene worked—or didn't work—to cause disease inside the body.

Greaser's accidental discovery, as described in *Nature Medicine*, filled in the blank. In healthy individuals, the RBM20 protein is involved in the alternative splicing that helps trim titin down to its smaller, adult form. Without it, titin doesn't get processed correctly, and the presence of extra-large titin in heart tissue leads to disease.

"Now doctors can analyze people showing symptoms of dilated cardiomyopathy, see if they're carrying this mutation and factor this information into their treatments," says Greaser. That treatment would probably start with careful monitoring to catch any further deterioration of the heart condition, Greaser notes.

—NICOLE MILLER MS'06

**Marion Greaser's "accidental" discovery sheds light on how a faulty gene can lead to a fatal heart condition.**



PHOTO BY SEVIE KENTON BS'80 MS'06

# Better Fishing and Hunting

CALS undergrads apply ingenuity to classic Wisconsin pursuits

When his grandfather would complain to him about the difficulty of fishing on choppy days out on Green Bay, biological systems engineering student Justin Vannieuwenhoven did more than listen. He came up with a solution.

His invention, a boat-mounted holder for fishing rods that self-adjusts to keep bait steady relative to the bottom of the water, won the top prize and \$10,000 in this year's Innovation Days competition, held by the College of Engineering for undergraduates to showcase their creative and marketable ideas.

And in a separate Innovation Days contest, another BSE student took the top prize of \$2,500 for a device that improves safety for hunters. Luke Stedman teamed with mechanical engineering senior Steve Burbach to create TreeREX, a portable tree stand equipped with steel "jaws" that clamp around a tree trunk and use the hunter's weight to secure the clamp. The heavier the hunter, the firmer the grip on the tree.

Both avid hunters, the students said they were interested in addressing safety because falls from tree stands are the leading cause of death during Wisconsin's gun deer season. (Stedman once took a bruising 20-foot fall from a tree stand himself.)

As for fishing, Vannieuwenhoven says his device, which he calls the CFS Holder, works so well because keeping bait steady makes it look more natural to the fish. In addition—unlike other fishing rod holders on the market—its construction makes rods less likely to pull out when a fish bites, and allows fishers to quickly change bait after a catch. Also unlike other holders, the CFS Holder also can be used on ice or land.

Vannieuwenhoven tested his invention with several experienced anglers who reported higher success rates during rough weather. He has filed a provisional patent application for his design and is launching a business called 3 in 1 Holders. Meanwhile, he continues to gather feedback for further improvements.

At least one target market is already satisfied. "My grandpa has six to eight on his boat at all times," Vannieuwenhoven says. "He's in love with it."

—CHRISTIE TAYLOR

**Luke Stedman and Steve Burbach won \$2,500 for the TreeREX, a safe, portable tree stand for hunters.**



Justin Vannieuwenhoven, above, won \$10,000 for his CFS Holder, a boat-mounted fishing rod holder. He went on to win another \$10,000 in a contest run by the School of Business.

PHOTOS BY MARK RIECHERS





# The Value of GMOs

A long-term study sheds light—and numbers—on benefits to farmers

For all the discussion surrounding genetically modified foods, there have been strikingly few comprehensive studies that put a numeric value on the costs and benefits.

Now there's more to talk about.

By analyzing two decades' worth of corn yield data from Wisconsin, a team of CALS researchers has quantified the impact that various popular transgenes have on grain yield and production risk compared to conventional corn. Their analysis, published in *Nature Biotechnology*, confirms the general understanding that the major benefit of genetically modified (GM) corn doesn't come from increasing yields in average or good years—but from reducing losses during bad ones.

"For the first time we have an estimate of what genetically modified hybrids mean as far as value for the farmer," says CALS and UW-Extension corn agronomist Joe Lauer, who led the study.

Lauer has been gathering corn yield and other data for the past 20 years as part of the Wisconsin Corn Hybrid Performance Trials, a project he directs. Each year his team tests about 500 different hybrid corn varieties at more than a dozen sites around the state, with the goal of providing unbiased performance comparisons of hybrid seed corn for the state's farmers. When GM hybrids became available in 1996, Lauer started including them in the trials.

"It's a long-term data set that documents one of the most dramatic revolutions in agriculture—the introduction of transgenic crops," says Lauer, who collaborated with CALS agricultural economists Guanming Shi and Jean-Paul Chavas to conduct the statistical analysis, which considered grain yield and production risk separately.

Grain yield varied quite a bit among GM hybrids. While most transgenes boosted yields, a few significantly reduced production. At the positive end of the

spectrum was the Bt for European corn borer (ECB) trait. Yield data from all of the ECB hybrids grown in the trials over the years showed that ECB plants out-yielded conventional hybrids by an average of more than six bushels per acre per year. On the other hand, grain yields from hybrids with the Bt for corn rootworm (CRW) transgene trailed those of regular hybrids by a whopping 12 bushels per acre. But even among poor-performing groups of GM corn, there are individual varieties that perform quite well, Lauer notes.

Where transgenic corn clearly excels is in reducing production risk. The researchers found that every GM trait package—whether single gene or stacked genes—helped lower variability. For farmers, lower variability means lower risk, as it gives them more certainty about the yield levels they can expect.

Lauer equates choosing GM crops with purchasing solid-

**Agronomist Joe Lauer (right) and agricultural economists Jean-Paul Chavas and Guanming Shi analyzed two decades of data to determine the benefits of GM corn for farmers.**



PHOTOS BY WOLFGANG HOFFMANN BS'75 MS'79





performing, low-risk stocks. Just as safe stocks have relatively low volatility, yields from GM crops don't swing as wildly from year to year, and most important, their downswings aren't as deep.

GM crops help reduce downside risk by reducing losses in the event of disease, pests or drought. Economists Shi and Chavas estimated the risk reduction provided by modified corn to be equivalent to a yield increase ranging from 0.8 to 4.2 bushels per acre, depending on the variety.

Risk reduction associated with GM corn can add up to significant savings for farmers—as much as \$50,000 for 1,000 acres, calculates Lauer. “It depends on the price that farmers can receive for corn,” he says.

But the two factors quantified in this study—yield and production risk—are just part of the overall picture about GM crops, says Lauer. He notes there are other quantifiable values, such as reduced pesticide use, as well as ongoing concerns about the safety and health of growing and eating genetically modified foods.

“There’s a lot of concern about this biotechnology and how it’s going to work down the road,” says Lauer, “yet farmers have embraced it and adopted it here in the U.S. because it reduces risk and the yield increases have been as good as—or some would argue a little better than—what we’ve seen with regular hybrid corn.”

—NICOLE MILLER MS’06

PHOTO BY HEIDI ZOERB

## Yummier Burgers

**Who appreciates burgers** more than a college student—particularly if the student is interested in meat science? It made sense that Gilly’s Frozen Custard would turn to enthusiastic young people—led by CALS/UW-Extension meat expert Jeff Sindelar, CALS food science lecturer Monica Theis and UW executive chef Jeff Orr—in a quest to create a better burger for their restaurants. Eighteen students and one staffer split into teams and created their own blends of ground beef, combining such types as flank, brisket, sirloin or chuck within a certain price point. They presented their formulations to members of the Gilly’s leadership team, who judged them for overall beef flavor, bite/texture and juiciness. The winner was “Burger E” by Seth Schulz, an outreach specialist in CALS’ Meat Science and Muscle Biology Laboratory; food science undergrad Abbey Thiel; and food science graduate student Cherry Lam Wing Yu. Their creation is already being sold at two Gilly’s locations.



Meat science graduate student Bill Shazer (right) and veterinary medicine student Kenneth Brandenburg (middle) describing their burger to Gilly’s executive Chris Meyer (far left).

## classAct

Jordan Ebert

### A Ringing Success



PHOTO COURTESY OF WORLD DAIRY EXPO

"They called my cow's name and the place lit up," says dairy science major Jordan Ebert. "It was an adrenaline rush—the coolest experience I have ever had showing." That moment happened at World Dairy Expo last fall, when Siemers Goldwyn Goldie, a Holstein from his family's 2,900-cow dairy farm in Algoma, was named the junior supreme champion.

Ebert started showing cattle at age 4, often working with his sister, Whitney. "Our county fair had a Kiddie Showmanship class," he recalls. "Our first purchases of show cattle were Jerseys because my sister and I were pretty small people, so we started with smaller animals." As he grew in size and ability he started presenting at bigger venues. By age 10 Ebert was showing Jerseys at World Dairy Expo and began garnering honors from shows large and small.

Alongside his work with cattle, Ebert was active in 4-H, FFA and, eventually, high school sports including baseball, track and basketball, all while maintaining a 4.0 GPA.

Ebert, now a sophomore, brought his love of sports to the UW–Madison campus. He spent his freshman year as a student manager for the men's basketball team, working behind the scenes to help keep logistics and office work running smoothly for coaches and players. "It's been an awesome experience," he says. He's also been involved with the Badger Dairy Club.

Ebert hopes to bring what he learns at CALS back to the family farm, Ebert Enterprises, which has nearly 30 full-time employees and up to 20 seasonal workers. "My plan is to work my way up through the ranks into a management position where I am making some decisions, learning what it takes to run the farm through my dad, and eventually take it over," Ebert says.

Showing cattle has helped his professional development, Ebert notes, citing the value of networking and interacting with industry professionals. "My success in the show ring has gotten my name out there a little bit," he says. "I have met people along the way and am a familiar face. I feel comfortable talking with them and introducing myself."

—JORDAN SIMONSON

**AWARDED** \$9.9 million from the USDA: CALS/UW–Extension soils specialist **Matt Ruark** and CALS genetics and agronomy professor **Molly Jahn**, to conduct a five-year, multistate project to identify dairy production practices



that minimize the emission of greenhouse gasses and are more resilient to the effects of climate change. The project was announced at UW–Madison by U.S. Secretary of Agriculture **Tom Vilsack** (in photo).

**RENEWED** for another five years with a \$25 million-per-year grant from the U.S. Department of Energy: the Great Lakes Bioenergy Research Center, established in 2007 under CALS leadership to focus on development of advanced cellulosic biofuels. In other news, GLBRC director **Tim Donohue**, a CALS professor of bacteriology, was named president of the American Society for Microbiology, the oldest and largest life sciences membership organization in the world.

**HONORED** with an Entrepreneurial Achievement Award from the University of Wisconsin–Madison: **Richard Burgess**, a CALS professor emeritus of biochemistry who co-founded ConjuGon, a company that develops products to combat the growing epidemic of antibiotic resistance.

**DECORATED** with three gold awards, one silver and one honorable mention: *Grow* magazine, from the national Association for Communication Excellence (ACE). Winners were designer **Diane Doering** (gold, for the fall 2012 "Vitamin D" cover), writer



**Nicole Miller** MS'06 (silver for her spring 2012 story about "Vanishing Waters" and honorable mention for "Vitamin D") and editor **Joan Fischer** and team (gold for best magazine/periodical for the spring 2012 issue and for best publication entry overall).

## Number Crunching 2,900 POUNDS of FRUITS and VEGETABLES



were grown last year by members of F.H. King Students for Sustainable Agriculture, a student garden organization based on campus. The group grows food at Eagle Heights Community Gardens and in a rooftop garden at the Pyle Center and distributes it free of charge to students and local food pantries. This year the group is expecting an even bigger harvest. They've upped their space at Eagle Heights from 1.75 to 2.25 acres.



## Five things everyone should know about . . .

# Hazelnuts

By Brent McCown



- 1 | They're crazy nutritious and gluten-free.** Hazelnuts are rich in vitamins (particularly vitamin E and B-complex groups of vitamins, including folates, riboflavin, niacin, thiamin) as well as dietary fiber. Like almonds, they are gluten-free. They also are rich in monounsaturated fatty acids such as oleic acid and linoleic acid, which help reduce LDL, the “bad” cholesterol, and increase HDL, the “good” cholesterol.
- 2 | An exciting market beckons.** Hazelnut oil serves various purposes in the kitchen (most notably as salad and cooking oil) as well as in cosmetics and pharmaceuticals. Kernels can be eaten fresh; used in baked goods, confections and other edibles; or ground for use in nut flours. An appetite is growing for spreadable hazelnut butters (Nutella, anyone?). And then there's biofuel—the high oleic acid content makes hazelnuts an excellent feedstock for biodiesel and bio-industrial products.
- 3 | They're good for the environment.** As a long-lived woody perennial, hazelnut bush plantings can be used to stabilize sensitive soils and erodible sites. Plantings do not have to be reestablished for decades. They can be closely associated with other high-diversity approaches to agriculture, including agroforestry and multicrop plantings. Since American hazel is a prominent native, there is no risk of invasiveness, and interrelationships to support Wisconsin wildlife are well established. In addition, hazel production readily integrates with small and medium-sized farming operations and family/cooperative farm unit organization.
- 4 | Growers are emerging in the Midwest, including in Wisconsin.** Southern Europe is still king in world hazelnut production, with Turkey leading at 75 percent. In the United States, commercial hazelnut production is still limited to the Pacific Northwest, where the climate allows for growing European cultivars. But a number of Midwestern farmers are trying their hand with two species, American (*Corylus americana*) and beaked (*Corylus cornuta*), that do well in cold climates and sandy soils. Surveys have identified about 130 hazelnut growers in Wisconsin, Minnesota and Iowa, with nearly 135 acres in production.
- 5 | Important genetics work is underway.** Farmers now growing Midwestern hazelnuts are also growing important data as there are, as yet, no commercially proven cultivars of hazelnuts in this region. Breeders are working to develop genotypes focusing on both pure lines of native American hazel and on hybrid crosses between European and American. By selecting from the very diverse native populations and by crossing European with American, they hope to develop a hazelnut shrub with the nut quality and yield of the European and the cold-hardiness and disease tolerance of the American.

Brent McCown, an emeritus professor of horticulture at CALS, is a program partner in the Upper Midwest Hazelnut Development Initiative (UMHDI, [midwesthazelnuts.org](http://midwesthazelnuts.org)), a regional collaboration that includes representatives from UW-Madison and UW-Extension.

Jason Fischbach, an agriculture agent with UW-Extension and a program partner with UMHDI, contributed to this piece.

## WEST AFRICA

## “Highway Robbery” Has Far-Reaching Costs



**Bribes are part of the cost of doing business for truckers in West Africa—but they take a heavy toll on local economies, CALS researchers say.**

In the busy port town of Tema, Ghana, the driver of a tanker truck of gasoline northbound for Bamako, Mali, loads a few dozen pineapples onto his rig and sets out for the distant capital city. His six-day drive will take him through 60 checkpoints, where he will pay about \$200 in small bribes to police, customs and other officials, offering gifts of pineapples to speed his way through these delays.

on amounts and collectors of bribes, Bromley and Foltz estimate that corruption costs—focusing on losses from time delays and bribes paid—add 15 to 30 percent to the cost of transporting food and other products to and from markets in the region.

Foltz became interested in the topic when his own car was stopped by bribe-seeking police during his Fulbright fellowship in Mali a few years ago. “Bribe-taking at highway checkpoints is widespread,” Foltz says. “Because it appears that the profits are shared all the way up the chain of command, it’s immune to quick policy fixes.”

Such corruption hurts the economy in far-reaching ways. At stake, Foltz and Bromley say, are prices

paid to farmers growing products for export to distant markets. With increased transport costs eating into profits, farmers gradually abandon certain crops such as cashew trees that grow well on marginal lands and prevent soil erosion.

“The issue here is that net returns suffer, agricultural investments are necessarily delayed, yields fall, and soon attentive management is not worth the trouble,” they wrote in an article for *Natural Resources Forum*. “Fields and specific crops are left unattended. Tree crops are ignored or ripped out. Economic malaise sets in. Sustainability suffers.”

But the damage doesn’t end there. “Petty corruption of the type we are

studying has a more deleterious effect on private investment than larger-scale government corruption,” says Foltz. “African countries have some of the lowest levels of foreign investment in the world and can ill afford to perpetuate a system that hampers growth even more than taxation.”

Foltz and Bromley are now focusing on understanding the structures, incentives and constraints to corruption, with the goal of providing information to policy makers and others seeking to eliminate this important barrier to development.

The outbreak of violent warfare in the region has not made their work any easier—or less needed.

“We’re studying the impact of new anti-corruption policies in Ghana and also how civil conflicts affect corruption,” says Foltz. “For example, in the recent conflict in Ivory Coast, rebel militias funded their operations in part by extorting bribes that were three or four times higher than normal. In Mali, rebels have used kidnapping and drug smuggling to raise money.”

—BARBARA FORREST BS’76



PHOTOS COURTESY OF JEREMY FOLTZ



In Madaoua, Niger, a southbound trucker bringing onions to the market in Accra, Ghana, will pay \$580 in bribes along his 2,000-kilometer route and be delayed nearly six hours, adding \$1,165 to his total transport costs.

Such stories are commonplace among thousands of drivers in West Africa for whom bribes are simply the cost of doing business. But taken as a whole, this form of petty corruption does a lot of damage to the region’s economy.

Professor and UW-Extension specialist Jeremy Foltz and professor Dan Bromley, both from the CALS Department of Agricultural and Applied Economics, used a unique data set compiled by USAID teams to put some numbers on it.

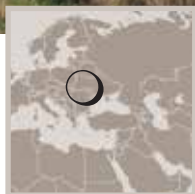
Analyzing detailed surveys of more than 1,500 long-haul truckers in Mali, Burkina Faso and Ghana, including data





PHOTOS COURTESY OF BRIAN HOLMES

## MOLDOVA



### Better Barns for Dairy

Gaining independence from the Soviet Union in 1991 left the tiny nation of Moldova with plenty of barns and other structures from former collective farms—but not enough money or expertise to catch up with modern agricultural practices.

In recent years, however, capital has been flowing into Moldova's dairy industry—and with it, a desire to upgrade old Soviet facilities. Most of them consist of tie stall barns housing a maximum of about 100 cows each, and milking is done with bucket milkers. Between securing, feeding and milking the cows, such facilities require significantly more labor than the freestall barns and milking parlors commonly used in the United States and elsewhere.

That's where CALS can help. Biological systems engineering professor and UW-Extension specialist Brian Holmes recently spent two weeks in Moldova under the auspices of CNFA, a nonprofit that focuses on rural economic growth in developing countries. Holmes visited four dairy farms and provided hands-on training and presentations on everything from building ventilation, freestall barn arrangements and milking parlor design to feed storage and manure management.

Because capital is still limited, dairy farmers often have to make decisions based on thriftiness rather than on labor efficiency or the benefit of the cow, Holmes says. Upgrades often come through remodeling existing facilities rather than building new ones—and therein lies the challenge.

But Holmes was able to provide options that farmers can put into practice even under resource constraints. "Producers who implement these recommendations should expect to see improved animal performance, reduced labor costs, improved profits and improved environmental protection," Holmes says.

Sudden change in how a society is governed does not necessarily result in sudden change in how people behave, Holmes observes. "The old ways and 'the way we've always done things' persists for extended periods," he says.

For example, some of his recommendations require farmers to think in new ways about animal care.

"A classic situation is to convince the dairy operator that the prefabricated concrete sidewall panels should be removed for good summer ventilation and to use curtains to close the sidewalls in winter," says Holmes. "There's a strong belief that cold temperatures are detrimental to cows and that they should be kept warm in winter."

There's still much work to be done in the former Soviet Union, and not just in Moldova, Holmes says—and he's ready to keep doing his part. Earlier this year he traveled to Belarus and worked with dairy farmers who had very similar needs and goals.

—JOAN FISCHER

**Renovation needed:**  
A typical dairy barn on a former Soviet collective farm in Moldova.



**CALS' Brian Holmes, wearing yellow visor cap, discusses draft freestall barn plans with Moldovan farmers.**

# Happy Cows Everywhere

**Amy Stanton** seeks to establish and translate best practices for dairy cattle management into easy guidelines for farmers and other professionals



PHOTO BY SEVIE KENTON BS '80 MS '06

**A**MY STANTON joined CALS and UW-Extension in 2012 as a dairy science professor with particular expertise in animal well-being. Prior to joining CALS she was a post-doctoral fellow in the department of population medicine at the University of Guelph in Canada, where she also had earned a BS in agriculture and a Ph.D. with a dual emphasis in epidemiology and animal welfare. Stanton started off her academic career as a farm kid from a large dairy who was determined to work with animals, specifically dairy cattle. She thought she'd become a veterinarian until the science of animal welfare caught her eye. "It was really then that I found my passion," she says. "Rather than treating individual animals I could start to look at the big picture. How could we change dairy cattle management practices and improve well-being for all animals rather than just treating the sick ones?"

## **Can you describe to us what you mean by animal well-being?**

Animal well-being, or animal welfare science, is basically evaluating how an animal is performing in its environment. We take three basic principles: one is, how is the animal feeling? Is it hungry? Is it thirsty? Is it frustrated? The other principle is, how are the animals functioning? Are they growing, are they healthy, are they productive? The third is the animals' ability to express important behaviors. What behaviors are very important to them? Are they able to groom if grooming is important to them? Are they able to escape if they're in a fearful or stressful situation? By looking at these three factors we can evaluate if an animal is in the best possible situation for itself and how we could potentially improve it.

## **How do you determine what's important to a cow?**

One way is to force them to make a choice. We do what's called a preference test. An example for a cow would be if we wanted to see which was more important—feed or the ability to rest. We might restrict the cows' ability to lie down and eat for a few hours and then give them an option where they must choose one or the other. What we've found is that cattle actually prefer to rest rather than eat. So if you keep the animals away from their home space, perhaps going to the milking parlor for an extended period of time, you will actually reduce their feed intake because they have a limited amount of time in which to feed and sleep and they will choose to sleep.

## **How might we apply this information? What are some goals you'd hope to achieve?**

Our overall goal is to get the animals to be comfortable and feeling very happy so that they are productive in such a way that they are sustainable for the dairy industry. By providing this information we can alter the cows' environment. Taking the example of feed and rest, we know that we cannot keep them away from their home pen for long or we're going to compromise their feed intake, and that is a big driver for milk production. We need to know where these trade-offs are, and through that we can improve their productivity and well-being.



**Q Are cows happier in California than in Wisconsin?**

No comment! [laughs] No, regardless of whether a cow is in Wisconsin or California, what it really comes down to is how we manage the animals. It doesn't matter what size or what type of farm you have. It's the human-animal interaction that seems to be the biggest driver. The farmers who are very dedicated to cow comfort and cow management—that's where you see the really good and happy cows.

**Q Is there any relationship between how humans feel and how the animals either feel or are treated?**

That has a huge impact, and there actually have been studies to show that really we feed off of each other. When you have a really close working relationship, which is what farmers and their cattle have, you see that how the producer feels will impact the cattle and their productivity. So, if a producer has very negative interactions with his animals you see that they are less likely to let their milk down in the parlor and that decreases their productivity. On the other hand, you can also have feedback the other way; if you have sickness and a disease outbreak, and I often see this with many farmers, there's concern about depression and anxiety in the producer because these animals

doing very precisely." We can then improve disease detection and prevent disease outbreaks by identifying the sick animal early to prevent the spread of disease.

**Q You want to put some very objective measures on what that looks like.**

Yes, exactly, and perhaps developing a score sheet so we can say, "Okay, if you see these one, two or three behaviors in dairy calves, go and take a closer look at them and do a physical exam."

**Q One of your colleagues, dairy science professor Pam Ruegg, took pictures of dirty cows. They're the most remarkable four pictures: here's a very, very dirty cow, here's a somewhat dirty cow, here's a somewhat cleaner cow, and here's a clean cow. It's as simple as it could be.**

Yes, and that's really the simplicity that I'd like to develop for identifying sickness behavior. This is what a sick cow looks like—and surprisingly, for people who haven't grown up around cattle, and even for some people who have grown up around cattle, that's a very difficult thing to identify. You start to see them as a whole group rather than the individuals and how those behaviors are different.

**“There are a lot of people who have not grown up on a farm who are handling the animals on a day-to-day basis.”**


that many of the farmers are quite closely bonded with are sick. They don't enjoy going to the farm as much and it's very upsetting for them to have their livestock ill. You can have feedback both ways.

**Q Can you tell us a bit about your research priorities?**

One of my first priorities is to look at sickness behavior. My research project is twofold. One aspect is to try to identify when is the optimal time to look for sick animals, and two, what are their behaviors and how can we train people who are not familiar with dairy cattle to identify sick calves.

What we really find in the changing dynamics on farms is that there are a lot of people who have not grown up on a farm who are handling the animals on a day-to-day basis. If we can move beyond, "Look at that animal. Can't you tell she's sick?" to "Okay. Look at this animal. Perhaps her back is arched, she is lying down, she's slower to get up." What are some behaviors where we can say, "This is what a sick animal is

**Q We've just opened a remodeled, state-of-the-art Dairy Cattle Center here on campus. What excites you the most about this facility?**

In terms of cow comfort, I'm really excited about the changes in stall design. The previous barn was built in 1956 and our knowledge of what cows need and want for their comfort has advanced substantially in that time. An example is the size of the stalls, which have been considerably enlarged to accommodate the larger Holstein cows we are using today compared to the smaller breeds used in the 1950s. We have also improved our handling facilities so that they are designed with cattle behavior in mind. This allows for lower stress and safer handling of cattle for both people and the animals. In the summer months, the cows should be much more comfortable as we have also focused on cooling the air in the summer. Cattle prefer cooler temperatures and during the summer they can experience heat stress. The new ventilation system will allow us to keep the cows much more comfortable. 



# Protecting *our* Pollinators

Bees, so crucial to our food supply, are dying off at alarming rates. CALS researchers are taking a close look at everything from the microbes in their hives to the landscapes they live in to identify in what conditions bees thrive.

By Jill Sakai



People and bees have a long shared history. Honeybees, natives of Europe, were carried to the United States by early settlers to provide honey and wax for candles. As agriculture spread, bees became increasingly important to farmers as pollinators, inadvertently fertilizing plants by moving pollen from male to female plant parts as they collected nectar and pollen for food. Today, more than two-thirds of the world's crop plants—including many nuts, fruits and vegetables—depend on animal pollination, with bees carrying the bulk of that load.

It's no surprise that beekeeping has become a big business in the farm-rich Midwest. Wisconsin is one of the top honey-producing states in the country, with more than 60,000 commercial hives. The 2012 state honey crop was valued at \$8.87 million, a 31 percent increase over the previous year, likely due in part to the mild winter of 2011–2012.

But other numbers are more troubling. Nationwide, honeybee populations have dropped precipitously in the past decade even as demand for pollination-dependent crops has risen. The unexplained deaths have been attributed to colony collapse disorder (CCD), a mysterious condition in which bees abandon their hives and simply disappear, leaving behind queens, broods and untouched stores of honey and pollen. Annual overwintering losses now average around 30 percent of managed colonies, hitting 31.1 percent this past winter; a decade ago losses were around 15 percent. Native bee species are more challenging to document, but there is some evidence that they are declining as well.

Despite extensive research, CCD has not been linked to any specific trigger. Parasitic mites, fungal infections and other diseases, poor nutrition, pesticide exposure and even climate change all have been implicated, but attempts to elucidate the roles of individual factors have failed to yield conclusive or satisfying answers. Even less is known about native bees and the factors that influence their health.

Poised at the interface of ecology and economy, bees highlight the complexity of human interactions with natural systems. As reports of disappearing pollinators fill the news, researchers at CALS are investigating the many factors at play—biological, environmental, social—to figure out what is happening to our bees, the impacts of our choices as farmers and consumers, and where we can go from here.

**A**t first glance,

a honeybee colony literally buzzes with activity, true to its industrious reputation. But there's much more than meets the eye.

"People forget these hives have more than just bees in them," says Kirk Grubbs, a graduate student in bacteriology. In addition to the workers, drones and queen, there are developing pupae; stores of pollen, nectar and honey used to feed the colony; and a resinous substance called propolis that seals and protects the hive. But beehives also house complex microbial communities that bind together the entire hive-centered ecosystem. "They all come together as a larger organism," Grubbs says.

A healthy hive likely depends on a healthy community of microbes, says bacteriology professor Cameron Currie, Grubbs' advisor. Much like those in our guts, bacteria in a beehive normally exist in a balance of good and bad, where the beneficial keep the pathogenic in check.

Hive microecology is relatively new territory for scientists. Grubbs and Currie are using an approach called next-generation DNA sequencing to take a genetic census of the microbial species present and begin to define what's "normal" for a hive community. Unlike previous attempts to survey hive microbes, this high tech approach uses DNA fingerprints of all the microbes present to reliably represent the population without biasing toward familiar strains or those more amenable to growing in a laboratory environment. With the benefit of the new technique, Grubbs has been able to look at more than 100,000 DNA sequences—previously an unthinkable feat.

So far his work with this and other methods has identified dozens of micro-



PHOTO BY SEVIE KENYON BS'80 MS'06

bial groups, including distinct communities associated with different parts of the hive—for example, pupae, adults, stored pollen or honeycomb. "These different components represent very different microbial communities," Grubbs says, similar to work that has identified discrete bacterial populations in different parts of the human body.

With this microbial portrait of a healthy hive, Grubbs is working to better understand the roles of these microcommunities in colony health and productivity. He's also asking how these symbiotic relationships may be affected by environmental influences such as agricultural chemicals.

Honeybees routinely encounter a stew of compounds, from pharmaceuticals used to control disease to pesticides and herbicides carried into hives by foraging adults. Grubbs is currently studying hives treated with the common crop pesticide chlorothalonil, which is frequently found in hives in large amounts. His approach allows him to look at community-level effects of exposure over a period of several weeks or months, which simulates the type of exposure faced by a real hive.

Preliminary results suggest that chlorothalonil exposure significantly changes the microbial communities associated

Kirk Grubbs, a graduate student in bacteriology, examines a hive he keeps on the sixth floor of the Microbial Sciences Building.

with adult bees, with lesser effects on pupal microbiota. He doesn't yet know what these changes will mean for the bees or how they might affect a hive's function. But he hopes to find distinct patterns that could serve as health indicators or even identify bacterial strains or new antibiotics that could be used to treat ailing colonies.

"Molecular characterization of this experiment could not have been done even three years ago," Currie says. "It's an exciting time to

do this work because next-generation sequencing is allowing us to get these insights we couldn't have gotten at before."

**W**hile Grubbs and Currie peer into the microenvironments of a beehive, entomology graduate student Hannah Gaines is taking a wider view of bees in the context of their macro-environments.

Though the familiar honeybee originated in Europe, there are hundreds of native bee species that play critical roles in both agricultural and natural landscapes. "When we think of pollination we think of crop plants, but 95 percent of all flowering plants require insect pollination—and most of those are being visited by native pollinators rather than honeybees," says Gaines, who is conducting her work in the lab of entomology professor Claudio Gratton.

Her research has shown that, in general, more diverse landscapes have more bees. She has documented more than 200 species of native bees in Wisconsin cranberry fields—a surprisingly high number for a single crop.

Contrast this to a vast almond orchard in central California, where the only bees in sight are imported honey-





PHOTO BY WOLFGANG HOFFMANN BS75 MS79

**What you see:** worker bees and cells filled with pollen (lower half) or pupae (upper half), with the dark queen in the middle. **What you don't:** the complex microbial communities that make for a healthy hive, which bacteriologists Cameron Currie and Kirk Grubbs are studying using next-generation DNA sequencing.

bees trucked in during bloom season. Though they may appear lush to human eyes, the vast monocultures that dominate major agricultural areas are virtual wastelands to a bee for the majority of the year.

Bees need just two primary resources: food and shelter. But the intensively managed landscapes of heavily agricultural areas often have neither. Groomed to maximize efficiency, such fields bloom simultaneously and have little uncultivated land with suitable bee habitat—undisturbed soil for ground nesters, hollow stems and snags for cavity nesters. Consider a large watermelon farm, Gaines says. “When the watermelon is in flower, there’s a huge resource for the bees, but when the watermelon’s not in flower, it’s a desert.”

As a result, commercial pollination has become big business. Beekeepers truck their hives around the country, hitting each crop when it is in bloom. A profitable hive may cover thousands of miles in a year, traveling between the Midwest and California or Florida and Maine.

In contrast, native bees cover relatively little ground, generally foraging

within a few miles of their nests and often specializing in one or a few types of flowers. Because of this, they need more biodiversity in a small area, including plants that bloom at different times of year.

Natural woodlands and prairies may be the ideal environments for these natives, but “if we want to talk about conservation, we have to talk about conservation in agricultural landscapes because that’s what we have,” Gaines says.

Her research shows that cranberry marshes in wooded areas have higher diversity and abundance of native bee species. “Within a certain radius, if you have more natural habitat you have more bees,” she says. She and other researchers published a paper this spring showing similar results for dozens of other types of global agricultural landscapes.

Native bees make a big difference. A study published in the journal *Science* this past spring found that wild pollinators significantly increased yield in 41 different cropping systems around the world—from coffee to cotton—whether honeybees were there or not. In contrast, honeybees enhanced yields in just

one-seventh of those cropping systems. Other studies have documented that honeybees become even more effective pollinators when wild bees are present, leading to more and better fruit.

Unfortunately, native bee populations may also be shrinking. Some bumblebees are known to be in decline; researchers believe other species also are experiencing drops, but they often lack historical data for conclusive studies. CCD is not the culprit since most natives are solitary rather than social and do not have hives, but it is likely that many of the same triggers—disease, poor nutrition and pesticides—may underlie the problems. A recent study conducted in Illinois by researchers from three universities implicated changing climate and land use in regional losses of dozens of bee species over the past century.

Gaines hopes that her landscape-level work will lead to research-based management recommendations that can benefit both farmers and pollinators. She and others have shown that specific agricultural practices can make a positive difference. Restricting use of pesticides and fertilizers, diversifying





PHOTO COURTESY OF HANNAH GAINES



**Hannah Gaines hand-pollinating cranberry plants in a campus greenhouse as part of her research studying the effects of various factors on cranberry pollination.**

fields and integrating bee habitat in or near fields can boost wild bee populations and productivity.

Amid growing recognition of this value, some farmers, especially in agriculturally dense areas, are experimenting with planting flowers along field edges and on unused land in an attempt to attract and support native bees and, in turn, honeybees. Ultimately, Gaines says, “Native bee management is really habitat management.”

**These findings emphasize** the critical role that people play in the bee ecosystem. Both natives and honeybees are enmeshed in human activities, highlighting the need to engage beekeepers, farmers, regulators and scientists toward supporting healthy bee populations.

Social and historical contexts are key for this process, says entomologist Sainath Suryanarayanan, a postdoctoral fellow in community and environmental sociology. Rooted in research at land-grant universities, agricultural entomology has largely focused on

controlling crop pests and improving yields. Common experimental methods were designed to look for large, rapid effects in a controlled environment—for example, acute toxicity of high levels of a single substance.

These approaches have not found consistent toxic effects on pollinators. Chemical companies arguing that their products are safe for bees routinely point to the lack of rapid lethality. Regulatory agencies have adopted a similar stance, accepting a lack of evidence of harm as evidence for no harm. But you only get answers to the questions you ask, cautions Suryanarayanan, and these questions are not the right ones when the goal is long-term health of a population.

For instance, the traditional research approach is poorly suited for detecting impacts of the types of exposures pollinators actually receive in fields—that is, chronic exposure to low levels of many different chemicals over a long period of time.

This shortcoming is especially problematic in light of widespread use of newer systemic pesticides that persist in crop plant tissues and lead to prolonged



**The decline of honeybees makes the role of native bees even more crucial. And diverse landscapes tend to have more bees, says CALS entomology student Hannah Gaines, who documented more than 200 species of native bees in Wisconsin cranberry fields.**

exposures. Residues can also accumulate over time in hives and on beekeeping equipment. Concerns about these compounds have led European regulators to ban neonicotinoids, a prevalent class of systemic pesticides, on bee-pollinated crops.

“The kinds of studies that are being done would not allow us to know with any degree of certainty whether they are hurting bees because of this complex set of interactions,” says Daniel Kleinman, a professor of community and environmental sociology. “There is essentially an area of ignorance that has been produced about this, things that we simply don’t know—and yet policy and practice are proceeding on the basis of that ignorance.”

In essence, the current system is biased against finding the majority of biologically relevant effects, yet our regulatory structure establishes policies based on the premise that harm we do not measure does not exist.

To be able to understand—and thus protect—pollinators, scientists and regulatory agencies alike must take a broader view of the issues at hand, acknowledge the complexity of the system and begin to explore some of the other perspectives involved, Kleinman and Suryanarayanan say.

Farmers who grow pollinator-dependent crops already tend to be more aware of bee-friendly practices, such as limiting chemical use during bloom season or spraying at night, says Gaines.

**Eugene Woller, owner of Gentle Breeze Honey (and a CALS Short Course grad), keeps some 600 hives mostly at dairy farms in and around southcentral Wisconsin and “pays” farmers with honey (though he charges a small number of crop farms for pollination services). Bigger operations rent out hives and truck them all over the country.**

Now it makes sense, she says, to start looking at other cropping systems and management practices. For example, corn, though not a pollinator-dependent crop, has large impacts on bees because the planting process generates clouds of pesticide-laden dust that can hurt downwind insects. The direction the growing biofuel industry takes may also have a big impact on resource availability for pollinators. Cornfields for biofuel feedstock offer neither food nor shelter for bees, diverse prairie-style plantings offer an abundance of both, and switchgrass falls somewhere in between.

The amount of complexity you find is determined by how much you look for, Grubbs notes. “The more questions you ask, the more questions you have,” he says. “This is no exception.” As he sorts through thousands of snippets of microbial DNA, he is looking for patterns and clues as to how outside influences may change hive microbiota. By focusing on the ecological impacts to the bees, he hopes to remove the emphasis on any individual stressor. “When you hear ‘disorder’ you think one cause,” he says. “But it’s a whole suite of things that set up susceptibility for something to take over the hive.”

Kleinman and Suryanarayanan would like to see a regulatory and policy-making system that can accommodate multiple types of information, including laboratory studies, multivariate analyses and even empiric evidence such as beekeeper observations. They are currently developing a project to bring together groups with different backgrounds but common interests. By linking beekeepers, regulators and scientists with a range of expertise they hope to improve methods of understanding the true impacts of different factors.

“Everybody agrees to some extent that it’s a multifactorial issue,” Suryanarayanan says. “What’s not resolved is which factors are more prominent and which factors are less.”

However, he thinks it’s clear that sound policy should arise from the intersection of these types of work. One key step is to rethink both the science and the sociology on which current regulatory policies are based. “Given the ambiguity of the evidence here, a precautionary approach would be the appropriate one to take as a policy matter,” says Kleinman.

Both our bees and our agriculture depend on it. 



PHOTO BY WOLFGANG HOFFMANN BS'75 MS'79

# Expanding the Global Classroom



CALS has long been renowned for extensive international engagement. A new program enriches global opportunities for undergrads by making international perspectives, skills and applications part and parcel of the science curriculum.

By Masarah Van Eyck





**A LITTLE MORE** than two years ago I started cold-calling CALS faculty and instructional staff requesting no more than 25 minutes of their time. The first thing I asked the dozens of respondents who agreed to my conversational survey was: “What do you already do to introduce your students to the international aspects of your field?”

Then I asked: “What would you do?”

And then: “What would you need to do it?”

Their answers were as varied as the sometimes spontaneous, often revisited and always generous conversations I enjoyed over the next few months. Some wanted technical support to connect their classrooms with equivalent courses in other countries. Many were eager to host their international colleagues as guest lecturers. Some envisioned podcasts and websites designed to share relevant teaching resources. Still others conjured up entirely new majors, or a renewed system for rewarding teaching engagement across campus more generally. All of them were eager to tackle the challenge.

In the end, three common needs stood out: more opportunities to collaborate with partners abroad; time to put new teaching projects together; and graduate student assistance to pull it off.

The CALS International Programs Office was prepared to meet those needs with a small awards program under the auspices of the campus-wide Madison Initiative for Undergraduates. International Programs director John Ferrick and undergraduate program development director Laura Van Toll conceived of the program to support science faculty interested in further introducing their students to the international aspects of their fields; I was brought on to help carry it out. We asked for “global learning outcomes” in the awards application so that we could learn the skills and perspectives instructors wanted their students to gain. And we gathered a group of faculty to evaluate and lend insight into the feasibility of their colleagues’ projects.

**Global science exploration:** (left) A landscape architecture student maps streams in Costa Rica for conservation planning; (center) Students learn about amaranth, a crop high in protein, from a program partner in Guatemala; (above) Dairy science professor Michel Wattiaux (standing, far right) and his students get an up-close look at dairy production in Mexico.

(below) In Guatemala, a student takes a close look at microbes as part of a class examining international food security and environmental conservation. Agronomy professor Pablo Prado, of the University of San Carlos, looks on.

From case studies to field studies, from podcasts to research abroad, instructors proposed an array of novel projects, all of them designed to introduce a global perspective into undergraduate science courses. In the roughly two years since the program's inception, these three dozen or so teaching innovations have reached approximately 2,000 students in more than 50 courses each year.

Equally important, they are showing us why—and in what way—infusing international content into undergraduate science education is of value.



#### Global concerns on campus:

Undergrads in a lab at the Wisconsin Institutes for Discovery attempt to make biodiesel from waste cooking oil straight from Steenbock's on Orchard, the restaurant downstairs.

**FOOD SECURITY,** global health and nutrition, renewable energy, environmental sustainability—our 21st-century challenges are not referred to as “complex, global problems” simply because they transcend geographical regions. They are both complex and global because they are embedded in an array of languages, religions, measurements, legal systems, trade policies,

and deeply held beliefs about one's personal well-being and relationship to the land.

CALS students know they are entering professions that are profoundly interconnected economically, politically—and daily. Whether searching for a means to feed a world population expected to reach 9 billion people by 2050 or the best way to brand Wisconsin's products to India's emerging middle class, they are eager for the



skills not just to navigate in this new environment, but also to lead. They may be studying a seemingly value-free subject like biochemistry, but they are keenly aware that effectively applying that knowledge requires a nuanced understanding of the world around them. As one nutritional scientist told me in an early meeting: the spleen may work the same way around the world, but people's diets are very different.

“Awareness of other cultures and awareness of what's going on around the world has huge implications [for how we conduct our work],” a junior majoring

## SHARED CLASSROOMS, SHARED BENEFITS

LAST FALL, plant pathology professor Caitilyn Allen and botany professor Don Waller connected their class on the fifth floor of Russell Labs with an equivalent course at the University of San Carlos in Guatemala, taught by agronomy professor Pablo Prado. Comparing agricultural and conservation practices in the tropics and the American Midwest, students shared lecture content throughout the semester and communicated via videoconference technology and social media.

And in January they embarked together on a two-week field study through Guatemala, observing industrial and traditional agricultural practices and new conservation efforts. The students helped harvest seed corn in a mountainside milpa plot, interviewed former orchid poachers

who have learned to grow their own orchids, compared organic and conventional coffee farms, and lunched with Mayan sheep and potato farmers on a bare and windswept highland plateau.

For many of the Guatemalan students, the trip was their first opportunity to see firsthand those aspects of their country. Prado later wrote that it helped at least one of his students discover “how fun a profession in agriculture could be.”

According to Allen, CALS students are hungry for the opportunity to contribute to—and not just “tour”—a region, whether through service learning, volunteer work or shared

experiences like these. “Our students are deeply idealistic,” she says. “They want to know that the lessons they learn in and about other countries also benefit the people they see there. They know that what we do here matters.”







in horticulture told us in a focus group earlier this year.

Enrollment trends echo this sentiment. Take the Undergraduate Certificate in Global Health, a cross-campus offering administered through CALS. Earning the certificate requires students to complete at least two core courses in global, public and environmental health and earn a handful of elective credits. They also must embark upon either a domestic or international field experience designed to expose them to global, intersecting issues of human, animal and environmental health. Launched less than two years ago, it is easily one of the most sought-after certificates on campus. As of the spring 2013 semester, it had 316 current students and 75 alumni.

For other students, the growing market demand for food, technology and biofuels in other parts of the world inspire them to gain international experience. “We live in a global marketplace, and science breeds products that get fed into that marketplace,” a microbiology major who also is earning a Certificate in Business told us.

Whether in the name of global competition or collaboration, the next generation of scientists will work in international, multidisciplinary teams. And their success will depend upon how well they apply their scientific knowledge to real-world challenges on the ground.

## WANTED: MOBILE SCIENTISTS

TODAY, junior scientists from foreign countries training in the U.S. are less inclined to make their careers here, given the growing support and resources for scientific research closer to home. In response, the head of the National Science Foundation recently advised that budding North American and European scientists see to it that they gain experience abroad to learn how science is conducted in these emerging epicenters of discovery.

Yet, given the intense credit load and lockstep course sequence of our science majors, carving out time to study abroad can feel insurmountable. With the help of CALS faculty, the International Programs Office has developed more than a dozen new study and internship opportunities with overseas partners that accommodate the needs of science students by taking place over summer or winter breaks.

Last summer, for example, nearly three dozen students from across Wisconsin completed a course on social entrepreneurship at Oxford University developed and taught by CALS’ Brad Barham, a professor of agricultural and applied economics, and professor John Hoffmire of the Wisconsin School of Business. Students learned from their professors and from practitioners in the field about social entrepreneurship, which harnesses market-oriented activities to address social, economic and environmental problems. They also collaborated in small groups on a number of hands-on assignments, most notably a week-long internship project in which they offered their assistance to—and learned from—a diverse range of entrepreneurial nongovernment organizations (NGOs).

Barham says the combination of engaged, active learning in the classroom with hands-on experience working with NGOs was transformative for the students.

“The key is taking students out of their comfort zones and concentrating their attention on a core theme so they can see how the education they are getting can be applied,” says Barham. “Without a doubt, some of our most innovative entrepreneurship comes from those experiences.”

Participant Caroline Collins, a double major in agricultural business and environmental studies, completed a long-distance internship with an entrepreneur in India who is working on micro-grid technology. He hopes that his innovation will bring reliable, safe power to India’s most impoverished rural populations. Collins’ group contributed both a market analysis and a business plan for his work.

“I was interviewing for summer internships this past fall and almost every employer asked me about my time at Oxford,” says Collins. “They all wanted to know what projects I worked on, what I learned and how I grew from the experience.”

The course, she says, “opened my eyes to how new methods and ideas regarding sustainable development can benefit both industry and the environment.”

Her experience abroad also made her feel more independent and confident in her ability to “conquer unfamiliar challenges and situations,” she notes. “I also gained better group work skills by completing projects with people from different cultures. All of these skills help me with everyday scenarios on campus and better prepare me for life after graduation.”

*Emi Kihslinger BS’13 contributed to this story.*





**Bringing global scholars here: Professor Pavel Krasilnikov (standing in pit), of Lomonosov Moscow University, conducting field work with CALS soil science students in Platteville.**

**MAYBE IT'S NOT** so surprising that in the world of higher education, CALS has been a leading force in the internationalization of science education. Our scholars have long been global citizens, collaborating with international research partners and taking care to see that their discoveries benefit us all.

In 1951, CALS faculty hosted agricultural delegates from nearly 40 developing nations for a conference on land tenure problems. In the following years CALS launched an annual International Farm Youth Educational Exchange Conference and by 1963 had matriculated more than 230 foreign students.

Cold War politics also sent an impressive number of CALS faculty abroad. Bolstered by external and federal funds made available after World War II, faculty from across campus, including those in agriculture, education and engineering, returned from working in countries like India, Brazil and Nigeria

eager to share their insights with their students.

Recognizing that our deeply local roots had become the foundation of our institution's undeniably global reach, in 1961 the University Board of Regents published a policy resolution that in effect "internationalized" their land grant vision:

"With the passing years, the welfare of the people of Wisconsin has become increasingly tied to national and international developments. It is logical, therefore, that the scope of the

Wisconsin Idea should be broadened [...]. We recognize that the university's first responsibility is to Wisconsin and its residents. But the university must look outward if this obligation is to be fulfilled."

Today CALS requires every one of its students to earn three credits of international studies coursework. Scores of CALS graduates have served in the Peace Corps. And nearly every one of the college's instructors engages in international work of some kind.

In this light, of course our faculty and instructors accepted my request for an interview—and embraced the opportunity to further expose their



**The young teaching the younger: UW students leading science activities at an elementary school in Tabuga, Ecuador.**



## THE WORLD AT THEIR KEYBOARDS

IN RECENT YEARS, UW–Madison has bolstered its commitment to offering high quality online education that harnesses the most cutting-edge technology and provides students with a more efficient and accessible learning experience. Faculty in the sciences have welcomed the opportunity to explore what online learning can bring to their classrooms.

Much like a “create your own adventure” story, online case studies ask students to tackle real-world problems as actors in a simulated scenario. With media-rich international content, instructors are now more able than ever to bring the world to their students’ fingertips—literally. Thanks to a partnership between CALS International Programs and UW–Madison’s Engage Program, students in dairy science, botany, pharmacy and plant pathology classes have experienced some of the most innovative products available.

Dairy science professor Michel Wattiaux, for example, collaborated with his partners in Mexico to produce an online case that asks students to evaluate the likelihood that smallholder farmers in Central Mexico would adopt a new milking technology.

And plant pathology professor Jeri Barak designed a program that asks students in her Global Food Security class to play the role of an intern to Ethiopia’s commerce minister. Tasked with evaluating the possible benefits and consequences of leasing out land to a foreign firm, each student must ultimately recommend which (if any) land proposal to accept.

**Online scenarios allow students to simulate making decisions in the context of other countries.**

At their best, such scenarios prompt students to tackle complex issues within real-world contexts, challenging them to come up with viable solutions to problems that often have no clear right or wrong answer. Just as important, these assignments—unlike, say, essays or class presentations—allow instructors to “watch” students’ decision-making processes as they click through the exercise, providing further insight into the best ways to teach the complex issues they are presenting.

An early study of the impact of these products found that a whopping 68 percent of students agreed or strongly agreed that classes with these online products increased their appreciation for understanding science in international contexts.

### Big Decisions in Small-Scale Dairy Farming



#### You arrive at the farm

Jose Juan, who is about 40 years old, welcomes you to his farm and immediately begins showing you around. You see that he has about 15 dairy cows in a corral adjacent to the house.

Jose tells you he uses the milk from his cows to produce cheese. The family sells about 3 kg. each day at the local market for 60 pesos / kg. The remainder he sells to a middle-man for 40 pesos / kg. who ships it east to Mexico City which is about 150 km. away from the farm.

Jose tells you that sometimes his customers complain about the quality of the cheese. He also mentions that he has been thinking about adopting mechanical milking and is receptive to your recommendations.

Next: Ask questions



Jose's herd



Cheese

Home

most junior students to the real-world, collaborative challenges they grapple with every day. We’re pleased to present miniprofiles of some of these efforts as part of this story (see photos and sidebars).

Our next step will be to support our instructors’ more strategic and measurable approaches to curricular internationalization—an inventory and assessment of the “international

content” in their departments, for example, or of an entire major. That will be tough to do for a moving target like global change—and that’s the point.

Even if we take it at its broadest definition—“to put more global content into the university experience”—the urgency to further “internationalize” CALS curricula has only gained traction.

And our students know it.

VISIT THE FOLLOWING WEBSITE to learn more about the program and projects described in this article: <http://ip.cals.wisc.edu/for-faculty-staff/globalizing-the-sciences/>

Want to take part in the CALS Science Internationalization Project? Contact author Masarah Van Eyck at [mvaneyck@wisc.edu](mailto:mvaneyck@wisc.edu), or tel. (608) 890-4196.

# *Seeding an Organic Future*

*By Nicole Miller MS'06*



PHOTO BY WOLFGANG HOFFMANN BS'75 MS'79

*CALS students and faculty are in the forefront of efforts to develop plant varieties for a burgeoning market*



*A*s a wicker basket containing old, faded seed packets made its way around the room, Tom Stearns asked each person to grab a packet and pour a few seeds into their hands. Some of the seeds were green and shriveled, others were tiny, shiny and black.

“Check them out,” encouraged Stearns, founder and president of Vermont-based High Mowing Organic Seeds, the only seed company in the nation to sell 100 percent organically produced seeds.

Addressing participants and speakers attending the Student Organic Seed Symposium at the Lakeview Inn in tiny Greensboro, Vermont, Stearns asked the group to consider what they could—and couldn’t—tell about the seeds just by looking at them. For many, all it took was a quick glance to know what plants they’d grow into.

But seeds hide an important part of their story beneath their coats. Just looking at a handful, it’s impossible to know who developed them and to what end. These details, however, have a lot to do with a farmer’s success.

Plant breeders have enormous influence over the varieties they develop, making key decisions about how, when and where they’ll grow best. Plants bred with high-input, conventional systems in mind (which generally employ chemical fertilizers and pesticides) tend to thrive in those systems. Likewise, those bred for organic systems tend to flourish in organic systems. Yet relatively little of this latter type of breeding work has been done over the past 50 years, mostly due to meager financial support. Today’s organic growers have difficulty finding organic-adapted seeds, and they are often forced to choose among conventional varieties.

To Stearns, this situation is ludicrous, on par with giving a beef cow to a dairy farmer. “You will get milk out of a beef cow, but not a lot—they haven’t been selected to produce milk. Beef cattle don’t have the right genetics for what dairy farmers are trying to do,” he explained to the group. “That’s what I think organic growers are dealing with. We don’t even know what we’re missing. The seeds we’re using aren’t genetically adapted to the kind of systems that we have.”

The most obvious solution is to have more plant breeders doing organic work. And, as Stearns looked around the room that day at the Lakeview Inn, he had reason to hope.

At a professional gathering about a year earlier, Stearns had met Claire Luby and Adrienne Shelton, graduate students in the Plant Breeding and Plant Genetics program at CALS, along with Alex Lyon MS’08, a CALS agroecology graduate now working on a doctorate at the Nelson Institute. During a dinner reception at the 2011 meeting of the Vegetable Breeding Institute—a Cornell University-based public-private partnership that fosters interaction between vegetable breeders and seed and food companies—the trio had shared with Stearns some of their experiences doing organic-focused work. While the students were excited about the work, they

also felt unsure about their career paths and somewhat isolated and discouraged. Graduate students working in organic plant breeding, like their faculty advisors, are few and far between, and they lack the support network enjoyed by their conventional-focused peers.

“There are a lot of activities and events geared toward graduate students who are going to work at the bigger plant breeding companies,” explains Shelton. “But it’s really hard to connect with other students doing organic plant breeding because the organic seed industry is so small in comparison, and there are just a few of us—at best—at each land-grant university.”

(below) CALS horticulture professor Irwin Goldman (left) presenting his onions to symposium participants in Vermont. Professor of agronomy Bill Tracy (holding a spading fork) listens in.

Before dinner was over, a plan had sprouted to put on a symposium, dubbed the Student Organic Seed Symposium (SOSS), to give this scattered group of students a much-needed opportunity to come together and feel like part of something bigger—part of the new and growing agricultural movement that they comprise. Luby, Lyon and Shelton would organize it, with support from their advisors. Stearns would help host it in Vermont. There would be talks by experts, farm tours and a visit to High Mowing Organic Seeds. There would also be time to just hang out and get to know each other.

“The whole idea was to try to build these connections, to create a scientific community that could support us throughout our careers,” says Shelton.

It all came together in early August 2012, with 20 graduate students cupping seeds in their hands, eager to develop new plant varieties to meet the needs of organic growers.

*Humans have* been breeding plants since antiquity. Simply by selecting which seeds to save and plant the following spring, people make decisions that alter the overall genetic makeup of their crops. It's a powerful technique, known as selection, that plant breeders still use to this day.

Modern plant breeders have many more tools at their disposal and bring a scientific approach to the whole process. A significant portion of the work involves making crosses. To do so, breeders pick two varieties with desirable traits, transferring the pollen from one to the pistil of the other, purposefully mixing together the good genes of both. The new plants created this way then go through years and years of re-crossing and selection until the breeder is satisfied with the final product. Only then is it released as a new variety. It's a time-consuming process, taking up to a decade and sometimes more.

Crossing and selecting are classical plant-breeding techniques that look pretty much the same whether they're used to breed plants for organic or conventional systems, so context is key.

“One of the underlying paradigms of plant breeding is you should breed for the conditions under which the crops are going to be grown,” says Bill Tracy, chair of the agronomy department at CALS.

And organic farms have a special set of conditions. Without chemical options to control weeds, insects and microbial diseases, organic farmers need varieties with a unique set of traits. For instance, they need varieties that are fast-growing and preferably dense-growing to out-compete and shade out weeds. They also need varieties with natural pest and disease resistance. At the same time, these plants need to produce a large, beautiful bounty.

“But to date there's been very little breeding for organic conditions, so there are opportunities and needs out there that aren't being met,” says Tracy, whose breeding program encompasses both conventional and organic sweet corn.

These unmet needs are expanding.

The organic food market is the fastest-growing segment of the American food industry, as it has been for more than a decade. Sales of organic foods increased 9.4 percent to \$29.2 billion in 2011, and now make up 4.2 percent of all U.S. food sales. Wisconsin alone has 1,200 organic farms, including dairy, beef, vegetable and berry.

And it's not just consumers. In recent years, students, too, have expressed growing interest in organic. “When we interview students who are potential undergrads or grad students at CALS, they ask, ‘What are you guys doing in sustainable agriculture? And how can I work in that space?’” says Irwin Goldman PhD '91, chair of the horticulture department, which, in partnership with the department of agronomy, co-administers the Plant Breeding and Plant Genetics (PBPG) graduate program. “We're hearing that more and more, and we're starting to address it,” Goldman says.

As one of the strongest plant-breeding programs in the nation, the UW-Madison PBPG program is well positioned to rise to the challenge. It has trained more professional plant breed-



PHOTO COURTESY OF SOSS





**Harvest bounty at the Student Organic Seed Symposium. Participants had sent conference organizers their seeds early in the season to plant on location so that their vegetables would be ready to sample come August.**

*In early spring* last year, weeks ahead of planting time and months before the Student Organic Seed Symposium that summer, participants and presenters from across the nation shipped seeds to Vermont for Stearns to sow in High Mowing's trials and showcase garden.

Stearns' team planted and tended the plants—organic-adapted varieties of sweet corn, carrots, broccoli, barley and wheat—so that by early August, many were near their peak, ready for a special show-and-tell among symposium attendees.

The group visited the demonstration plots on day two, a glorious and hot summer afternoon. With a backdrop of blue sky and rolling hills, CALS' Shelton went first. She described the challenge sweet corn presents to organic growers while picking and handing out ears to taste from her plot.

In sweet corn, the same genetic mutation that causes sweetness also causes the plants to have trouble germinating and popping out of the ground. For conventional growers, there's an easy fix: a simple chemical treatment applied

before planting protects the seeds from diseases and insects, helping them to survive until they emerge. But organic growers don't have that option. Instead, they struggle with the crop. Many choose to start seedlings in greenhouses, where they are relatively safe from harm, before transplanting them to the field, a time- and labor-intensive process with a marginal return.

"A lot of organic farmers only grow sweet corn because their customers

ers than any other program and earned the respect of seed companies large and small, including Monsanto, which donated \$1 million to the program in 2008 to support graduate fellowships. Breeders at UW release a constant stream of new varieties, and graduates have excellent job prospects. The seed industry is full of Badger alumni—all the way up to top leadership positions.

One of the benefits of such a large program is that there's room to accommodate a diversity of approaches. With

only a small handful of breeders and a few graduate students focused on organic systems at UW, the university is nonetheless considered a leader in the field, a hub for organic plant breeding work. For all involved, there's a huge opportunity to help organic farmers as they try to meet the demand of this burgeoning market.

"We're starting to incorporate this into what we do," says Goldman. "It's exciting to see us starting to serve this clientele."





demand it, especially if they're doing community-supported agriculture," says Shelton, referring to an increasingly popular program by which customers, in effect, buy shares of a farmer's harvest. "So we're trying to make it easier for them."

With support from the USDA's Northern Organic Vegetable Improvement Cooperative (NOVIC) program, and in collaboration with organic farmer Martin Diffley, Shelton and Tracy are developing a population of open-pollinated sweet corn that germinates and grows more quickly in organic systems. It also has enhanced disease resistance.

With that \$2.3 million program, NOVIC is underwriting the most substantial organic plant-breeding effort ever seen in America. In addition to sweet corn, the program focuses on breeding and trialing varieties of broccoli, snap peas, winter squash and carrots for organic farms across America's northern states.

At High Mowing, CALS graduate student Lyon gave an overview of the program, whose Midwest trialing efforts are being led by her advisor, agronomist Erin Silva. NOVIC's lead carrot breeder, John Navazio, MS'94 PhD'94, showed some carrots. Navazio, a breeder with the nonprofit Organic Seed Alliance, is partnering with CALS and USDA-ARS carrot breeder Phil Simon PhD'77

to develop new and improved organic-adapted varieties.

CALS' Irwin Goldman and Claire Luby took the opportunity to display their efforts as well, which were bred outside the auspices of NOVIC. They included Goldman's newly released varieties of orange and yellow beet—Badger Flame, Badger Torch and Badger Sunset—that are expected to be a hit among organic growers and other farmers looking to sell beautiful, unusual vegetables.

Recently, another novel funding source has cropped up to support this kind of work: Seed Matters. An initiative of the nonprofit Clif Bar Family Foundation, Seed Matters grew out of the idea that large food companies whose success is based on organic products, such as Clif Bar, Organic Valley and Whole Foods Market, need to build capacity and invest in the infrastructure of the agricultural system that they depend on.

"Organic has had great success, but there's always need for continued improvement," says Matthew Dillon, Seed Matters' director. "We realized that we needed to make a long-term investment in the primary foundation of organic agriculture—in the next generation of plant breeders."

Based on Tracy's organic sweet corn breeding work, Seed Matters selected CALS at UW-Madison to receive one

of four, five-year organic plant-breeding graduate fellowships that it awarded in 2012—the first such fellowships in the nation. With the funding, Tracy was able to bring on Tessa Peters in the fall of 2012. With Peters and Shelton, he now has two of six graduate students focusing on organic sweet corn. In spring 2013 Claire Luby, working under Goldman in horticulture, received a Seed Matters fellowship as well. For those in the field, it feels like momentum is building. "This is really the beginning, I think, of a concerted effort to breed varieties for organic systems," says Shelton.

On the final day of the symposium, the student organizers held a discussion about the future of the symposium itself. By that time the group had spent three intense days together from sun up to well beyond sundown, and they had clearly bonded, particularly after lunch at High Mowing the previous day, when students had shared stories about their lives and motivations.

The main question at hand: "Do we want to do this again next year?" But almost before the students could propose it, a team of student and faculty wheat breeders headquartered in Mt. Vernon, Washington, offered to host. A funding source soon followed. Without waiting to be asked, Seed Matters offered to foot most of the bill for the 2013 gathering, keeping it affordable for graduate students. The second




**Professor Bill Tracy and graduate student Adrienne Shelton sample their organic sweet corn in the field at the West Madison Agricultural Research Station.**

PHOTO BY SEVIE KENYON BS'80 MS'06



symposium is set for August 4–7 (more information provided below).

For his part, Goldman was deeply impressed by the whole gathering. “This really went into new territory,” he told the group on the last day. “I think the building that took place here went far deeper than work collaborations in research. It really went to the heart of what it means to have a shared dream and what it means to have a shared ambition.”

Students Claire Luby, Alex Lyon and Adrienne Shelton came home thrilled; their expectations had been surpassed. “I realized that there are other people who really care about this work and support you, and that there are job prospects, and that you can make this happen,” says Luby. “That’s why it was so energizing.” 

*The next Student Organic Seed Symposium takes place August 4–7. More information at <https://sites.google.com/site/studentorganicseedssymposium/>*

**Professor Irwin Goldman’s students Amy Freidig, Lynn Maher and Gregory Vogel work with carrots and beets in the Walnut Street Greenhouses on the UW–Madison campus. Through selective breeding the team hopes to improve the flavor and nutritional value of these crops as well as produce higher-quality seed.**

## Seeds for All

In order to develop new crop varieties, plant breeders need access to the wealth of genetic resources housed in even the tiniest seed. While patents often govern this access, some participants in the Student Organic Seed

Symposium are working to develop an innovative alternative model, one that supports the open exchange of germplasm with minimal restrictions on the use of seeds in further breeding.

Advocates of such free seed exchange are looking to the open source software community as an inspiration and model. A working group of plant breeders, farmers, nonprofits and seed advocates have joined in what they’re calling the Open Source Seed Initiative (OSSI). Explains Jack Kloppenburg, a CALS professor of community and environmental sociology and a founding member of OSSI, “It’s a parallel system, a new space where breeders and farmers can share germplasm.”

In addition to working

for the open exchange of germplasm for breeding, OSSI is committed to supporting a robust public plant-breeding sector, diversifying the commercial seed market and enlarging the opportunities for farmers to collaborate with university scientists in what they describe as “participatory plant breeding.”

The development of several open source licenses under which breeding lines and new cultivars would be released and exchanged is at the operational core of OSSI’s approach. Though each is created to fit unique circumstances, all three licenses preserve open access to material for further breeding.

Moreover, the licenses are “viral,” Kloppenburg notes, meaning that any new varieties bred from seeds released under one of these licenses must carry the same license. “This makes for an expanding pool of germplasm that any plant breeder can freely use,” he says.



PHOTO COURTESY OF SOSS

## in the field



Jay Blasi



Erin Crain



Brian Fluno



Paul Gobster



Rich Henderson

**Jay Blasi BS'00 Landscape Architecture**

• Jay Blasi started doodling golf course designs on placemats when he was eight years old. He began researching the field in high school, and since enrolling in the landscape architecture program at CALS, he hasn't looked back. He now runs Jay Blasi Design, a golf architecture firm dedicated to creating, restoring or renovating courses. One of his greatest accomplishments was being part of the team that designed the Chambers Bay course in Washington state, which will host the U.S. Open in 2015. He is one of the youngest contributing golf architects to design a U.S. Open course, a dream of his since high school. To top it off, Jay and his wife, Amy, who met while working on the project, were married a few years ago on the 15th hole.

**Erin Crain MS'99 Landscape Architecture**

• Whether she's hiking, gardening

or hunting for turkey, Erin Crain has a passion for the outdoors, so it makes sense that she found her professional calling with the Wisconsin Department of Natural Resources. She serves as director of the Bureau of Endangered Resources, where she is responsible for inventory, monitoring, research and management of rare and non-game species in Wisconsin. "I'm able to make a difference in protecting Wisconsin's natural resources as well as supporting the people who work in our program. I wouldn't trade this job for anything," says Crain.

**Brian Fluno BS'97 Landscape Architecture**

• Brian Fluno was drawn to landscape architecture because of the discipline's blend of science, horticulture and art, he says. As a licensed landscape architect, Fluno has worked on the design, drafting and supervision of many corporate, business, mixed-use and residential projects. He joined The Brickman Group, Ltd., where he currently works as an account manager, upon graduating from CALS. "I liked the creative aspect of the profession and also the forward-thinking aspect of planning for how a space will be used in the future," Fluno says. He remains deeply committed to the CALS community. Recently Fluno completed a six-year term on the board of the Wisconsin Agricultural and Life Sciences Alumni Association (WALSAA), including one year as board president.

**Paul Gobster MS'83 Landscape Architecture** • As a research social scientist with the USDA Forest Service's Northern Research Station in Evanston, Illinois,

Paul Gobster examines how people perceive, experience and value nature in urban settings, providing environmental managers with the information they need to optimally serve a diverse range of city stakeholders. In his last year at CALS Gobster helped organize a forum on the Wisconsin Idea, a concept that has influenced the way he works. "My UW experience taught me the value of interdisciplinary learning and the importance of linking knowledge to practice in solving real-world problems," he says.

Gobster serves as co-editor-in-chief of *Landscape and Urban Planning*, a leading international scholarly journal of landscape science, and as an adjunct lecturer in the environmental policy and culture program at Northwestern University. This past spring Gobster was named a Distinguished Alumnus by the Department of Landscape Architecture in recognition of his contributions to the field over the past 30 years.

**Rich Henderson MS'81 Landscape Architecture**

• As an ecologist with the Wisconsin Department of Natural Resources, Rich Henderson conducts research on habitat and natural area management, fire ecology, invasive terrestrial species, and species of greatest conservation need, especially those in southern and western Wisconsin. He is motivated by a deep desire to retain and recover the most reduced and threatened portions of our natural environment for current and future generations to enjoy. In addition to his work with the DNR, Henderson served as president of The Prairie Enthusiasts and as

**About In the Field**

These alumni represent the depth and breadth of alumni accomplishments. Selections are made by Grow staff and are intended to reflect a sample of alumni stories. It is not a ranking or a comprehensive list. To read more about CALS alumni, go to [www.cals.wisc.edu/alumni/](http://www.cals.wisc.edu/alumni/)

Know a CALS grad whose work should be highlighted in Grow? E-mail us at: [grow@cals.wisc.edu](mailto:grow@cals.wisc.edu)

**Next issue:** Alumni from CALS short courses



## Alumni who are making a difference

## Landscape Architecture



Lance Neckar



Pat Richter



Rodney Walter



Susan Weiler



Barbara Wyatt

the leader of several projects with The Nature Conservancy.

**Lance Neckar MA'81 Landscape Architecture** • Lance Neckar is the founding faculty director of the Robert Redford Conservancy for Southern California Sustainability at Pitzer College, where he integrates the concept of sustainability into a multidisciplinary approach to understanding and reimagining our human-made surroundings, he says. “The landscape architecture program at CALS offered me the chance to be mentored by great faculty who launched several of the trajectories of my career,” says Neckar. An example? He serves as co-editor of *Landscape Journal*, which was founded by his CALS mentor, emeritus landscape architecture professor Arnold Alanen.

**Pat Richter BS'64, Landscape Architecture** • Before he became UW-Madison's athletic director; before he was commemorated with a bronze statue at Camp Randall; before he joined the Washington Redskins and was inducted into the College Football Hall of Fame, the Academic All-America Hall of Fame, the Rose Bowl Hall of Fame and the Wisconsin Athletic Hall of Fame; before he served as VP-Personnel at Oscar Mayer Foods; and before he went to law school, Pat Richter majored in landscape architecture at CALS.

“I've always been interested in the design aspects of both architecture and landscape architecture,” says Richter, who brought his love of sports into the mix by studying golf course architecture as well. After joining the NFL Richter spent several off-seasons working at the

landscape architecture firm T.D. Donovan and Associates, which at the time also employed CALS professor emeritus Darrel Morrison.

Richter remembers his years at CALS as being among the best of his life. And in his retirement he pursues his continuing interest in art and design. When his eight grandchildren aren't keeping him busy, he spends time creating glass fusion and stone sculptures.

**Rodney Walter MS'00 Landscape Architecture** • While majoring in landscape architecture at UW-Madison, Rodney Walter made a point of taking as many field ecology classes as possible. The hands-on education he received gave him a great appreciation for the diversity and complexity of Wisconsin's natural areas and led him to a career as director of habitat protection for the Wisconsin chapter of The Nature Conservancy. Walter chose this field, he says, because he wanted to work outdoors in a way that would respect and preserve the natural world rather than consume it. “The best part of my work is when I get to work directly with the landowners that the Conservancy is working with to protect their land and spend time seeing some of the best parts of Wisconsin,” he says.

**Susan Weiler BS'79 Landscape Architecture** • Susan Weiler is a partner at Philadelphia-based OLIN, a landscape architecture and urban design firm with an international practice. “We create places that enhance life: human, animal, natural and city life—that's what we try to do every day,” says Weiler, describing her work. She loves work-

ing with artists and seeing the integration of art and landscape. She is currently working on an installation with artist Janet Echelman to transform Dilworth Plaza in front of Philadelphia's city hall into a sustainable, accessible, green public space, she says. Her mantra is, “If you love what you do, you never have to work a day in your life.”

**Barbara Wyatt BS'89 Landscape Architecture** • Historic preservation and landscape architecture have always been close to Barbara Wyatt's heart. Growing up, she spent time designing garden spaces at her family's 18th-century farm and researching the farm's history. That personal interest led her to a career in historic preservation, with a special focus on landscape issues. She worked in the Wisconsin state historic preservation office and later had a landscape research/design consulting practice based in Madison. For the past several years she has worked for the National Park Service as staff for the National Register of Historic Places and National Historic Landmarks (NHL) programs. In that position she reviews National Register nominations from seven states, including Wisconsin, and works on special NHL projects, such as editing the Japanese Americans in World War II Theme Study. She is currently chairing an initiative to improve and increase National Register listings involving landscapes. Her work in historic preservation came full circle when the farmhouse in which she grew up, now her home, was added to the National Register of Historic Places.

—BY NATALIE HINAHARA

## Catch up with ...

Nicole Drives BS'11 Nutritional Sciences

AS A CHILD NICOLE DRIVES spent a lot of time in the kitchen with her grandmother, Laura Lee. “Lala” could make all kinds of wonderful food, but Nicole begged for them to make one recipe in particular—a nut confection called sugar and spice pecans. The scent of roasting nuts would fill the kitchen, and the resulting snack was crunchy and delectable.

Fast-forward to 2011, when Drives graduated from CALS with a degree in dietetics. She wanted work that would draw on her devotion to good food as well as her creativity, passion and discipline. Drives decided to take a bold leap by starting a business based on her grandmother’s treats.

With her parents’ encouragement, Drives wrote up a business plan, formed a limited liability company (LLC) and secured a \$10,000 loan to launch her business in a shared commercial kitchen space. The process called for learning all aspects of food business start-ups. Food safety regulations, sellers’ permits, market niche, price points and product distribution became terms she would eat, sleep and breathe during 90-hour workweeks, a schedule she still maintains.

The name of her company? Lala’s Nuts, featuring pecans and walnuts in either “sugar n’ spice” or “bodacious bourbon” flavors. The nuts are finding a growing audience in the higher-end specialty snack market—online, a five-ounce bag costs \$7.99—and are sold at nearly a dozen retail locations in Wisconsin as well as at expos, markets and festivals and directly to customers online.

This past spring Drives moved into her own commercial kitchen in the Madison Enterprise Center, an incubator for new businesses.



- **What’s your next move?** I’m working on some new recipes featuring a mixed nut bag and developing a few new flavors away from the sweet—so I’ll be adding more savory and salty options. I also hope to expand into Chicago, Minneapolis, and then perhaps toward the South because pecans are so huge there.
- **In a recent presentation to a CALS nutrition class, you had some constructive things to say about making mistakes.** (laughs) Oh, that I know I’ll make mistakes—but I try not to make the same mistake twice. Another food producer shared that with me when I started out. Because I’m the only one working in the business, I have to wear all the hats. And obviously I’m going to make mistakes. The first few months I was really hard on myself, but I’ve realized that mistakes are how you grow—I just try to learn from them and not make the same ones again.
- **What advice would you give a young entrepreneur?** Follow your heart and your passion. As long as you’re passionate about what you do, you will become successful at it. Figure out what you love and then go with that, because when work doesn’t feel like work, you’ll enjoy what you do.
- **What does Lala think about all this?** Oh, she loves it. She couldn’t be more proud. She thinks it’s so exciting that I took a great memory of her—something that I loved to do with her—and made it into a business. It’s a great way to keep those memories alive.

Learn more at [www.lalasnuts.com](http://www.lalasnuts.com)





Join Bucky and dozens of CALS faculty, staff and students at UW–Madison Day at the Wisconsin State Fair on August 7. Food-making demonstrations and hands-on science learning will be part of the fun.

**JOIN** fellow CALS alumni and friends at **Farm Technology Days**, held **July 9–11** in Barron County. Alex and Mary Olson of Breezy Hill Dairy (located near Dallas) are serving as hosts. CALS will offer daily receptions in “tent city”—look for the UW alumni tent. And the Wisconsin Agricultural and Life Sciences Alumni Association (**WALSAA**) will hold its annual picnic on **July 10**. More info at [barronfarmtech.com](http://barronfarmtech.com) and [walsaa.org](http://walsaa.org).

**ATTEND** UW–Madison’s **Corporate Open House** on **August 22**, 8 a.m.–5 p.m. at Union South. Keynote speaker: **Thomas C. Gentile III**, president and CEO of GE Healthcare Systems. The occasion marks the second year of this annual event, which invites representatives from a wide range of industries to explore how partnerships with UW–Madison can strengthen corporate competitiveness. More at [ocr.wisc.edu/openhouse](http://ocr.wisc.edu/openhouse).

**LEARN** more about how to develop biofuels from perennial grasses in a **new educational video series** in-

volving CALS faculty. Biological systems engineering professor **Kevin Shinn**’s video focuses on harvesting and processing switchgrass. View at [go.wisc.edu/bioharvest](http://go.wisc.edu/bioharvest).

**VISIT** Agricultural Research Stations around the state this summer. Fun events for the public include:

- **Arlington**, Organic Field Day (August 13) and Agronomy Field Day (August 28)
- **Hancock**, Potato Field Day (July 23) and Garden Tour (August 6)
- **West Madison**, Open House (August 17)

More info at [ars.wisc.edu](http://ars.wisc.edu).

**MARK YOUR CALENDARS** for

- **WALSAA Football Fire-Up**, September 7
- **World Dairy Expo**, October 1–5—CALS reception on Wednesday, October 2, 3:30–6 p.m.
- **CALS Honorary Recognition**, Thursday, October 17, 6 p.m. reception, 7 p.m. dinner, at Union South. Call 608/262-4930 for more info or visit [cals.wisc.edu/alumni-friends/recognition/](http://cals.wisc.edu/alumni-friends/recognition/).

## Stewarding Our Soil

Our planet and its 7 billion people face a number of challenges, many of them concerning providing enough food and water for a growing population. And soil science plays a fundamental role in meeting those challenges.

“Since most of our food comes from the land that filters our waters and we are solely dependent on this planet, we will have to manage it wisely,” notes Alfred Hartemink, a professor of soil science.

A new funding stream has opened at CALS to help students learn to do just that. Fittingly, it is named after a scholar whose contributions to soil science are internationally renowned and whose teaching style served as an inspiration to generations of students: Francis D. Hole

(1913–2002), a professor of soil science and geography.

Among his many achievements, Hole made great contributions to understanding the formation and distribution of soils in Wisconsin. He wrote a seminal book on the soils of Wisconsin and led a grassroots campaign to have Antigo silt loam named Wisconsin’s state soil.

The F.D. Hole Soil Studies and Expedition Endowment will be used to offer hands-on learning experiences for students, in the spirit of Hole’s oft-quoted belief that we should “read each landscape for practical purposes or simply for the pleasure of it.”

“Given the upsurge in soil science we need to make sure that our graduates have field knowledge about the soils of Wisconsin,” says Hartemink. “The fruits of this endowment will be used to enhance field-based studies in the light and vision of Francis Hole. As with many things in life it all starts with fascination and curiosity. The endowment will help foster our students’ fascination for the natural resource upon which we all depend—the soil.”



Francis Hole

To help support the F.D. Hole Soil Studies and Expedition Endowment, visit: <http://supportuw.org/giveto/soilsstudy>.

The UW Foundation maintains more than 6,000 gift funds that provide critical resources for the educational and research activities of CALS.



For more information, go to:  
[www.grow.cals.wisc.edu](http://www.grow.cals.wisc.edu)

# Help Students Get a Start

## The skills and sense of stewardship young people learn at CALS

help make the world a better place. But first they need your help. Nearly 40 percent of CALS students demonstrate significant financial need.

Your gift to the CALS Annual Fund is an investment in their future.

PHOTO BY SEVIE KENYON BS'80 MS'06

### ■ Jennifer Holle BS'12

received a scholarship reserved for undergraduates from rural communities. Such support is helping Holle reach her goal: To become a veterinarian serving Wisconsin dairy farms like the one she was raised on.



## Your support makes these opportunities possible

Your gift of any amount to the CALS Annual Fund is needed in a time of changing funding sources for the university.

To make a gift, please visit [supportuw.org/giveto/cals](https://supportuw.org/giveto/cals)

or mail to UW Foundation, US Bank Lockbox, Box 78807, Milwaukee, WI 53278-0807

You may also contact Barb McCarthy, (608) 265-5891 or [barb.mccarthy@supportuw.org](mailto:barb.mccarthy@supportuw.org), to learn more.





# Take the FINAL EXAM!

Fill out your answers online. Ace our quiz and we'll enter you in a drawing for a gift box of Babcock Hall cheese. Go to: [www.cals.wisc.edu/grow/](http://www.cals.wisc.edu/grow/) for more details.

## Environmental Science

**1. The U.S. Environmental Protection Agency has moved away from monitoring total particulate matter because**

- a) acid precipitation and long-distance transport of toxins preclude this measurement
- b) smoking bans have eliminated the need for it
- c) radionuclides necessary for the test are more harmful than the particulates
- d) fine particles observed with PM2.5 and PM10 are more deleterious to human health
- e) all of the above

## Soil Science

**2. What is the percentage of soils in Wisconsin that are covered with more than 30 cm loess?**

- a) 10%
- b) 40%
- c) 60%
- d) 90%

## Biochemistry

**3. Which of the following is true regarding the presence of molecular oxygen (O<sub>2</sub>) in our planet's atmosphere?**

- a) O<sub>2</sub> was not present in the atmosphere when life first evolved on earth
- b) O<sub>2</sub> in the atmosphere originates from the splitting of water molecules during photosynthesis
- c) O<sub>2</sub> has accumulated in the atmosphere because, over geologic time, there has been more photosynthesis than processes such as respiration and combustion that consume the products of photosynthesis
- d) All of the above

## Global Health

**4. According to the World Health Organization, the leading cause of death in developing countries is**

- a) Malaria
- b) Diarrhoeal diseases
- c) HIV/AIDS
- d) Lower respiratory infections
- e) Ischaemic heart disease

## Wildlife Ecology

**5. What kinds of cranes may be considered alpine?**

- a) red-crowned crane
- b) Eurasian crane
- c) black-necked crane
- d) white-naped crane
- e) both a and c

LAST ISSUE: Answers were 1: B, 2: B, 3: B, 4: H, 5: A. Congratulations to Mary Kraft-Lee BS'86, who was randomly selected from the 29 people who correctly answered all questions. She wins a gift certificate to Babcock Hall.



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## ***INSIDE THE HIVE***

A close-up view of worker bees feeding on honey. CALS researchers are learning more about what makes for a healthy hive. Read about it starting on page 16 and at [grow.cals.wisc.edu](http://grow.cals.wisc.edu).

