Consider Farming!

*Extension gives veterans an option*
Ever True to Land-Grant Mission

In announcing “Ever True: The Campaign for Purdue University,” President Mitch Daniels invited the entire Purdue family to support the largest fundraising effort in the university’s history to “elevate our university’s reputation for research excellence and intellectual achievement in a new era of accountability in higher education.”

The College of Agriculture has been fortunate over the years to have so many alumni and friends who give their generous support. It helps us prepare students for careers that will make an impact, stretch the frontiers of science to find solutions for many of our most pressing global challenges, and, through Purdue Extension and engagement programs, help the people of Indiana, the nation and the world strengthen their lives and livelihoods.

You will see evidence of this in Agricultures, with these articles illustrating the breadth and scope of just some of Purdue Agriculture’s important work:

• Purdue Extension has a long history of service to our military veterans and their families through many programs, the latest of which helps veterans get established in agriculture.

• Students’ time at Purdue is not limited to the classroom and the pursuit of good grades; we strongly encourage them to work summer internships and get involved in other “transformational experiences” that will help them become the strongest job candidates they can be.

• The Purdue Improved Crop Storage project, known as PICS, has helped smallholder farmers in East and West Africa not only improve their livelihoods but also provide more food for their communities and themselves year-round. The crop-saving bags have been received so well that they are the focus of an annual celebration in Burkina Faso.

With the help of our supporters throughout this campaign, we will remain ever true to our land-grant mission of furthering education, research and outreach to help people right down the street, throughout the state, across the country and around the world.

Jay Akridge
Glenn W. Sample Dean of Agriculture

On the cover:
Sara Creech is a former Air Force nurse who decided to become a farmer, and information she received at Purdue Extension workshops helped her get started. Over the summer, Creech opened her Blue Yonder Organic Farm in North Salem, Indiana, for a tour as a way to help other veterans get started in farming.

Cover photo: Tom Campbell
Features

Employment Outlook to 2020
4
It’s bright. But students need more than good grades these days; they need experience outside the classroom, too. In the College of Agriculture, it is an expectation they hear about “from Day 1.”

Summer Vacation?
6
Not for student interns. It was a lot of work. But they consider their summer jobs an investment in their futures, an opportunity to experience life in the work world as they prepare for their careers.

Pop Stars
8
While we simply enjoy eating popcorn, staff at the Agricultural Alumni Seed Improvement Association take their work in breeding popcorn hybrids much more seriously. They continue the tradition of popcorn genetics pioneered at Purdue.

Turning Swords into Plowshares
10
Purdue Extension has long provided support services to people in the military, veterans and their families. Now comes the Beginning Farmer and Rancher Program, a component of which helps veterans become farmers.

Nitty Gritty of Dirt
14
Students in the “Introduction to Soils” class dig their work in the Soils Resource Center in Lilly Hall. They get handfuls of learning about the growing importance of soils around the world.

PICS Passes the Test
16
Seeing is believing. In the West African nation of Burkina Faso, 10,000 people celebrated how the crop-saving PICS bags have improved their lives. Writer and photographer Tom Campbell was there to document it.
SPOTLIGHTS

College selects goals for “Ever True” campaign

The College of Agriculture has identified three broad goals for its part of “Ever True: The Campaign for Purdue University,” the largest fundraising effort in the university’s history.

The goals involve engaging College of Agriculture students in a world-class academic curriculum and transformational co-curricular experiences; ensuring that faculty and staff have the resources to achieve their boldest aspirations in the classroom, field and laboratory; and improving its facilities—both on campus and across the state—so they support world-leading science and education programs.

Purdue President Mitch Daniels announced the campaign in October. It continues through June 30, 2019, concluding in the university’s 150th anniversary year. The title of the campaign comes from the lyrics of “Hail Purdue!” and speaks to the loyalty and commitment the Boilermaker family has long demonstrated.

In the College of Agriculture, private gifts are essential to the success of our education, research and Extension missions, says Jay Akridge, Glenn W. Sample Dean of Purdue Agriculture.

“The support our donors have provided in the past has helped us pursue scholarships, faculty support and facility investments that have been crucial to building the global reputation for excellence we hold,” Akridge said. “As we look to the future, it will take continued investment from our alumni and friends if we are to help our students, faculty and staff realize their aspirations to help build a better agriculture, Indiana, nation and world.”

For information about how to support any initiative in the College of Agriculture, contact Eric Putman by email at EAPutman@prf.org or by phone at 765-494-8672 or 800-718-0094. To learn more, visit www.purdue.edu/EverTrue, or connect with #PurdueEverTrue on social media.

Public’s views on animal agriculture surveyed

A new Purdue Extension publication presents local and state leaders with research findings on the similarities and differences in how people in rural and urban Indiana perceive animal agriculture.

The authors of Views on Animal Agriculture in Rural Versus Urban Indiana Counties explain the viewpoints that influence food purchasing decisions and evaluate how residents in rural, urban and “mixed” counties—those where there is a combination of both urban and rural living—get their information on animal welfare and form their opinions on livestock operations.

Among the findings: A larger percentage of people in rural counties than those in urban counties said they would not oppose the building of new livestock operations. Responses were neutral, however, among people in rural, urban and mixed counties when they were asked if livestock operations make good neighbors.

“This is interesting because while people who live in rural counties are friendlier to growth, the perception of livestock operations as good neighbors is not statistically different from those in urban, rural or mixed counties,” the researchers concluded.

The publication, based on a July 2014 survey of 797 Indiana adults, is the latest in the Rural Indiana Issues series, begun in 2013, to help state and local leaders better tackle the many quality-of-life issues facing people in the most rural counties in Indiana. All of the publications are available for download in Purdue Extension’s The Education Store at https://edustore.purdue.edu/wk_group.asp?tgroup=Rural.

The publication was written by lead author Ann Cummins, an agricultural economics graduate student; Nicole Olynk Widmar, agricultural economics associate professor; Joan Fulton, agricultural economics associate department head and professor; and Candace Croney, director of the Purdue Center for Animal Welfare Science.

By Aspen Deno
Purdue University researchers are exploring the agronomic and economic potential of industrial hemp, a crop that has been banned for nearly 80 years.

The 2014 Farm Bill legalized the growth of industrial hemp for research purposes. Commercial hemp cultivation remains illegal.

The researchers planted test plots of industrial hemp at Purdue's Meigs Farm to help provide answers to basic questions of its production, such as the yields growers can expect, optimal soil conditions for hemp, which nutrients to apply, and how to identify and manage pests and diseases. The test plots were the focus of a Purdue Extension field day over the summer.

Janna Beckerman, professor of botany and plant pathology, and Ron Turco, professor of agronomy and assistant dean for agricultural and environmental research at Purdue, co-led an effort to obtain federal and state permits to grow hemp for research, as well as import and export permits from Canada, in anticipation of a future market for U.S. hemp.

Hemp can be grown for its seed or fibers. The seed is a valuable source of oil and a good protein source for animal feed. The plant produces fine fibers suitable for textiles and rougher fibers that can substitute for fiberglass and building materials. The lower part of the plant consists of a tough material that can be used in products such as “hempcrete,” a cement mix that is strong, carbon dioxide-absorbent and recyclable.

By Natalie van Hoose

Purdue food and nutrition scientist Mario Ferruzzi says nursing women can boost the carotenoid levels of their breast milk by eating orange or yellow produce and dark, leafy greens.

By Natalie van Hoose

When they weren’t doing coursework on campus, students in the 2015 Purdue Agribusiness Science Academy toured several Indiana agribusiness sites, including the DuPont Pioneer operation in Tipton, Indiana.

Twenty-eight minority high school students visited Purdue University’s West Lafayette campus for a program that exposed them to educational and career opportunities in agriculture.

Most of the students in the two-week summer institute, Purdue Agribusiness Science Academy, or PASA, were from northwest Indiana, and all had limited or no direct connection to agriculture. They got involved in learning about science, technology, engineering and math—the so-called STEM areas of education—in agriculture.

“The program exposes students to the wide variety of career opportunities in the field of agricultural sciences that many students might not have known even existed,” says Myron McClure, assistant director of the College of Agriculture’s Office of Multicultural Programs.

The annual program is open to all high school students entering the 10th, 11th or 12th grades, but the emphasis is on recruiting under-represented minorities such as African-Americans, Latinos and Native Americans.

This year’s program consisted of classroom instruction and laboratory work on campus three days a week and field-day trips twice weekly.

By Keith Robinson

Ag.purdue.edu/agricultures
Marcos Fernandez wants to make sure Purdue University College of Agriculture graduates land many of the tens of thousands of jobs expected to open each year nationwide in agriculture and related occupations over the next several years.

The associate dean and director of academic programs believes that both the college and students need to do their part to make that happen.

“We can’t rest on our laurels,” Fernandez says, noting that the college annually has a high placement rate for its graduates and this year was ranked fifth-best agricultural college in the world by Quacquarelli Symonds, a British company that specializes in information about higher education and careers. “We need to continue to be one of the institutions that employers come to for graduates to hire.”

Highly Skilled Work Force Needed

An employment outlook the college produced this year with grant support from the U.S. Department of Agriculture’s National Institute of Food and Agriculture concludes that about 58,000 jobs will become available each year in professions involving food, agriculture, renewable natural resources and the environment through 2020.

The jobs reflect a need for a highly skilled work force to support food, agriculture and national resources industries amid projections of a world population that is expected to grow from 7 billion people today to 9 billion by 2050.

The report projects that 46 percent of the estimated new job opportunities will be in management and business. Twenty-seven percent will be in science, technology, engineering and mathematics, the STEM areas. Jobs in food and biomaterials production will comprise 15 percent, and 12 percent of the openings will be in education, communication and governmental services.

While the college continually reviews its academic programs to provide students with an education that meets the needs of agriculture and related professions, Fernandez is emphatic that much of the responsibility for students’ success rests with the students themselves. He says they are told “from Day 1” as freshmen that they are expected to be involved in “transformational experiences” such as internships, externships—“shadowing” a professional—research and student clubs during their college career to get experience that employers seek in graduates.
Internship as a Journey

Jacquelyn Brown, a junior agricultural economics major from Medford, Oregon, understood that message and worked as a food security intern last summer in the Land O’Lakes Emerging Leaders program. Her internship took her far from the company’s headquarters in Arden Hills, Minnesota. She had learning experiences under the tutelage of CEOs, scientists and policymakers during trips to Ohio; Washington, D.C.; and Africa.

“The biggest thing for me was that I learned there are many different ways you can pursue a career in agriculture,” she says.

An internship can help students discover what they are passionate about or might not want to do as a career. “The best way to figure out what you want to do is to try it for a while,” says Brown, who plans to seek another internship next summer.

Good Grades Aren’t Enough

College leadership feels so strongly about the benefits of experience outside the classroom that they started a program called College of Agriculture Transformational Experiences, or CATE, that provides students myriad ways to improve their skills in leadership, critical thinking, problem solving and cultural issues, among others. Fernandez points out that a goal in the college’s strategic plan is for all students—100 percent of enrollment—to get such experience while at Purdue.

Despite the positive outlook for jobs, Fernandez says competition for them will be tough. To help students rise to the top, he encourages them to take advantage of the many co-curricular educational and development opportunities that make Purdue one of the leading institutions in the world for undergraduate students.

“Achieving only good grades could be seen as a lost opportunity.”

Contact Keith Robinson at robins89@purdue.edu
Summer Vacation?

A Lot of Work (and Some Fun),
But They Did It for Their Futures

By Tom Campbell

Summer vacation used to mean loading up the family station wagon and heading to the beach for some much needed R&R. But for college students looking for an edge that will enhance their college experience or make their resume stand out, that’s no longer true. Agriculture students who worked summer jobs, share stories of their experiences here in their own words.

Eli Hugghis
(pronounced (HU’-jis)

Hometown: Upper Marlboro, Maryland

Year/Major: Junior studying plant cellular and molecular biology and international studies in the Department of Agronomy

Summer job: Lab intern for Dow AgroSciences in Indianapolis

Job responsibilities: I perform DNA extraction and PCR analysis of corn plants to determine genetic purity. I look at the purity and characteristics of the corn plant materials to validate the use of a more modern method of DNA extraction over an older method that is more subjective in its data analysis.

How this job enhances my education at Purdue: I am seeing an application side to what I have been learning at Purdue regarding plant DNA, breeding and genetics, chemistry, communication, time management, etc.

How this job prepares me for a career: It has shown me several aspects of industry and working with a company, like how to manage my own project, how to work with others in a collaborative effort to see a goal accomplished, to see what things I do and don’t like in a future career.

More and expanded stories about students and their summer jobs are in the fall edition of Connections at www.ag.purdue.edu/connections
Austin McCoy
Year/Major: Junior majoring in plant sciences in botany and plant pathology
Summer job: Field biologist in the rain forests of Guyana, South America
Job responsibilities: Collect, examine and archive litter-trapping fungi found on assorted trees.
How this job enhances my education at Purdue: I’m really interested in mycology (the study of fungi). This trip was a great opportunity to learn about, identify and collect various fungi in the field. Firsthand, I learned and saw things that I would not normally be able to see in a classroom setting or learn out of a book.
How this job prepares me for a career: The entire adventure was a crash course preparing me for graduate school, which is what I am interested in.

Valerie Scott
Year/Major: Senior studying animal agribusiness in the animal sciences department
Summer job: Retail sales intern with Kent Nutrition Group
Job responsibilities: I represent the company in 25 Rural King stores in Indiana, Michigan, Ohio, Pennsylvania, West Virginia and Kentucky. I merchandise our products by designing and implementing eye-catching displays. I work with management on educating employees on the products, and I even get to act as a salesman by talking with the management about the potential products that a store can order.
How this job enhances my education at Purdue: This job helped me realize what classes and extracurricular involvements would help me to be more desirable as an employee. I look forward to my course load this year because the classes like applied animal nutrition and sales and marketing are going to apply to my career choice.
How this job prepares me for a career: I have a better vision of what I am interested in pursuing after I graduate. I love every aspect of my job.

Jannet Rivera
Year/Major: BS ’15, wildlife in forestry and natural resources
Summer job: Environmental/historic preservation intern, Indianapolis Museum of Art
Job responsibilities: Maintain and restore natural habitat at the 100 Acres Art and Nature Park. I plant and care for native trees and plants, weed and remove invasive species and clear trails. I also post updates about the park on social media and write nature blogs.
How this job enhances my education at Purdue: This job is a hands-on way of learning, which is important. Habitat management is taught in a classroom setting. As great as my classes at Purdue were at providing lab and field experience, nothing compares to facing the challenges on a piece of property without controlled variables.
How this job prepares me for a career: It provides me with a lot of experience with land management techniques and strengthened my identification skills. I learned about many new native and exotic plant species. More importantly, I’m developing decision-making skills.

Contact Tom Campbell at tsc@purdue.edu
In a growing global market for popcorn, standby styles like buttery or caramel-coated share shelf space with popcorn spiked with wasabi, Kalamata olive flavoring or chili powder and a squeeze of lime.

And at a farm operation near Romney, Indiana, the staff at the Agricultural Alumni Seed Improvement Association Inc. all take their popcorn the same way: very seriously.

For the past three decades, Ag Alumni Seed, a Purdue University-affiliated seed breeding company, has turned out high-performing popcorn hybrids, continuing in the rich tradition of popcorn genetics pioneered in the College of Agriculture.

“We are passionate about popcorn—and we don’t apologize for that,” says Jay Hulbert, president and CEO.

Passion is a prerequisite for carving out popcorn acreage in the Midwest, more renowned for dent corn. About 180,000 acres of popcorn were planted in the U.S. this year, compared with 88 million acres of dent corn. The industry’s small size—the U.S. market contains fewer than two dozen processors—makes popcorn akin to other specialty crops such as tomatoes and watermelons, Hulbert says.

But Ag Alumni Seed’s dedication to the crop has paid off: The company has become a leading supplier of popcorn hybrids, and Indiana consistently ranks among the top popcorn-producing states.

Packing Popcorn’s Punch
Breeding the perfect popcorn is a formidable task, says Max Robbins, the company’s director of research.

Robbins and his team must develop hybrids with solid yields, disease resistance, hardy stalks, good kernel color and size, “poppability” and suitability for filling a specific slot in the market such as theatre, microwave or ready-to-eat popcorn. And those are just the agronomic factors.

The team also evaluates popcorn flavor, aroma, expansion ratio, moisture content, mouthfeel and fluffiness. The flake even has to be “attractive” once it pops.

Suddenly, your late-night snack seems as complex as a fine cabernet.

But Robbins savors the challenge. “It makes the breeding fun,” he says. “Dent corn is just about yield. With popcorn, we’re looking at so many things.”

Sowing New Science
Started in 1938 by the Purdue Agriculture Alumni Association as Indiana’s foundation seed company, Ag Alumni Seed’s purpose shifted as private businesses took over public breeding programs.

“We had to find another means of survival,” Robbins says. “Because of Purdue’s long history in developing popcorn hybrids, it made sense for us to move into that niche.”

Legendary Purdue popcorn geneticist Bruce Ashman helped the company make the transition by joining as a consultant. By 2001, Ag Alumni Seed had become a major grower and supplier of popcorn foundation seed, typically releasing several new varieties a year.

Hulbert estimates that Purdue genetics account for more than 60 percent of the global popcorn industry.

The company’s focus may have changed, but its twofold mission has not. It continues to offer improved genetics to farmers and support Purdue.

Over the last 10 years, the company has given more than $2.5 million to Purdue agricultural research and Extension programs and scholarships, including $500,000 to kickstart a plant phenotyping facility that will collect billions of field measurements to help researchers develop new crop varieties for a range of environments.

Ag Alumni Seed also plays a valuable role in commercializing crop varieties and seed traits developed at Purdue, says Marshall Martin, Purdue senior associate director of agricultural research and a member of the company’s board of directors.
“For over 75 years, this relationship has been mutually beneficial to Purdue faculty and students and to farmers around the world,” he says.

In addition to popcorn, the company has programs in sorghum and soybeans and works closely with Purdue’s small grains program headed by wheat breeder Mohsen Mohammadi.

“We rely on Ag Alumni to commercialize the varieties we develop,” he says. “The market is a big share of the work.”

While the company is always looking to diversify, Hulbert predicts its heavyweight crop won’t change. “Popcorn is really our heart and soul. We’ll be doing popcorn forever.”

Contact Natalie van Hoose at nvanhoos@purdue.edu
Soon after Sara Creech bought a farm she had never seen in a place she had never been, she drove to her local feed store to pick up her first livestock. “Every good adventure starts with a chicken,” she says with a smile. The five hatchlings she took home that day represented the start of a new life for Creech, a former Air Force nurse who had suffered a string of personal setbacks. Like many veterans, she had a hard time readjusting to civilian life after witnessing the horrors of war. Starting a farm was her redemption, she says, and she is working with Purdue University’s Beginning Farmer and Rancher Program to help other veterans rebuild their own lives, as she did, through agriculture.

Learning How to Grow
Creech joined the Air Force in 2004 and served as a combat nurse in Iraq during 2005-2006. When she returned home, she was emotionally paralyzed and couldn’t go back to work. “I struggled with post-traumatic stress disorder from some of my experiences and really had a hard time connecting with people again and basically connecting with my life again,” she says. Her husband, Robert, an Air Force pilot, suggested that she try gardening as a way out of her depression. “I had never been on a farm, didn’t really know anything about being outdoors,” she says. “I pulled up my entire front yard in Florida, where we were based, put in some vegetables and started learning how to grow things. I was just really excited by planting a seed and seeing something come up.”

Just when Creech thought her life was getting back on track, her husband was diagnosed with colon cancer. The couple traveled to Houston, Texas, and lived in a hotel for nine months while he was treated at the M.D. Anderson Cancer Center. “There was nothing for us to do but drive around and look at farms,” Creech says. “At that time we really started looking at our diet and how our food was grown.

Continued on Page 12
We met all these farmers and saw all these different types of farm enterprises and were just totally engaged by what they were doing. We really felt it was something we wanted to look at as soon as he retired in a few years."

But they never got the chance. Robert died in 2011.

"At that time, I had to figure out really how to start a new life, and the one thing that kept popping up was go and farm, go and farm, " she says.

Middle of Nowhere

Creech scanned the Internet and found a listing for a plot of land that seemed ideal. There was no picture and only a vague description of the property, but she put in an offer anyway, not really expecting anything to come of it. On the day she was supposed to start a new job at a bank near her Florida home, she got a call from a real estate agent. Her offer had been accepted. Her adventure began.

But every good adventure story has a few plot twists. The first came when Creech arrived in her new hometown. North Salem, Indiana, is a dot on a map at the intersection of state Routes 75 and 236, about 20 miles west of Indianapolis. There are two stoplights and about a dozen old-fashioned storefronts. It seemed to Creech like "the middle of nowhere."

At first glance the farm, just about a mile down the road from the town center, looked bad. After further inspection it was worse—weedy, rocky and nearly ruined by soil depletion. Optimistically, Creech named it Blue Yonder Organic Farm, a reference to the official Air Force song.

Continued from Page 10

Sara Creech collects eggs on her Blue Yonder farm (top) and sits a spell (left) to enjoy some time with her chickens.

Cindra Chastain, who served for 30 years in the Army and the National Guard, is now farmer veteran coordinator for the National AgrAbility Project based at Purdue.

Tour of Duty

Creech began attending Purdue Extension workshops and the annual Purdue Small Farms Conference. When the Beginning Farmer and Rancher Program proposed a daylong workshop and farm tour for veterans, Creech volunteered to be the host.

Organizers hoped to attract 25-30 veterans to the event. More than 40 signed up, including Tom Beaudette, who was nearing retirement after 25 years as a construction engineer in the Navy.

Beaudette had never farmed before, but he and wife Mandy bought nine rolling acres just south of Kokomo in north-central Indiana, where they hoped to raise livestock. During the workshop he was especially interested in the presentations by the Farm Service Agency, Natural Resources Conservation Service and Farm Credit Service about the financial assistance available to veterans who want to start farms.

"Farming would give me a chance to keep working, " he said. "I'm not a couch potato. I love working with my hands and with animals."

Viable Career Option

Creech says she is excited about military veterans getting involved in agriculture.

"I think it's a type of business that has a lot of variables and really needs somebody who can see an entire big picture, but at the same time can be really flexible and
Purdue Resources for Veterans

Purdue University offers support services for veterans, active duty personnel and military families, including:

• **Beginning Farmer and Rancher Program**
  Provides direct, practical assistance to anyone who is new to farming, especially operators of small farms and military veterans. Contact Tamara Benjamin at 765-496-1930, tamara17@purdue.edu.

• **National AgrAbility Project**
  Supports farmers, ranchers and other agricultural workers with disabilities through education, networking and direct services. Contact Cindra Chastain at 765-496-2377, chastai1@purdue.edu.

• **4-H Military Partnership**
  Supports children of military families through 4-H Club activities. 765-494-8435, in4hmilitary@gmail.com.

• **Veterans Success Center**
  Provides academic and social support services for student veterans at Purdue. 765-494-7638, dogtags@purdue.edu.

• **Military Family Research Institute**
  Through research and outreach, works to improve the lives of service members and their families. 765-496-3403, mfri@purdue.edu.

Contact Darrin Pack at dpack@purdue.edu

---

“**We hope to create a network of farmer veterans who can interact and learn from each other.**”

*Cindra Chastain, National AgrAbility Project*

responsive to the issues that come up.”

Cindra Chastain, farmer veteran coordinator for the National AgrAbility Project based at Purdue, believes agriculture offers a viable career option for former military members.

“There has certainly been a movement of military veterans coming out of the service and pursuing careers in agriculture,” she says. “We hope to create a network of farmer veterans who can interact and learn from each other.”

One of Chastain’s priorities when she came to Purdue in 2014 was to work with the newly established Beginning Farmer and Rancher Program to create a broad-based support system for veterans interested in farming.

“The hardest part, for many veterans, is finding the financial assistance they need to acquire land,” she says. “One of our goals is to help them identify and apply for the various government grant and loan programs they’re entitled to.”

**Her Own Kind of Healing**

Chastain, a Purdue Agriculture graduate, served for 30 years in the military, first in the Army and then the National Guard. Her final command was the 119th Agribusiness Development Team, a unit assigned to help rebuild the war-ravaged farms of Afghanistan.

She thinks the skills and characteristics that make a person a good soldier can also help make a good farmer.

“You have to be able to work outside, work with your hands and, most of all, be disciplined,” she says. “And working with animals and plants can be therapeutic.”

Creech found her own kind of healing on the farm.

“I think military veterans especially have this need to put some positive healing back into the land and back into the community,” she says. “I think most people who go into the military do that out of a desire for service, a desire to help out their community and their country. And I think as military veterans we’re always looking for that next mission, and with farming that mission is to provide healthy foods to our communities.”

Contact Darrin Pack at dpack@purdue.edu
To be in this class, you really have to dig the work you could end up doing for the good of the world.

For many students, Purdue Agriculture’s “Introduction to Soils” sets them on firm footing on career paths that could lead them into not only agriculture but also ecological and environmental engineering, consulting and other professions to meet the challenges from growing concerns over Earth’s future.

Soil comes into play in climate regulation; production of food, fiber and fuel; water purification; flood control and carbon sequestration. It is a foundation for roads and bridges. It is a source for pharmaceuticals. It is a habitat for organisms. It enables life, and its importance is increasing as the world’s population gets bigger and bigger, and the soil is used more and more.

“Environmental Push” Adds Interest

Many years ago, nearly all of the focus on soils was in agriculture. Class instructor John Graveel says that’s not so anymore.

“While most of the students in the class are in agriculture, we’re seeing an upswing in students in Earth and planetary sciences and from Triple-E—ecological and environmental engineering,” Graveel says.

Graveel also expects to see more people from urban areas get into soil sciences because of the “environmental push.”

Among them is Minerva Dorantes, who earned her master’s degree at Purdue last year and is now a research soil scientist in the agronomy department. She is from inner-city Chicago and sports a T-shirt with a message that shouts “I Dig Soils!”

Dorantes, who is interested in soil conservation as a career, is in a five-year project with a team headed by associate professor of agronomy Phillip Owens to map the soils of the entire Central American countries of El Salvador, Honduras, Nicaragua and Guatemala. They are assessing soil...
The United Nations designated 2015 as the International Year of Soils to raise global awareness of their importance.

properties so that the government and farmers can make better-informed decisions for land management.

“You really have to have a passion for a science like this—to get your hands dirty and better understand how people and soils relate to each other,” she says.

Center Offers “Active Learning”

The hub of the “Introduction to Soils” class is the Soils Resource Center in Lilly Hall. Students spend much of their time there. (They must in order to know the course material because there is only one weekly classroom lecture, plus a discussion session and quizzes in small groups.) They listen to audio tutorials and follow a study guide that directs them to run specific experiments or observe a demonstration. A faculty member or graduate teaching assistant always is on hand to make sure the equipment is working and to offer help to students.

Students working in the center have at their fingertips one of the world’s largest collections of preserved soil samples, called monoliths, which give students a better understanding of the many types of soils around the world.

The center was created in the early 1970s to make soil science more appealing to students. The course was changed from the traditional classroom and lab to the more “active learning” that the center provides.

“Active learning is a big thing now,” Graveel says. “But we are way ahead in this movement.”

Bill McFee, a retired Purdue soil scientist and former agronomy department head, says the

“Introduction to Soils” class is important because a basic understanding of soils is critical to all aspects of environmental management and the world’s food supply.

“And the conservation of our soil resource is critical to the world economy,” he adds. “Improving our soils’ productivity will become even more important as the world population continues to grow.”

Contact Keith Robinson at robins89@purdue.edu
PICS Passes the Test

African Farmers and Consumers Benefit from Triple-Bag Crop Storage

By Tom Campbell

On a sweltering piece of sun-scorched earth somewhere near the Burkina Faso-Mali border, 10,000 Africans gathered for an agricultural fair. For hours they walked, hitched rides on the backs of flatbed trucks, rode scooters and biked to the tiny village of Lankoue. They celebrated and illustrated how far Larry Murdock’s life mission has come in the nearly 30 years since he first began the research that generated the Purdue Improved Crop Storage technology known as PICS.

Murdock, Purdue University distinguished professor of entomology and pioneer of the technology, recognizes the beauty in the simplicity of PICS. “Sometimes, the best ideas are the simplest,” he says. Here’s how it works: African farmers put their grain in a plastic bag and seal it. The bag goes inside another bag, which is also sealed. The double bags are put in a third bag and tied shut as well.

It’s called triple-bagging. Crop-damaging insects locked inside run out of oxygen and water and die. Millions in Extra Cash

The success of the project has been remarkable. To date, more than 5 million PICS bags, at a cost of $2 to $3 each, have been sold and used in West and Central...
Africa. A survey conducted in Niger indicates most PICS bags are used at least three years, says Jess Lowenberg-DeBoer, a Purdue agricultural economist and one of the early members of the PICS team. He says a conservative estimate of the extra cash flow for African farmers and households attributable to PICS was $33.95 million for the 2012-13 storage year.

In storage, insects can destroy a crop in a short time, even within days. Before PICS, farmers often had to use pesticides and eat or sell their crop soon after harvest to avoid insect infestation. But with PICS bags, pesticides are not needed, and users can wait to sell their grain when prices rise in the weeks and months after harvest.

“In the meantime, they have well-preserved, pesticide-free grain for food for their families or seed for planting the next season,” Murdock says.

In addition, supply chains have been established, benefiting not just farmers but countless African businesspeople. The PICS team’s idea from the beginning was to create and promote a technology that would sustain itself.

“The technology would be manufactured in Africa, so it would generate jobs, and the benefits would come to many people along the way,” Lowenberg-DeBoer says.

Larry Murdock, Purdue distinguished professor of entomology, rests on a pile of PICS bags during a trip to Africa, where local farmers attended a bag-opening ceremony (below) and saw firsthand the value of the crop-saving technology.
Baoua Ibrahim, a Purdue Improved Crop Storage team collaborator based in Niger, measures the moisture content of cowpeas in a PICS bag.

Baoua Ibrahim spent most of 2008 out of the lab and on the road. A Purdue Improved Crop Storage team collaborator based in Niger, Ibrahim went from village to village in his native country, teaching farmers to use PICS bags to store their cowpeas.

He visited over 200 villages that year.

“I went hut by hut,” he said, “to see how the PICS technology was developing and to discuss with individuals to get their feedback.”

Farmers filled the PICS bags with their weevil-infested cowpeas and stored the tied-off bags in the sleeping rooms of their small brick and mud huts. Days later, Ibrahim paid a follow-up visit and was met with smiling faces.

“Come see the bags. They worked,” a farmer would declare. “They stopped the weevils.”

The nighttime sky in the African villages is quiet—not enough to hear a pin drop but enough to hear weevils feeding. When the farmers laid down to go to sleep, they were used to hearing the sound of weevils gnawing on the cowpeas stored inside the old bags they traditionally used. The insect activity also produced a measurable increase in the temperature of the cowpeas.

But there was silence inside the triple-bagged PICS bags. The insects had stopped feeding. Not only that, the bags were cool.

The farmers taught Ibrahim things about the performance of PICS bags he never expected to learn.

“Sometimes you don’t need sophisticated scientific equipment to learn what observant people can tell you,” Ibrahim says.

Continued from Page 17

the value chain, from the manufacturer through to the farmer,” Murdock explains. “Truckers transport the bags and make a profit. Regional businessmen and women distribute the bags to vendors, who sell them to farmers in villages and local markets. At each point, small profits are made.”

Technology Is “Life-changing”

The Bill and Melinda Gates Foundation, which has a mission of supporting projects that help reduce world hunger, has given over $24 million to the PICS program.

“This type of project and technology is very simple, but it is life-changing for farmers in Africa and around the world,” says Charlene McKoin, senior program director for the foundation. “It allows farmers to have food security and the ability to store their crop without using pesticides.”

Murdock, McKoin and several members of the PICS team observed the impact of triple-bag technology in that remote corner of Burkina Faso in West Africa in May, seven years after the first festival in 2008 at the end of the first year of the PICS project. That event to celebrate women, agriculture and the PICS technology drew about 100 people.

To Burkina Faso visitors such as Murdock, seeing the event grow a hundredfold since then was nothing short of amazing. Dignitaries sat under tent canopies. The early arrivals huddled in the shade provided by the few leafy trees, while everyone else formed a giant ring to listen to speakers and singers and watch dancers. They saw firsthand, in hundreds of demonstration bags, just what PICS bags can do.

By killing the feasting insects, Murdock and the PICS team have increased food security, helped farmers in West and Central Africa increase the value of their crops by hundreds of millions of dollars and, ultimately, saved lives by minimizing the use of harmful pesticides.

The “True Test”

Murdock started to work on what would eventually become the PICS technology after visiting Cameroon in 1986. It was the first of some 60 trips he has made to the African continent. He became aware of the need
to extend the storage life of cowpeas, a staple crop in Africa. Murdock saw that no matter how the harvested crop was stored, insects, mainly weevils, destroyed a large part of it.

In 1987, Murdock put together a team of researchers in the U.S. and Africa to provide African farmers choices for how to best attack the storage problems. The team was fueled by a lofty ambition that powers it to this day. Murdock determined the project would be considered a success only if the technologies developed were accepted and used by families in villages throughout Africa.

“That was our true test,” he says.

Dieudonné Baributsa left a position at Michigan State University in 2009 to join the PICS program. A research assistant professor at Purdue, Baributsa grew up on a small farm in central Africa, hungrying for something like PICS that would help his own family.

“I saw how my mother struggled to store grain to feed our family,” he says. “She used different chemicals, but most of the time, they were ineffective. Getting involved in the PICS program was a big opportunity for me to give back to Africa, to contribute to food security among small farmers in several countries in Africa.”

Now, Baributsa has set an ambitious goal for the future of PICS.

“We want to make the PICS bags available to every farmer in every village in Africa,” he says, referring to farmers such as Burkina Faso’s Bouda Marcel.

“I ask that the PICS bags be available throughout Burkina Faso so that all producers can have these bags,” Marcel says, “first for storage and also for the health of the producer and for the family, to guarantee seed for consumption and for sale of the cowpea for a good price.”

**Commanding a Premium**

Lowenberg-DeBoer says the PICS team early on set out to learn how African consumers reacted to grain storage damage. They bought grain samples in Cameroon and later extended their purchases to about 30 markets throughout West Africa. Every month, they would buy cowpeas and examine the number of holes, the size of the beans, things any consumer could see.

“What we found was that consumers all across Africa wanted a discount from the moment they saw even one hole in one bean,” Lowenberg-DeBoer says. “These were poor people. They didn’t have much money to spend, and they were very careful about how they spent it. They wanted value for their money, and they didn’t want damaged products.”

Now farmers have indicated their triple-bagged cowpea crop commands a 10-15 percent premium in some markets because consumers know that the grain hasn’t been treated with insecticides.

Nearly three decades after Murdock began his research, the PICS program is stronger than ever as the 10,000 people testified with their celebration near the village of Lankoue.

“Women stood proudly by their PICS bags and opened them to exhibit perfectly preserved grain after 4-6 months of storage,” he says. “The bags are used for all kinds of grain now, not just cowpeas, but maize, peanuts, sesame seeds and many more. PICS bags work for them all.”

Contact Tom Campbell at tsc@purdue.edu

To see a video about PICS, visit ag.purdue.edu/agricultures.
For Nathan Mosier, nothing is wasted.
Where others see potato peels, this professor of agricultural and biological engineering sees a means of generating electricity. To him, the stover left after a corn harvest is the stuff that could power planes. He envisions water bottles made from plant matter and carpets that biodegrade rather than clog landfills.

He uses conversations with colleagues from other disciplines to gain insights into his own field and transformed an equation-laden engineering course into the testing grounds where students design their own food products. A jam session on the guitar is not just blowing off steam—it fires up creative juices to use back in his lab.

Whether it’s a field of switchgrass or a freshman struggling with thermodynamics, Mosier looks for and sees potential.

"Nothing is single use," he says. It’s a premise he applies to his teaching, interactions with industry, and research, which focuses on developing new ways to convert agricultural materials into fuels, chemicals or other products traditionally made from petroleum and natural gas.

"In every project, I’m thinking ahead to how we might translate the understanding we gain from advances in fundamental science into an application for some issue or problem. My research is always use-inspired," he says.

Teamwork Generates Better Biofuels
Mosier is this year’s recipient of the Agricultural Research Award, given to a faculty member in the College of Agriculture who has achieved a level of excellence in research and made significant contributions to agriculture, natural resources and quality of life for Indiana citizens.

He earned his master’s and doctoral degrees from Purdue’s Department of Agricultural and Biological Engineering and joined the faculty in 2003. The impetus to stick around, he says, stemmed from great colleagues and the ease of working across colleges and disciplines.

“All the really interesting, challenging problems we need to solve as a society are ones that people from varying backgrounds need to address.”

He points to Purdue’s Center for Direct Catalytic Conversion of Biomass to Biofuels, or C3Bio, as an example of a team that unites people of fields who don’t often collaborate on projects.

One of the main challenges Mosier and the center tackle is how to efficiently free sugars from cellulose to produce biofuels. The foundation of the plant cell wall, cellulose is the most abundant organic compound on the planet. But the rigidity it confers to plants and wood make it a difficult material to break down.

In addition to writing a renowned review study of pretreatment technologies, Mosier researches ways to create catalysts that mimic those in the rumen of cows and guts of termites, some of the few organisms that can digest cellulose.

Machine Turns Scraps into Electricity
Perhaps the best example of his ability to integrate multiple aspects of science and engineering into a novel technology is the van-sized portable generator he and colleagues at Purdue’s Laboratory of Renewable Resources Engineering developed to convert trash into power.

The machine converts food waste into ethanol and heats paper, plastic, Styrofoam and cardboard under low-oxygen conditions, producing a flammable gas. It can run on either of these fuels, diesel or a combination and can process a ton of waste a day to produce enough electricity to power about 2-3 houses. The U.S. Army tested a prototype in Iraq for several months.

“It solved two problems for them," Mosier says. “They have to do something with the waste they’re generating, and it’s often difficult to supply power or energy to remote locations. We figured out a way to do both at the same time.”

In class, he uses the machine to illustrate the variety of engineering involved—mechanical, biological and chemical—as well as the need to interact and collaborate with others.

“Dr. Mosier is an exceptional scholar, mentor and researcher who has brought significant recognition to Purdue through the national and international impacts of his research and by working with industry in Indiana,” said Bernie Engel, head of the Department of Agricultural and Biological Engineering.

“His knowledge and contributions to the field of renewable bioenergy are enhanced by his passion for motivating students to become the best researchers they can be.”
College of Agriculture Transformational Experiences provides professional and personal development outside the classroom.

CATE helps students:
• Increase their engagement in and satisfaction with Purdue
• Realize their potential
• Prepare for life after college

Learn more: www.purdue.edu/experience

Sara Weaver, Manchester, Indiana
– Senior, majoring in environmental science and wildlife
– Summer job: Hang gliding instructor
– “I love the environment. Hang gliding gives me the opportunity to teach people about flying and the environment. Learning how to talk to people is a huge skill to learn.”
Africans Make PICS Bags a Success

Purdue College of Agriculture research led to the development of Purdue Improved Crop Storage bags, which have improved the livelihoods of smallholder farmers in Sub-Saharan Africa and have helped provide more food year-round for consumers. About 10,000 people there turned out for an agricultural fair, where they celebrated PICS.

See Page 16