EDITOR'S NOTE:
The study of science is often underrepresented in discussions on education abroad and international exchange as traditionally these areas were established in humanities and social science disciplines. This article is the sixth in an occasional feature series on science in international higher education. Earlier articles have been on marine biology (March/April 2007), archaeology (July/August 2007), engineering (November/December 2007), global climate change (May/June 2008), and architecture (September/October 2008).

Planting See

Oklahoma State University students and professor Thomas Kuzmic weeding pots at a tree nursery at El Empedrado in Honduras with Menelio Bardales of the Honduran Corporation for Forest Development:

DAVID HENNEBERRY

ds of Change

Farming may seem like a local enterprise but it's not—now, more than ever, agriculture is becoming an increasingly globalized field. And colleges and universities are picking up on the trend and helping agriculture students become more internationally aware. **BY NICOLE BRANAN**

VAST GREEN SUGARCANE FIELDS stretch across millions of acres in south-central Brazil. The thick perennial grass, standing more than 10 feet tall, is a simple, ancient plant, but over the past three decades, it has accomplished an astounding feat: sugarcane has helped Brazil get rid of its foreign oil dependence. Today Brazil has the world's first sustainable biofuel economy, which is what Joshua Blair, an agricultural education major at Oklahoma State University, came here to learn about.

Blair and other Oklahoma State students traveled to Brazil for a few months to study at two local universities and learn about ethanol fuel production from sugarcane. The education abroad program is one of many that take Oklahoma State students to countries across the globe where they learn about different practices in agriculture. The field lies at the heart of many of today's most important challenges, such as food security for a rising global population, environmental degradation, and energy security. Learning how different countries tackle such issues is a valuable and often eye-opening experience for students, says David Henneberry, professor, assistant dean, and director of international programs in agriculture at Oklahoma State University.

When it comes to making fuel from plants, Brazil is a true pioneer. The biofuel bug bit the South American country in the 1970s, a time when the rest of the world continued to focus its attention on biofuels' fossil counterparts. Over the next three decades, Brazil developed a robust ethanol industry. This accomplishment was one of the reasons why Blair became interested in Brazil. "I like the fact that they took it upon themselves to start studying [biofuel production] and the advances they have made," he says. The small sugar molecules inside sugarcane plants covering about seven million acres of Brazil's farmland end up as ethanol and fuel the vast majority of cars that zoom around the country's roads and highways. In the United States, interest in biofuels has risen sharply in recent years, partly due to

growing concerns over dependence on foreign oil as well as fuel price woes, something that Blair witnessed first-hand when living on a 10,000-acre family soybean farm in Oklahoma. "Growing up farming I saw that in the last five years or so, fuel prices have risen, and we had to make a lot of cutbacks in our family." In recent years, domestic ethanol production has been booming, and in 2005 the United States actually surpassed Brazil's production. However, the two countries go about the business in very different ways. Instead of sugarcane, the United States uses mainly corn as its biofuel feedstock, a practice that has received criticism, partly because it contributes to the rise of food prices. In addition, it takes a lot of energy to produce ethanol from corn, "so the net gain is not as large," Henneberry says. During their trip, Blair and other students learned about such differences. The group studied not only the planting and harvesting of sugarcane, but also the processing into fuel. Blair says that the trip made it clear that "Brazil gets a lot more out of the sugarcane than we do here in the United States when we use corn." For example, Brazil's ethanol plants are set up such that they can burn the crop residue to power the plant. Therefore, the processing plants don't need any fossil fuels. In addition, sugarcane yields almost twice as many gallons of ethanol per acre of land as corn does. "I can see now since I have been exposed to sugarcane that corn is not the way we need to go. [The trip] really opened up my eyes to the fact that we need to find something that is much more efficient," says Blair, who eventually wants to work in the biofuels sector. Learning about different approaches to biofuel production helps students gain a new perspective, Henneberry says. That's important, particularly because Oklahoma State University is pursuing research into new ways to biofuel production, for example, using switchgrass, which, unlike the tropical sugarcane plant, can grow widely in the United States.

Growing up on farms, many Oklahoma State students are intimately familiar with the agriculture business, but seeing their industry in a new context often opens their eyes and gives them new ideas.

Expanding Education Abroad Offerings in Agriculture

Over the past decade, Oklahoma State University's College of Agriculture has expanded the number of education abroad programs it offers significantly, and currently 35 percent of students take advantage of the opportunity to study in a different country—the highest number of any college at Oklahoma State, Henneberry says. However, there is still a long way to go to reach the school's goal of having 100 percent of its students experience international education before they graduate. As a step toward reaching that goal, the college has eliminated financial hurdles for its seven semester-long programs, such as the biofuel program in Brazil. Students participating in these programs usually end up paying the same as or less than they would at Oklahoma State, Henneberry says, "So we are able to say that there is no financial barrier to studying abroad." The reason why some students still opt out of education abroad is that the prospect of spending a whole semester in a foreign country is often "very daunting to our students," he says. That's why the school offers a large variety of two-week programs, which often whet the students' appetite for more. "These short-term programs act as a gateway, and participants often end up going for a semester later on," Henneberry says. Blair, who had participated in Oklahoma State's short-term China program before going to Brazil, is one example. "During my two-week trip to China, we didn't get to experience the culture as much as I would have liked," he says. His time in Brazil, however, offered ample opportunities for intercultural exchange. "We lived with families and this opened up my eyes to a lot of things," Blair says. "For example, I was impressed that, no matter what, family is number one there. We often get accustomed to how things are here and my time abroad has allowed me to get outside the box and see what life is like in other countries." Henneberry adds that education abroad courses in agriculture offer the advantage of students usually getting the chance to go "way out into the rural [and therefore less cosmopolitan] areas" of the countries they visit. "Sometimes our students refer to it as seeing 'the real China' or 'the real Italy,'" he says.

International Connections Matter

Getting acquainted with local cultures and customs is extremely important in the field of agriculture, where the need for international experience may even be greater than in other fields because most companies in the sector work internationally, Henneberry says. The food industry is just one example. "Just take the hot dog; about 80 percent of hot dogs in the United States are sold in the summer time, such as during baseball games, and that means that a hot dog company cannot survive in the United States market alone. Instead, it has to find a market in Argentina, South Africa, or Australia, so that it can produce for export during the United States winter." The same is true for the rest of the agricultural sector, he adds. "All the lawn and garden equipment companies, for example, have to develop southern hemisphere markets so that in the slow season here they can market effectively down south." That makes having internationally savvy employees a necessity. According to Henneberry, it happens all the time that a company will tell an employee, "You know, we are having problems at our feed mill in Mexico; we need you to go down there next Thursday and sort that out." If the response to such a request is a "deer-in-the-headlights look," they'll say, "This person is unemployable," he says. "You can't have someone who doesn't have a passport

As part of the Oklahoma State University education abroad program in Honduras, student Jaben Richards plants trees with school children at El Empedrado

PHOTO COURTESY OF DAVID HENNEBERRY

and is scared to get on a plane. That just doesn't work anymore." And because many students at Oklahoma State grew up in small farming towns, they are not necessarily used to international travel. "So, we have got to give them those skills," Henneberry says.

Firsthand Look at Differences in Agriculture

Participation in education abroad programs also lets students see differences in food markets, such as poultry, Henneberry says. For example, in the United States white meat and breast meat from chickens sell for almost as much as an entire bird because there is a much bigger market for it than for legs and thighs. In Asia, on the other hand, dark meat is considered better, and consumers pay a lot more for dark meat than for white meat. As a result, big poultry companies in the Unites States try to pair up with companies in Asia to sell legs and thighs at a higher price market and import white meat. "When our students go to Vietnam or Thailand or China they see that firsthand, and all of a sudden the light bulb goes on that poultry is an international business, and it isn't just raising chickens," Henneberry says.

Growing up on farms, many Oklahoma State students are intimately familiar with the agriculture business, but seeing their industry in a new context often opens their eyes and gives them new ideas. "There is sort of a professional awakening that students go through because they just never realized how different agriculture could be in another country," Henneberry says. This is a benefit that foreign students who come to study at Oklahoma State experience as well, he adds. For example, many students come from developing countries through the United States Agency for International Development- or World Bank-funded programs with the aim to learn about different agricultural practices, bringing their knowledge back to their home country to increase food production there.

Understanding Cultural Attitudes

Spending time abroad not only raises students' awareness of different practices, but it also highlights differences in attitudes toward those practices. One example is the position on agricultural biotechnology, says Michael Zeece, professor of food science and technology at the University of Nebraska-Lincoln and director of a two-week education abroad program that takes U.S. students to Ireland. Biotech foods are made from crops that have been genetically modified so that they can withstand diseases or specific pesticides used to kill unwanted weeds, for example. According to the Grocery Manufacturers of America, about 75 percent of the processed foods that fill the shelves of United States grocery stores contain ingredients from genetically engineered plants. That's very different in European countries, many of which severely restrict or even ban them. These stringent regulations are mainly rooted in the strong opposition that European shoppers have toward biotech foods. "In this country, in contrast, there seems to be no consumer concern," Zeece says.

A stroll around European grocery stores reveals other differences as well. For example, unlike their United States counterparts, European consumers have great interest in functional foods—products containing substances that may provide health benefits in addition to their nutritional value, Zeece says. Examples are foods containing antioxidants or yoghurt products that are supposed to boost immunity. "If you walk into a grocery store in Ireland or England, you will see a lot more of these products than you do here."

During their trip to Ireland, University of Nebraska students learn about such differences by attending the University College in Cork Ireland and by participating in debates with Irish students. The trip also gives students background on Ireland's history and culture, which have contributed to shaping these differences.

Global Savvy Necessary for Food Science Careers

Gaining an international perspective of food sciences is an important preparation for students' later careers, Zeece said. Many of the participating students will end up in careers related to the foods industry, including the government. "Who knows, there may be future policymakers among them," he says. "Having a different perspective besides what they grew up with in the Midwest, and Nebraska specifically, might benefit them. Even if they don't remember specific facts, they will come back with a definite impression that things are much different in different places in the world, and that's an important consideration when one is making [food] products, creating regulatory rules, or making public policy."

Oklahoma State student Kyle Jones and villagers construct a "living fence" at La Cuchilla as part of the education abroad program in Honduras.

PHOTO COURTESY OF DAVID HENNEBERRY

Understanding Policy

Agriculture education abroad programs also help students gain insight into how current policies and legislation are affecting local farming operations, says Roy Robinson, program director of international studies at the University of Missouri. That becomes particularly apparent in countries that have undergone political regime changes in the recent past. During an education abroad program to the Czech Republic, for example, University of Missouri students get to learn about the changes that have occurred during and after the transition from collectivized to private farming. "Students see how this happened and how they have gone about that process," Robinson says. Students also learn how the Czech Republic's joining of the European Union in 2004 has affected agriculture in the country, he adds. "They see how markets get opened up and what happens to those markets." During the six-week program in the Czech Republic, University of Missouri students not only take classes, but also participate in excursions to manufacturing plants and working farms in various regions of the country. Seeing how farmers run their operations was very educational, says Edward Cope, an agriculture systems management and agriculture economics major at the University of Missouri and recent participant in the program. For example, one of the Czech farmers whom Cope and other students visited powered his entire hog operation with the methane gas emitted from the animals' manure, says Cope, whose family owns a small hog farm in Missouri.

The Czech Republic program is only one of a large number of education abroad opportunities that the University of Missouri's College of Agriculture, Food, and Natural Resources offers. During some of these programs, students work on specific projects related to agriculture or natural resources. One example is the University of Missouri's coral reef habilitation project in the Phi Phi Islands in Thailand. During the 2004 tsunami, tons of debris landed on the coral reef and destroyed much of it. In addition, the reef is suffering from man-made destruction, such as people walking on the corals and breaking them. For the past three years, University of Missouri students, led

by entomology professor Bob Sites, have traveled to the site and worked on restoring the reef.

Environmental issues that various countries face, resulting from natural disasters or human actions, are often the biggest impressions that students take away from their trips abroad, Robinson says. For example, during a recent education abroad program in Queensland, Australia, students learned about and saw the effects of the drought that the region is currently dealing with. While visiting farms and talking to farmers, students got to see how people in the region were trying to conserve water. In order to fill a pool, for example, "you had to show that you brought the water in from another state in Australia that isn't experiencing such a drought," Robinson says. That's difficult, and as a result, the University of Queensland pool was empty when University of Missouri students arrived on campus.

"Even if they don't remember specific facts, they will come back with a definite impression that things are much different in different places in the world, and that's an important consideration when one is making [food] products, creating regulatory rules, or making public policy."

A Long History of Agricultural Education Abroad

While many universities started their agriculture education abroad programs over the past decade, some have offered programs for more than 30 years. One example is Oregon State University, which has had a program with Lincoln University in Christchurch, New Zealand, since the 1970s. With respect to agriculture, there has long been significant cooperation between the state of Oregon and the country of New Zealand, says Marvin Pangborn, a New Zealand dairy farmer and teacher at Lincoln. That's mainly because the two are very similar in terms of their agricultural products and because the seasons are opposite to each other, Pangborn says. For instance, a company may develop a seed in Oregon, then send it to New Zealand to replicate it, and then back to Oregon. "That way they can cut the time that it takes to get the seed up to a commercial level in half." Pangborn was one of the early participants in Oregon State's education abroad program in New Zealand and met his future spouse during his time abroad. He remembers that it was unusual to study abroad in the 1970s. "I don't remember any of my friends doing it," he says. He applied for the program "on a whim" after seeing a flyer advertising the trip to New Zealand. His time abroad allowed him to view the United States from a different perspective. "It was at the end of the Vietnam War, and at that point, we were such an insular society that I didn't really know how the rest of the world felt about us most of the time," he says. "Being in another country and seeing how they saw us really changed a lot of my thoughts and attitudes."

Besides immersing themselves in a different culture and learning about different approaches to agriculture, Oregon State students who spend time at Lincoln University in New Zealand today also get to learn about the impact of environmental problems that weren't yet well-known in the 1970s, such as climate change. Recently, rising temperatures have sparked wide-ranging policy changes that could have dramatic impacts on New Zealand's farmers, Pangborn says. The country's last government signed up New Zealand, which ratified the Kyoto Protocol, for an emissions trading scheme under which farmers will have to buy carbon credits. If this policy comes into effect it will hit the agricultural sector hard, Pangborn says. Dairy farms rely on ruminants, whose methane emissions are the leading source of New Zealand's carbon contribution to the atmosphere. Under the current proposal, Pangborn would have to pay an additional $100,000 every year to buy carbon credits for his two dairy farms, which would make them uneconomic, he says. Oregon State students attending Lincoln University learn about these issues.

After more than 30 years, the program between Oregon State and Lincoln is still going strong. Pangborn's son, for example, studied abroad at Oregon State in 2005. But while he was eager to study in the United States, in part because it provided an opportunity for him to meet his extended family, it is sometimes difficult to convince students to go abroad, Pangborn says. Paul Dorres, who is the student services coordinator at Oregon State University and in charge of the program at Lincoln, shares this sentiment. One reason is that being enrolled in a well-known and renowned program in the United States sometimes blinds students to of the importance of including an international component into their education, he says. "They think 'Well, what do I need to go halfway across the planet for when we have got the best program on the West Coast right here?'" Dorres says that he tries to help students understand that the ways in which people have determined best practices in agriculture and forestry around the world vary greatly from the ways we encounter and work with our own agricultural resources; without seeing this first-hand, students are limiting themselves. That is one of the most important things that students who do participate in the program take away from the experience, he says. "They see 'Wow, so there really are other ways of doing things that work just as well even though they are different.'" The time abroad also provides an opportunity for students to reflect on their own culture. "All of a sudden your own culture comes under a magnifying glass, and you come to realize all the differences," he says.

However, Dorres points out that what students take away from the experience also very much depends on their attitude going into the program. "We try to help them be as prepared as possible and to be aware of the opportunities for learning." Still, "I think some of the students that we have sent have gone with the perspective that 'They speak English, so I don't have to learn a foreign language, and

I am going to go study agriculture, so how different can it really be?'" This attitude sometimes inhibits students and prevents them from letting "the differences in cultural norms and practices really penetrate their being and modify their own schemes of how the world works," Dorres says. Yet other students experience a "surprise factor" when they realize how their time abroad has changed their personal lives because they see so many more options available to them. For example, students who grew up in rural areas sometimes come to study at Oregon State so that they can go back later and take over the family farm, Dorres says. "Now, all of a sudden they have this huge world of possibilities that is set before them that they just never knew was possible." For example, they may learn about different practices they can take back to the family farm and "make it that much more successful." Some are so fascinated with the country and its culture that they decide—often to their parents' dismay—to relocate to New Zealand instead, he says.

Merging Academics and Intercultural Understanding

New Zealand's natural beauty is one of the biggest factors that draw United States students there, and it was one of the reasons that Oregon State student Talia Filipek chose the education abroad program for her first travel outside of the United States. New Zealand's unique and pristine landscape attracts millions of tourists every year, which is why outdoor recreation takes a priority in the way the country manages its land. Filipek, who majors in recreation resource management, says that it was very interesting to be exposed to a land management system different from that in the United States. The country places a lot of emphasis on the preservation of its rich Maori history, Filipek says. "There is a greater respect for the cultural history of an area. You don't see that as much in the United States." Kids in New Zealand are also much more engaged in the outdoors, she says. "The value of outdoor exposure for children seemed to be much more apparent in New Zealand than it is in the United States," Filipek says. "Parents seemed a lot more comfortable to let their kids roam and explore."

After completing her education abroad program, Filipek traveled the country for some six weeks. To finance the additional time she participated in WWOOF (World Wide Opportunities on Organic Farms), an international program during which travelers volunteer on organic farms in exchange for food and lodging. "That was a really interesting exposure for me because I got to live with local families as opposed to seeing New Zealand from a student's or tourist's perspective." Many participating farms are located in remote areas with little nearby attractions or places to go, which means that "you get a real connection with the land, the property, and the family." That allowed Filipek to gain insight into the issues that locals are dealing with, such as the compromises that have to take place between the Maori and other inhabitants. "Preserving the cultural history of an area is really important, and you recognize what a big factor that plays when you hear the families considering the significance of their property and applying it to their land practices." But Filipek also enjoyed rich intercultural exchange during her time at Lincoln University. Instead of staying in the dorms, she decided to live off-campus together with many other internationals in the city. "I wanted a cultural experience instead of a college experience." That allowed her to come together and bond with people from around the globe. "It makes you feel like peace is possible because you converse and form friendships with people from all over the world. Even through a language barrier that is often present, you can still communicate [about] interests, passions, and issues," she says. That experience had a profound impact on her personal life, she adds. "It is so important to realize that the world is so much larger than the area you live in and that you are so small but can be so influential at the same time. That's what study abroad did for me; it made me feel smaller but also bigger." **IE**

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