2009 Annual Research Report

Florida Agricultural Experiment Station

Institute of Food and Agricultural Sciences

UF | UNIVERSITY of FLORIDA

Note from the Dean for Research

"The Land Grant University" – the words are easily spoken by some and, unfortunately, all but forgotten by many. This great university of ours is a land grant university. Not because of the leaders that steer the ship, but due rather to the spirit of those that hold the land grant passion in their hearts. This is not a description of where we came from, it is a description of what we are called to be. To some it may mean nothing, but for others it is a way of life, a way of instilling passion and focus on being a citizens' university that integrates TEACHING, RESEARCH and EXTENSION and reaches out to meet the needs of society.

In this issue of the Florida Agricultural Experiment Station's Annual Research Report, we focus on the discoveries of IFAS faculty. We look at the integration of research and teaching through our Summer Internship Program and the partnership with Extension in our discoveries for the future. We often talk about our researchers as pioneers and explorers. They are! They seek discoveries that will make a difference and match the goals of the true land grant university. These researchers, these explorers believe in doing something for the greater good – connecting with citizens and seeking solutions to life's challenges. The breakthroughs we summarize in this report have impact, are exciting and reflect a commitment to make a difference.

In this report you will explore carbon sequestration and food safety breakthroughs. You will be introduced to microbes that are helpful and microbes that are harmful. We discuss insects and the new discoveries in biological control as well as managing insects that impact humans. We introduce you to a new superior bahiagrass for cattle and new tomatoes with better taste and higher lycopene. We hope you enjoy this introduction to some of our IFAS explorers.

We are passionate about our basic sciences, for it is these sciences that power our discoveries. We nurture innovation, for it is innovation that brings us to the next insight. And we are focused on applications, for it is the connection of our discoveries and innovations applied to real world needs that keeps us relevant.

There are some that would dismiss the land grant university as outdated and not suited for the modern world and thus ready to be dismantled and reused. This is short-sighted thinking that misses the point of why IFAS researchers care so much about the impact of their work. We are a citizens' university – connected to the land, our farmers and ranchers. We are connected to our natural resources, air, water, land and seas. But most of all, we are connected to people, the citizens of the State of Florida and their needs. IFAS researchers are the vanguard, the point, the lead in seeking answers to serve and improve the quality of lives. Welcome to the Florida Agricultural Experiment Station.

Mark R. McLellan
Dean for Research, IFAS
Director, Florida Agricultural Experiment Station

UF UNIVERSITY of FLORIDA
IFAS Research
Florida Agricultural Experiment Station

Table of Contents

ANNUAL RESEARCH REPORT is published by the University of Florida's Institute of Food and Agricultural Sciences and is produced by IFAS Information and Communication Services (**JACK BATTENFIELD**, Director).

To change an address, request extra copies of ANNUAL RESEARCH REPORT, or to be added to the mailing list, e-mail research@ifas.ufl.edu or write to Research Administration, P.O. Box 110200, University of Florida, Gainesville, FL 32611-0200.

ANNUAL RESEARCH REPORT is available in alternative formats. Visit our Web site: http://research.ifas.ufl.edu

MARK R. McLELLAN
Dean for Research and Director,
Florida Agricultural Experiment Station

DOUGLAS L. ARCHER
Associate Dean for Research

MARY L. DURYEA
Associate Dean for Research

MARZINNIA DEAN
Producer

ROBERT WELLS
Writer

HEATHER READ
Co-Writer

TRACY BRYANT
Designer

TYLER JONES
Photographer

DAVID GODWIN
Cover Photo

MICKIE ANDERSON
DARRYL PALMER
Copy Editors

PRINTED BY: StorterChilds Printing

FLORIDA AGRICULTURAL EXPERIMENT STATION
SUMMER INTERNSHIP PROGRAM

PHOTO BY IAN MAGUIRE

Summer vacation typically conjures up thoughts of beach vacations, time off without homework, and maybe working a part-time job at the mall or lifeguarding by the pool.

But for a group of hard-working University of Florida students, the summer is an opportunity to focus on hands-on research alongside expert faculty as part of the IFAS research summer internships with the Florida Agricultural Experiment Station. The internship program is a cooperative effort between the College of Agricultural and Life Sciences (CALS) and the Experiment Station.

For six weeks in the summer of 2009, 30 students participated in the Research Summer Internship. Four of the faculty-led internship programs are highlighted here to give a brief glimpse into some of the exciting research that students were able to delve into and make a part of their own.

FOLATE RESEARCH HITS CLOSE TO HOME

Intern Moline Blanc is extracting DNA from blood samples collected in developing countries from women of reproductive age who have been consuming low-folate diets. Dr. Lynn Bailey, professor, Department of Food Science and Human Nutrition, observes Moline's analytical procedures and provide direction.

Moline Blanc and Lynn Bailey were first-time participants in the summer internship program. Blanc is a senior majoring in biology who moved to the U.S. from Haiti when she was 15. After talking to her genetics professor about getting involved in research, she was introduced to Bailey, a professor of human nutrition. Bailey took Blanc on as an intern to assist her in researching folate and its effects on DNA. Bailey's research has focused primarily on determining the requirements of folic acid (vitamin B9) and folate (the naturally occurring form), key nutrients essential for normal maternal health and fetal growth.

Blanc began by reading about folate and writing a detailed research report to present to one of her classes. "I didn't know anything about folate before this research," she said. "Now I know a lot and can sit down with friends and talk about it, how to get enough of it, and how important it is to nutrition and health."

Folate is only concentrated in certain foods, including citrus and leafy green vegetables such as spinach. In the U.S. birth defects from this vitamin deficiency are not as much an issue because many foods are fortified with folic acid.

"It is even in breads, so people don't even need to eat much citrus or leafy greens," Bailey said. "But this is not the case in developing countries, because there is no fortification, and babies die. The goal is birth-defect prevention."

All Bailey's work is in collaboration with the Centers for Disease Control and Prevention (CDC). She works with the Birth Defects and Disabilities Prevention branch of the CDC where they are now defining how changes in folate status changes DNA and affects birth defects. Eventually they would make recommendations for fortification. The summer was time for Blanc to get her feet wet in the lab, where her work involved isolating, extracting and measuring DNA from blood samples from Honduras and China to see how folate affects DNA. "What excited me about working with Moline is her grassroots involvement," Bailey said. "She is from Haiti, so has seen firsthand poverty and its effects there. She has a cousin who was born with a birth defect."

This firsthand knowledge, together with seeing the impact of proper nutrition, is the main reason Blanc now wants to work in the medical field. From the summer internship she learned about the research process and its importance.

"I come to the lab every morning and see how the lab works," she said. "After I graduate, I want to get involved in the clinical aspect. I want to help people and so might apply to school to be a physician's assistant."

BIOENERGY FOR A BETTER WORLD

Dr. Ann Wilkie, associate professor, Department of Soil and Water Science, and interns discuss experiments with growing algae. Interns learned about the potential of algae cultivation for biodiesel production and waste remediation. **PHOTO BY THOMAS WRIGHT**

The Bioenergy Summer School was one of the bigger concentrations of interns in the summer 2009 internship program. The group of six who researched bioenergy with Ann Wilkie, an associate professor in the soil and water science department, came from diverse backgrounds to explore the emerging sustainability frontier. Danielle Keeter, Lanie Klopfer, Eric Layton, Taylor Norrell, Christa Rummel and Divik Schueller utilized the summer to immerse themselves in the concepts of bioenergy and sustainability.

Wilkie is the founder of the Bioenergy Summer School, which is funded by the IFAS summer internship program. This is the fourth year of the program, an interactive research internship allowing students to acquire knowledge of and passion for bioenergy and sustainable technology through hands-on experience. The internship covered a broad range of sustainability topics including renewable energy, waste management, climate change, the food vs. fuel debate, sustainable agriculture, and social and political issues.

Throughout the summer, the students worked together on group projects and developed individual projects to pursue their own interests in sustainability. Field trips were an important aspect of the internship experience; these included the biofueling station at the UF motor pool, the experimental cellulosic bioethanol plant on campus, a small farm practicing sustainable agriculture, the southwest landfill in Archer, GRU's Deerhaven power plant, and an anaerobic digester pilot project in Ocala. To gain professional experience, the students attended conferences throughout the state, including the Florida State Horticultural Society and the Soil and Crop Science of Florida annual meeting in Jacksonville, the Florida Alliance for Renewable Energy meeting in Largo, and the Florida Farm-to-Fuel Summit in Orlando. As a group project, the students also researched the nation of Haiti and how bioenergy and sustainability could help the citizens of Haiti prosper.

For some real hands-on, "dirt under the nails" experience, the interns planted and maintained an energy garden. Plants included oil crops, like sesame, sunflowers, peanuts and canola; and sugar and cellulosic crops, like sweet sorghum, sugarcane, napiergrass and energycane. To illustrate the food vs. fuel debate, they also planted and tended an organic food garden alongside the energy garden.

"The goal of the garden is to harvest what we grow and press the oil, filter it and see what could work for biodiesel," said Rummel, a food resource and economics major.

Not only do the interns plant the crops but they harvest the seeds, hand-press the oil, and convert (transesterify) the oil into biodiesel within the laboratory. Through the energy garden, they experience the entire process of making biodiesel literally from the ground up, pressing the oils out of the seeds they grew.

The students were able to tailor their individual projects towards their own interests. Norrell, an environmental engineering major, worked to create an anaerobic digester for sustainable development. Anaerobic digestion is the process through which organic material is converted into methane-rich biogas and nutrient-rich biofertilizer. Biogas can be used as a sustainable alternative to natural gas, while the biofertilizer effluent can be used as an organic nutrient source for agriculture.

Almost any organic material can be processed with anaerobic digestion, including biodegradable waste materials such as waste paper, grass clippings, food waste, sewage and animal waste.

In developing countries, simple home- and farm-based anaerobic digestion systems offer the potential for cheap, low-cost energy for cooking, heating and lighting. Norrell developed a small-scale digester with a low-cost, simple design that would be practical for families in developing nations. One of the lessons he learned this summer was the beauty of simplicity and how to hone his design for ease of use in developing countries.

"I had to encourage our engineers to go with more simple designs," Wilkie said. "Taylor had tried using a number of agitators, but found the simplest was just as effective."

Eric Layton's independent project was to design a portable solar water heater made with glass bottles and bamboo. The idea behind this project was to incorporate solar energy technology in locations where access to manufactured solar water heaters is not available, and make the design portable so it can easily be transported.

"Bamboo is a very rigid material and in China can be substituted for rebar in structures up to seven stories high," Layton, a mechanical engineering major, said. "I was researching a portable, easy-to-carry design that could be built in a developing nation."

Danielle Keeter, an environmental science major, works at a local bakery and was interested in looking at the waste that is produced there. She performed a waste audit at the bakery to determine how much food waste was produced. She collected the daily waste for two weeks, separating out the food scraps from other waste. From this data, she estimated the total biogas production the bakery could expect by anaerobically digesting its food waste. This is an integral step in establishing anaerobic digestion of food waste from local businesses.

Christa Rummel's project also focused on food waste conversion to bioenergy. She drafted a business plan for a company that collects food waste, anaerobically digests this waste and then uses the biogas energy to generate electricity to put back into the grid. Diverting food waste from landfills for sustainable biogas production supports Florida's statewide recycling goal of 75 percent by 2020.

Divik Schueller, a political science major, was interested in the political process of funding and supporting bioenergy

Wilkie and graduate student Ryan Graunke demonstrate burning biogas from a food waste anaerobic digester.
PHOTO BY THOMAS WRIGHT

projects by the government and by the public. He conducted research of policies supporting bioenergy and sustainability research and projects. There is still a lack of funding and pertinent legislation, which Schueller believes can be attributed to lack of awareness and education.

"People need to see how developments in bioenergy can impact their lives and by seeing the positive changes they can bring, such as lowering our reliance on fossil fuels, they will become more supportive and willing to speak up," he said.

Lanie Klopfer, a microbiology and cell science major, examined methods of breaking algae cells to release oils contained within. Algae represent a huge potential for future bioenergy developments due to their extremely high growth rate and ability to use waste nutrients, marginal lands, and nonpotable water. Oil-producing algae are currently being researched at Wilkie's bioenergy and sustainable technology laboratory as an alternative source of oil for fuel production. One tough challenge is how to crack the recalcitrant cell walls that are characteristic of some oil-rich algae. By finding an effective way of harvesting the algal oil, fuel from algae will be one step closer to fruition.

The students worked hard over the summer and gained knowledge of the many bioenergy options available. They also learned that to bring these technologies to a large scale requires public education and outreach. They remain confident, though, that success can be attained.

"You have to start a fire with a spark," Rummel said.

SPONGES AND CORAL AND LOBSTERS! OH MY!

Dr. Donald Behringer (right) research assistant professor, School of Forest Resources and Conservation, directs FAES intern Mike Dickson (center), and graduate student Corey Stall (left), to a sponge restoration research site.
PHOTO BY IAN MAGUIRE

When Donald Behringer, a research assistant professor of marine ecology at the School of Forest Resources and Conservation, received a message announcing the summer internship program, he jumped at the chance to involve students in his research in the Florida Keys. He had never had undergraduate interns before

and would have to house them because of the distance to the research site, so he wasn't sure what to expect.

"This is a great opportunity to expose undergrads to research," Behringer said. "A lot of times there is a kind of warm fuzzy notion that marine biology is all about playing with dolphins and turtles. [But] there are long, sweaty hours out in the field. It was an opportunity to really see what research is all about and if it is for them. The program gives us assistance with our projects, gives us skilled labor because not just any student get this. It is win-win."

Over the summer Behringer and his three interns, Matt Smukall, Jonathan Bake and Michael Dickson focused on two projects. With funding from Florida Sea Grant they researched a lethal virus discovered in the juvenile Caribbean spiny lobster (*Panulirus argus*). These lobsters are heavily fished in the Caribbean and are a major impact economically and ecologically. The researchers wanted to get a handle for how the virus affects the fishery and vice versa.

The other project was a collaboration with the National Park Service, the National Oceanic and Atmospheric Administration (NOAA) and the Nature Conservancy to expand the sponge restoration in Everglades National Park. Between the southern tip of Florida and the Florida Keys lies Florida Bay, a relatively shallow estuary. The hard, flat rock bottom is populated by numerous sponges and corals that serve as nurseries for many organisms including loggerhead turtles and crabs.

The sponges are very sensitive to cyanobacteria, and the last bloom in 2007 wiped out most of the big sponges. The ecological significance of this loss is great, because sponges filter water and serve as habitat. Behringer's research focuses on understanding how to restore the hard bottom habitat, particularly sponges. The researchers took sponges from unaffected areas and put them in the affected area to find out the best arrangement for new growth.

At the beginning of his six weeks in the Keys, Dickson, a wildlife conservation major, worked mostly with lobsters, setting up experiments, taking care of the wet lab, and going out on weekly collecting runs. Toward the end of summer he worked with sponges, setting out 24 x 24 meter areas for placement of transplanted sponges. Dickson did lab studies as well and found the program to be a good balance between field and lab work.

Some of the lab studies involved chemical detection. One of the key findings was that healthy lobsters can detect and avoid diseased lobsters. Dickson was advancing work on that premise to see what lobsters are detecting in the marine environment.

Behringer (right) shows FAES intern Mike Dickson how to tell when a Caribbean spiny lobster is infected with the lethal PaV1 disease. **PHOTO BY IAN MAGUIRE**

"I really enjoyed learning about the lobster disease," Dickson said. "Like most people I had never heard of this before talking to Dr. B, and I was really intrigued by it. I enjoyed coming down here and getting hands-on lab experience every day. Living together we are like a family down here, it's been great."

Behringer heartily agrees.

"The internship in general has been a smashing success," he said. "I would do it again in a heartbeat. I think the program and experience was fantastic."

BREEDING FLORIDA-FRIENDLY PLANTS FROM A-Z

Dr. Zhanao Deng (center), associate professor of environmental horticulture, Gulf Coast Research and Education Center, showing FAES interns Mary Derrick (right) and Monica Raguckas the flowers of gerbera daisy to be used for hand pollination. **PHOTO BY PATTY MCCLAIN**

At the Gulf Coast Research and Education Center this summer, Mary Derrick and Monica Raguckas delved into plant breeding and care, including determining pollen viability and understanding the process of raising plants in a research setting.

The two worked with Zhanao Deng, an assistant professor of horticulture whose research program focuses on the development of new cultivars for the Florida environmental horticulture industry and for Florida-friendly landscaping. Florida plants face severe challenges, including devastating diseases, temperature stresses, and invasive species.

Deng's research involves the genetic sterilization of lantana to develop non-invasive, drought-tolerant, wildlife-attracting cultivars. His program has searched for sources of desirable plant characteristics, developed large breeding populations, and screened tens of thousands of progeny.

"I have been interested in the internship program for some time, and after coordinating with the Plant City Campus, I received applicants eager to become involved in breeding research," Deng said. "It has been a great experience."

Over the six weeks, both Derrick and Raguckas commuted to the site. Their internship focused on ornamental plants and genetics. They were involved in a number of projects and worked in a greenhouse, in a lab and out in the field.

"Mary and I were both interested in learning about plant breeding and research," Raguckas said. "We heard about the intern experience and chose to do scientific research."

Derrick and Raguckas worked with and learned from Deng's two graduate students, David Czarnecki and Sarah Smith. Czarnecki was excited to be a part of the process and thinks such experience is really helpful for learning about the kind of research a graduate student does.

"When I was an undergraduate, I didn't know what it was like to be a grad student, so I hope I showed them a little bit," Czarnecki said. "I worked in a lab some, but I didn't really see the kind of work involved as a grad student. They came in at a really good time. It took me three years to see everything they got to see in one summer.

Raguckas worked on projects with Czarnecki and Smith that included evaluating data and helping determine pollen viability.

"It was interesting work, and I was really given insight into research," Raguckas said.

Most of the work Derrick did was with lantana pollination and learning how to take care of plants in a research situation, including the everyday care of plants, recordkeeping, and taking cuttings. The research process involved planting new cultivars to identify new properties and comparing the results with commercial varieties.

"We showed them the different aspects of breeding," Deng said. "Mary even started her own research project with her plants from beginning to end. She selected the materials, designed an experiment, collected data. She got plants and had a trial in ground as an expansion of her internship research into an independent study."

Both Derrick and Raguckas agree the summer was a great overall learning experience and that they will continue with their interests in research.

"I think both of us will be going on to graduate school," Derrick said. "I'm now more interested in plant science than raising plants to sell at nurseries. This was a really good way to get involved. It has been an invaluable experience."

It was a summer of discoveries for the student interns. They discovered a passion for research, innovative ways to overcome everyday problems, and even new, exciting paths to venture down. And while their short six week immersion into various research projects may be over, the students move forward with a firmer grasp on the research process, a better understanding of what can be accomplished through diligent work, and a glimpse into the possibilities the future holds for them as students and beyond.

Prescribed fire supports carbon capturing goals

School of Forest Resources and Conservation researchers Drs. Timothy Martin (left), associate professor; Wendell Cropper (center), associate professor; and Rosvel Bracho (right), postdoctoral associate, measure a longleaf pine tree on the School's Austin Cary Memorial Forest near Waldo, Florida. Research on the Austin Cary has quantified the impacts of prescribed fire on forest carbon cycling.

Despite being a local source of carbon dioxide emissions, a common forest management tool likely allows more carbon to be captured than released across a region, new research finds.

This finding is important, as capturing carbon has the potential to generate tens of billions of dollars in annual revenue for U.S. forest landowners. These landowners must balance the use of prescribed fire, a recommended practice in many pine forests in the southeastern U.S., with the need to transfer carbon dioxide from the atmosphere into growing trees.

To better understand this dynamic, Tim Martin, an associate professor of tree physiology in the School of Forest Resources and Conservation (SFRC), researched the flow of carbon surrounding prescribed fires in the Austin Cary Memorial Forest near Waldo, Fla. The SFRC is part of the University of Florida's Institute of Food and Agricultural Sciences.

Martin's research was a part of the Florida AmeriFlux project that uses eddy covariance technology to measure the flow of carbon, water and energy to and from different pine ecosystems in North Florida. Eddy covariance includes tools such as a sonic anemometer and an infrared gas analyzer to measure wind speed and the chemical composition of air. Martin combined this technology with harvest and weight data gathered from plant material before and after prescribed fire to understand how fire affects an ecosystem's carbon flow.

The researcher found that a prescribed fire in the forest released anywhere from 9 to 14 metric tons of carbon per hectare into the atmosphere. The burning of understory shrubs, vegetation, dead needles and branches on the ground largely contributed to the carbon release. Additionally, the longer the time since the last burn, the more carbon was released due to the accumulation of extra plant material.

"On an annual basis, the release of carbon from prescribed burns is almost equal to the amount of carbon sequestered by the ecosystem," Martin said. "In other words, with frequent prescribed fire, the stand is still a sink for carbon, but just barely."

Martin noted that although prescribed fires reduced carbon accumulation in an individual pine forest, the widespread use of the practice in a region likely will help increase carbon accumulation by reducing the risk of wildfires. Wildfires are fueled by underbrush and release even more carbon than prescribed fires. The technique also allows older trees to grow larger by eliminating competing plants, and larger trees tend to capture more carbon, Martin said.

SFRC associate professor Wendell P. Cropper, Jr.; assistant professor Leda Kobziar; post-doctoral researcher Rosvel Bracho and former post-doctoral researcher Gregory Starr also worked on the study. The research was funded by the National Institute for Global Environmental Change, the National Institute for Climatic Change Research and the U.S. Forest Service.

Postdoctoral research associate Rosvel Bracho uses a drip torch to ignite a prescribed fire on the School of Forest Resources and Conservation's Austin Cary Memorial Forest. **PHOTO BY LARRY KORHNAK**

Discovery of bacterial factors in oyster contamination

Eating raw oysters is under increased scrutiny, as the U.S. Food and Drug Administration wants dangerous *Vibrio* bacteria sometimes present in the popular seafood reduced or eliminated. These bacteria can cause sickness or even death when ingested, especially in people with chronic diseases. But a University of Florida researcher has discovered the factors that help *Vibrio* bacteria colonize and contaminate oysters, a finding which could lead to ways to make raw oysters safer for human consumption.

Anita Wright, an associate professor in the food science and human nutrition department of UF's Institute of Food and Agricultural Sciences, found that bacteria are better able to infiltrate oyster tissue when they have certain physical characteristics, such as capsular polysaccharides, pili and flagella.

These characteristics, known as virulence factors, aid bacteria by protecting them from immune systems, allowing them to anchor to surfaces and giving them increased locomotion.

To discover the influence of these characteristics in contaminating oysters, bacteria with the virulence factors were compared to bacteria that had them removed by a process called gene deletion.

In the study, which was funded by the U.S. Department of Agriculture and Florida Sea Grant, fresh oysters were placed in saltwater tanks and treated with an antibiotic to remove *Vibrio* already present. One oyster tank then received bacteria with virulence factors, while the other tank received those without. As many as 10 million *Vibrio* bacteria were inoculated in each tank. After a 24-hour incubation period, the number of bacteria present in each oyster was counted to determine how well they absorbed the bacteria. When the virulence factors were absent, Wright found there was as much as a 90 percent decrease in the number of bacteria inside the oysters.

Dr. Anita Wright, associate professor, Department of Food Science and Human Nutrition, uses molecular diagnostics for more rapid detection of *Vibrio* pathogens.

Ultra-low freezing is one of the current processes being used to reduce *Vibrio* bacteria in oysters.

Collaborators on the research included Paul Gulig, a professor in the molecular genetics and microbiology department; Max Teplitski, an assistant professor in the soil and water science department; postdoctoral researcher Melissa Jones and graduate students Milan Srivastava, Mike Hubbard and Rick Swain.

Wright hopes future research will lead to treatments to eliminate virulence factor expression and stop *Vibrio* colonization of oysters. These treatments could include antimicrobial peptides produced by other bacteria, or the use of small molecules that prevent the formation of virulence factors.

The FDA estimates that approximately 100 of some *Vibrio* bacteria per gram of oyster is a toxic level for humans. Oysters are considered safe once levels are reduced to 30 per gram, Wright said.

Since *Vibrio* bacteria are so common in oysters, Wright said these virulence factors might not be what they seem.

"They probably did not evolve as virulence factors for humans at all," Wright said. "They are more likely to be adaptations that allow the bacteria to be better able to colonize and survive in an oyster."

New methods save Florida oyster industry

Victor Garrido (left), research programs coordinator and Dr. Steve Otwell, professor, Department of Food Science and Human Nutrition, display a container of raw oysters prepared through exposure to the new FDA-approved irradiation process developed by the University of Florida to reduce potential harmful bacteria.

New methods introduced by the University of Florida have help prevent the shutdown of the oyster industry by federal mandates, while protecting public health.

The recent mandates impose strict limits on the number of potentially harmful *Vibrio* bacteria, such as *Vibrio vulnificus*, that are present in oysters intended for raw consumption. Consumers also have issued their own mandate by calling for safer raw oysters.

In response, Steve Otwell, a food science and human nutrition professor with UF's Institute of Food and Agricultural Sciences, and Victor Garrido, a research coordinator, have helped implement innovative processing methods to make raw oysters safer. This assistance has allowed the industry to comply with federal regulations and meet consumer demand.

The methods, frosting and irradiation, are easier and less expensive to implement than post-harvest processing techniques currently available and are as effective.

"These options are the least costly choices," Otwell said. "They suit our particular size and nature of industry."

Frosting freezes oysters in a minus-120-degree Fahrenheit liquid nitrogen tunnel. Then, when the oysters warm up to frozen storage temperature at 0 degrees Fahrenheit, the resulting temperature differential initiates crystal growth in the cells of the bacteria. Preliminary research showed through electron micrographs that the crystal growth kills the bacteria. In addition to increased safety, frosted oysters have a longer shelf life than fresh oysters and offer the convenience of already being shucked.

For irradiation, the researchers developed a commercial processing practice using gamma radiation to consistently eliminate *Vibrio vulnificus* bacteria without changing the oysters' taste, texture or color. The method allows processors to bring in pre-packaged oysters on palettes, run them through gamma radiation and place them back on a truck without ever having to open the product. The reduced handling decreases costs by saving time and energy. The state has a gamma irradiation facility for food, one of the few in the country, in Mulberry, Fla.

Irradiation offers an advantage over frosting and other post-harvest processing methods because the oysters stay alive through the processing, and the *Vibrio* bacteria still are reduced to an undetectable level.

The researchers validated the procedures through microbial analyses that showed a reduction of *Vibrio vulnificus* in raw oysters to a level believed to be safe. In agreement with the U.S. Food and Drug Administration, the Florida Department of Agriculture and Consumer Services accepted the validations. The validations allow the industry to label frosted or irradiated oysters as safe for human consumption.

The Florida oyster industry implemented oyster freezing in 2005, and irradiation currently is being introduced to the market. Florida Sea Grant and the U.S. Department of Agriculture funded the research.

Analyzing the effectiveness of youth programs

The good news: A University of Florida study has shown that two expensive, publicly funded youth programs are effective at raising test scores and job earnings. The bad news: The same study found that Hispanics and blacks do not benefit as much as whites.

Alfonso Flores-Lagunes, an assistant professor in UF's food and resource economics department, performed the research on the effectiveness of 4-H and Job Corps.

"Given the considerable resources devoted to these programs, it is important to evaluate whether they accomplish their intended goals," Flores-Lagunes said.

For Job Corps, the researcher examined the program on a national, regional and state level. Job Corps is a federally funded educational and vocational training program for disadvantaged youth.

On a national level, Flores-Lagunes looked at why Hispanics, in comparison to other groups, did not receive higher weekly earnings four years after Job Corps participation. This difference was first noted in a national study of Job Corps commissioned by the U.S. Department of Labor and published in 2001. Using that data, Flores-Lagunes found that Hispanics, and blacks as well, tend to live in places where there are more adverse economic conditions relative to whites, and Job Corps is not enough to overcome those challenges. An implication of this finding is that the effectiveness of publicly funded training programs is highly dependent on the overall condition of the economy, Flores-Lagunes said.

His research on Job Corps in the Southeast and Florida was done in conjunction with Abu Mansoor, a master's student. They discovered that for the Southeast, Job Corps participation results in higher earnings per week and higher probability of employment compared to the nation. In Florida, these figures were nearly the same as for the nation. The difference in the program's effectiveness may be due to differences in industry composition, the researcher said.

For 4-H, Flores-Lagunes and doctoral student Troy Timko investigated whether there is a causal relationship between 4-H participation and scores on Florida's Comprehensive Assessment Test, or FCAT. Administered by the U.S. Department of Agriculture's Cooperative State Research, Education and Extension Service, 4-H is a youth organization that teaches citizenship, leadership and life skills. The researchers collected data on 4-H participation rates at grade and school district level from 2002 to 2008 from the Florida 4-H office and merged it to the same grade and school district level data on FCAT scores in math and reading from the Florida Department of Education. After controlling for an assortment of observed and unobserved factors, the researchers found that higher 4-H enrollment is related to a statistically significant higher passing rate in both math and reading and a statistically significant higher average score in the reading subtest. The positive economic impacts of these effects are currently being quantified.

"Even though 4-H doesn't have an explicit goal to increase standardized test scores, 4-H impacts behaviors that have been found to be related to higher test scores, like interest for science and technology, healthy choices and citizenship," Flores-Lagunes said.

Dr. Alfonso Flores-Lagunes, assistant professor, Department of Food and Resource Economics.

Researchers create highly effective fly trap for military

Fly control device inventors Dr. Philip Koehler (left), professor, Department of Entomology and Nematology, and Ph.D. student Joe Diclaro, holding their invention in front of a two-sided light tunnel. The light tunnel was used to determine fly attraction to colors of reflected light.

Researchers in the entomology and nematology department of UF's Institute of Food and Agricultural Sciences have discovered a way to trap flies that is more effective and may have applications for the military and disaster relief efforts.

"The field data that we have is that it's probably a thousand times better than the fly traps currently available," said Philip Koehler, the professor who led the research, which was funded by the Department of Defense's Deployed War-fighter Protection research program.

Dr. Koehler's team included Joe Diclaro, a Ph.D. student from the U.S. Navy; Roberto Pereira, an associate research scientist; and Jeff Hertz, a former graduate student from the U.S. Navy.

The new trap design discovery began when the researchers noticed that flies would come to conventional fly traps, but not necessarily go inside them and die. To make the trap more effective, they decided to put the insecticide, which is in the form of wool cord soaked in pesticide, on the outside of the trap, so that the flies would die without going inside the trap. The method proved effective, and the researchers found that even in the absence of a trapping device, the flies would come to a cord, land on it and die.

To understand the flies' attraction to the cord, the researchers decided to analyze the vision of a fly. In conjunction with the U.S. Department of Agriculture, Koehler's team employed electroretinograms to determine what a fly sees. In this method, a tungsten probe was inserted into the fly's eye, and the neurological response of both the large eyes and the simple eyes was measured to see which colors generated the strongest reactions. In a separate but concurrent experiment, Koehler's team set up two-sided light tunnels to create a color-preference behavioral test. In this experiment, a horizontal tube connected two light sources. Flies crawl up through a vertical center tube, and then when they get to the connecting horizontal tube, they must decide between a black side and a color side. The side with the most flies was determined to be the most attractant. The researchers eventually determined that blue was the most attractant color.

Koehler's team then tested different colors of wool cord and found that black wool cords combined with a blue trap background were the most effective at luring and killing flies.

In addition to killing house flies, the trap lures and kills blow flies and the previously uncontrollable phorid flies. It has been tested successfully in the U.S., Greece, Iraq, Afghanistan and Mauritius. Places affected by natural disasters, as well as military personnel at risk from disease-carrying insects, could benefit in the future from the new fly trap. The trap can be adapted to a variety of shapes, from a collapsible, portable form to a flowerpot design appropriate for a restaurant or home. A patent is pending on the trap and worldwide distribution could come soon.

The fly control device was modified as a decorative flower arrangement for discreet fly management in homes and restaurants.

New breeding method may expand market for Florida tropical fish

Research by the University of Florida's Tropical Aquaculture Laboratory has revealed a new breeding method for puffer fish that may make more ornamental fish available for retail and research markets.

The discovery came when laboratory director Craig Watson began a project to successfully breed green spotted puffer fish for the pet store market. Upon starting the study, Watson learned that previous attempts to breed captive puffer fish – an animal often used in genetic research – had failed.

"So we kept it in the back of our mind that it might be an opportunity beyond just selling them to the big chain fish stores but as a science animal," Watson said.

With the help of funding from the University of Florida and fish provided by the Florida Tropical Fish Farms Association, Watson eventually achieved a puffer fish hatch by inventing a new technique called ovarian lavage.

Ovarian lavage works by using a catheter to flood puffer fish ovaries with spawning hormones. The traditional method of inducing a hatch involved injecting the hormones into muscle. However, with the elastic nature of puffer fish skin, as well as their small size, needles transmitting the hormones were difficult to insert. Watson decided bypassing the skin and going directly to the ovaries with a catheter might work because he regularly used a catheter to check the ovaries for ovulation readiness.

"And it did," Watson said. "It was just one of those 'a-ha!' moments."

Farmers have been asking for ways to produce green spotted puffer fish to meet growing consumer demand. U.S. fish wholesalers import around 250,000 green spotted puffer fish annually at a price of 50 cents to $1 each, depending on size and availability. Large puffers can demand up to $4 apiece, Watson said.

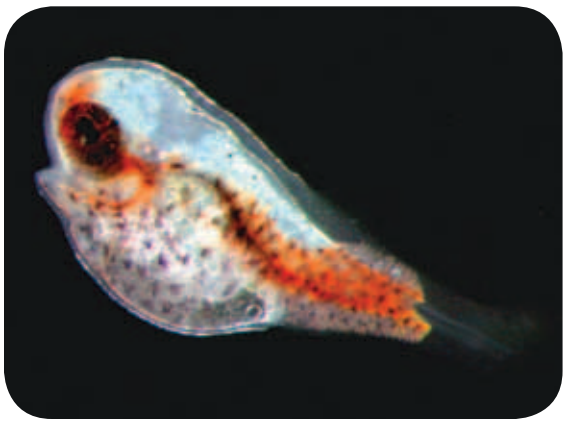
Dr. Craig Watson, director, Tropical Aquaculture Laboratory, holds a mature, wild-captured puffer fish. Fish commonly sold in the aquarium trade are less than half this size.

As a result of his invention, some Florida-grown green spotted puffer fish are now available in aquarium stores around the country. Researchers in Canada also are buying farm-raised puffer fish from a Florida producer.

Watson said there are a large number of other fish that are difficult to breed, and ovarian lavage may help them reproduce in captivity. The researcher has since used the technique on several types of fish and also is trying it on different species of puffer.

"And I'm still maintaining two generations of our puffer fish offspring," Watson said. "Which is a rather major event whenever you're working with a new animal, to have a domestic-produced brood stock."

First-ever picture of one-day-old green spotted puffer fish. At this age they are about the size of a poppy seed.



New technique lowers packaging design costs

Dr. Bruce Welt, associate professor, Department of Agricultural and Biological Engineering, unwinds a multi-layer barrier film in preparation for oxygen transmission rate analysis using his newly developed unsteady state method.

Researchers in the agricultural and biological engineering department of the University of Florida's Institute of Food and Agricultural Sciences have created an innovative new way to measure the amounts of oxygen that move through product packaging. Oxygen limits the shelf life of many products, so understanding the gas transmission rate of packaging is critical.

The new measurement method uses what is known as an unsteady state approach and is up to 95 percent less expensive than the current, industry standard, steady state method, said Bruce Welt, an associate professor. Welt, along with graduate student Ayman Abdellatief, developed the new method in the Packaging Science Laboratory.

"A major application for this is in respiring produce for modified atmosphere packaging, but it could be used for any product that is sensitive to oxygen," Welt said. Other applications include beef, chicken, fish, cosmetics, medical products or even motor oil.

Modified atmosphere packaging is an approach in packaging design that attempts to achieve a different atmosphere inside the package than ordinarily would exist. With highly respiring produce, such as ready-to-eat salads, baby carrots, broccoli or apple slices, shelf life can be extended when the level of oxygen inside the package is reduced to an optimum level.

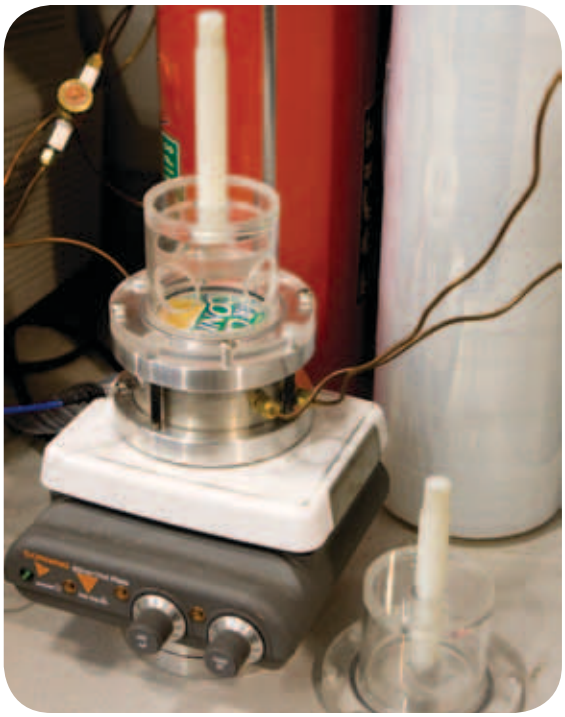
Welt began developing the new method after being approached by the food packaging industry to design a technique to measure oxygen transmission rates for micro-perforated film. Because of the holes in the film, the steady state method was failing at recording measurements.

In both the steady and unsteady state methods, packaging film is mounted between two chambers. In the unsteady state method, gas is introduced into one chamber, escape valves are closed, gas permeates the film and accumulates, creating an "unsteady state." In the steady state method, gas is run continuously into both chambers so that conditions remain constant with excess gas escaping into the atmosphere. With perforated films, the steady state method fails because gas streams through holes with even the slightest differences in pressure. Since the unsteady state method does not use constantly flowing gas, streaming is not an issue.

The new method is more economical because it requires much less gas to operate, the gas it uses is less expensive, it has lower maintenance costs, and it requires less expertise. The new method also employs a fluorescent sensor that does not consume oxygen during the measurement, and therefore does not alter the experiment's condition.

Welt said the new method may lead to more ready-to-eat healthy foods, longer shelf lives and higher quality products. An exclusive license agreement is in the works with a company that plans to produce equipment that uses the technique. A patent is pending.

Prototype test apparatus used to develop the new unsteady state method.



Overcoming the effects of heat stress on cow fertility

A researcher in the animal sciences department of the University of Florida's Institute of Food and Agricultural Sciences has discovered a way to decrease the cost of embryo transfer – a method proven to increase fertility in heat-stressed dairy cows.

Fertility is important in the dairy industry because cows must be fertile to conceive, give birth and produce milk. Decreased fertility in the summer is a major concern in Florida but also affects dairy farmers as far north as Wisconsin.

Pete Hansen, a professor of environmental and reproductive physiology, has found that eggs obtained from harvesting ovaries at a slaughterhouse can be used in embryo transfer.

"The advantage is it's cheaper, and we can produce embryos on a large scale," Hansen said.

To improve the typically average genetic makeup of slaughterhouse eggs, semen from a high-quality bull can be used during fertilization. One semen straw potentially can fertilize 100 oocytes and out of those, perhaps 30 embryos will form.

Hansen also uses a new technique called "sexed semen" that allows him to fertilize eggs with sperm that has been sorted according to gender. The sperm is run through a flow cytometer that differentiates between X sperm and Y sperm. The Y sperm have slightly less DNA because the Y chromosome is shorter than the X.

Got embryos? Aline Bonilla, Ph.D. student, prepares embryos for transfer into cows.

Some of the members of the embryology team from the Department of Animal Sciences in their native habitat (the Bovine In Vitro Fertilization Laboratory). From left to right: Dr. Pete Hansen, professor; Barbara Loureiro, doctoral student; Manabu Ozawa, postdoctoral research associate; Sarah Fields, doctoral student; Marc Charbel, undergraduate student; Justin Fear, master's student; and Dr. Jim Moss, chemist.

As a result, the flow cytometer can determine how much DNA each cell has as it goes by its sensors and then place a charge on each cell. For instance, the X sperm may receive a positive charge while the Y sperm receives a negative charge. As the sperm pass electric fields, X sperm go one way, and Y go the other way. Hansen said sexed semen allows him to receive up to 85 and 90 percent females from his embryos, and females have more value to dairy farmers than do males. Hansen's novel use of in vitro fertilization with slaughterhouse eggs and sexed semen allows him to achieve better fertility and desirable offspring at less cost when compared to other methods currently available.

Over the years, genetic selection has created cows that produce more milk but have increased susceptibility to heat stress. The more milk a cow produces, the more heat it must release as part of its internal milk manufacturing process. During hot and humid weather, extra heat makes it difficult for a cow to maintain its body temperature. As a result, hyperthermia can occur in high producing cows at temperatures as low as 80 degrees Fahrenheit, and fertility declines.

Embryo transfer places 7-day-old embryos into a cow at an age when embryos can resist more heat stress. The method bypasses a critical time when an embryo in the womb can be damaged by even a 0.9 degree Fahrenheit increase over normal body temperature. Embryo transfer was originally developed in 1989 by UF researchers Bill Thatcher and Maarten Drost.

Gene for high temperature tolerance discovered

Dr. Bala Rathinasabapathi, associate professor, Department of Horticultural Sciences, examines Arabidopsis plants engineered to express brake fern gene PvGrx5.

Concerns about the negative impact of rising global temperatures on crops have sparked interest in plants better able to withstand heat. With this in mind, University of Florida researchers have discovered that a gene responsible for a plant's tolerance to arsenic can also aid in the plant's heat tolerance.

Bala Rathinasabapathi, an associate professor in the horticultural sciences department of UF's Institute of Food and Agricultural Sciences, made the discovery after transferring genes from the Chinese brake fern into *Arabidopsis thaliana*, a plant related to the mustard family. The resulting organism, a genetically modified Arabidopsis, expresses the Chinese brake fern gene, PvGrx5. This gene codes for the protein glutaredoxin, and inserting it in Arabidopsis made the plant better able to tolerate high temperatures.

Rathinasabapathi uncovered the gene's characteristic while working with Lena Ma, a professor in the soil and water science department who first identified that the Chinese brake fern can hyperaccumulate arsenic from soil and is tolerant to the typically toxic element. Rathinasabapathi hypothesized that genes involved in the fern's tolerance to arsenic could be harnessed to build crops that are tolerant to other stress factors, such as high temperature. Since arsenic causes damage to the cell similar to abiotic stress factors like high temperatures, his reasoning was that some of the biochemical changes occurring in the cell due to the stress could be similar to those caused by high temperatures. The researcher worked alongside Sabarinath Sundaram, a post-doctoral research associate. They used Arabidopsis as a model plant for gene insertion because it is easy to use and has one of the smallest plant genomes. A model plant is a relatively simple organism that researchers use to understand other, more complicated plants.

Rathinasabapathi's discovery has implications beyond increasing high temperature tolerance in Arabidopsis. He is looking to insert PvGrx5' into rice in order to create varieties that could withstand high temperatures. Additionally, the discovery opens the door to research ways PvGrx5' could protect plants from other stress factors, such as drought, as well as ways it might protect plant proteins from damage.

"When we examined the proteins in the experimental plants, they were less damaged by oxidative stress than the proteins analyzed in the control plants," Rathinasabapathi said. "So this actually shows that the gene may have a role in protecting proteins from stress damage."

Oxidative damage occurs when a biological system cannot manage oxygen it encounters. Both high temperature stress and drought cause oxidative damage. By overexpressing glutaredoxin in a plant, Rathinasabapathi theorizes, many other proteins may be protected from oxidative damage, thus helping the plant thrive under adverse conditions.

Funding for the research was provided by a U.S. Department of Agriculture Tropical and Subtropical Agriculture Research grant and from the Florida Agricultural Experiment Station.

A frond of an arsenic-hyperaccumulating Chinese brake fern.

New bacterium can help produce alternative energy

With oil prices skyrocketing amid ever decreasing supplies, finding new sources of energy is critically important. Now the discovery of a naturally occurring bacterium could offer needed improvements to producing an alternative fuel source derived from plants – cellulosic ethanol.

The bacterium, a strain of *Paenibacillus* species named JDR-2, is able to break down a component of cell walls, hemicellulose, without the use of heat or acid, to release sugars that can be fermented into cellulosic ethanol. Current bacteria in use cannot break down hemicellulose and require thermal and chemical processing to release fermentable sugars. Due to its abilities, JDR-2's discovery may lead to more efficient and less costly cellulosic ethanol production.

The bacterium was discovered by researchers in the University of Florida's Institute of Food and Agricultural Sciences. Jim Preston, a professor in the microbiology and cell science department; post-doctoral researchers Virginia Chow and Guang Nong; John Rice, a senior biologist; and doctoral students Changhao Bi, Jason Hurlbert and Franz St. John did the research.

They discovered the bacterium by analyzing wood from sweetgum trees on Preston's tree farm in Micanopy, Fla. Intrigued by the rapid decomposition of fallen sweetgum wood, the researchers found an important contributor to the process by cutting circular wafers from a living sweetgum stem and burying them in the ground. Bacteria capable of digesting the wood rapidly colonized the wafers. The researchers removed the wafers from the soil and ultrasonically treated them to release the bacteria. Pure cultures of Paenibacillus JDR-2 then were obtained by growing the bacteria in petri dishes.

Preston and his team also isolated the genes from JDR-2 that are responsible for the digestion of hemicellulose. These genes may be moved into a bacterium that can produce ethanol, or alternatively, JDR-2 may be bioengineered to produce ethanol. Additionally, enzymes produced by JDR-2 could be isolated and utilized.

The common sweetgum, or alligator tree, here serves to support Dr. Jim Preston, professor, Department of Microbiology and Cell Science. Wood from the tree provided bacteria, seen as colonies below, for biofuel production from resources abundant in Florida.

"That is the major discovery I think we made here," Preston said. "JDR-2 could be the next source of enzymes and genes to try to make improved biocatalysts."

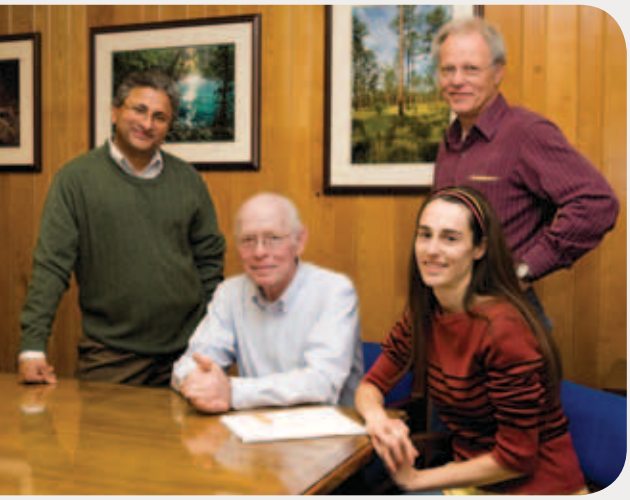
Biocatalysts are natural catalysts used to initiate chemical changes in organic material. Strains of E. coli and other bacteria currently serve as biocatalysts to convert sugars into ethanol or into raw materials for bioplastics.

Cellulosic ethanol turns renewable plant material, such as sugarcane bagasse and wood waste, as well as other energy crops, including energy cane, poplar and eucalyptus, into energy. Bagasse is a waste product from the sugar industry. All of these resources are prevalent in Florida.

Preston said applying the discoveries to improve cellulosic ethanol processing efficiency involves ongoing collaborative efforts with IFAS faculty in his department as well as with those in agronomy, agricultural engineering, forest resources and conservation and in the Florida Center for Renewable Fuels and Chemicals.

Grants from the U.S. Department of Energy, the Consortium for Plant Biotechnology Research and from the Florida Energy Systems Consortium funded the research.

Responding to declining bobwhite quail populations



The bobwhite quail researchers (left to right): Dr. Madan K. Oli, associate professor, Department of Wildlife Ecology and Conservation; Tommy Hines, Florida Fish and Wildlife Conservation Commission (retired); Dr. H. Franklin Percival, Florida Cooperative Wildlife Research Unit; and Dr. Virginie Rolland, associate professor, Department of Wildlife Ecology and Conservation.

Bobwhite quail populations have been in sharp decline across the nation since the early 1980s. To help preserve the species and the economically important sport of quail hunting, the Florida Fish and Wildlife Conservation Commission (FWC) funded a study to find out why the birds' numbers were declining in a popular Florida hunting area and how to reverse the trend.

The study focused on the Cecil M. Webb Wildlife Management Area, or Webb WMA, in Charlotte County, Fla., and information gleaned from the research can be used to help sustain bobwhite populations elsewhere.

The research team, consisting of Madan Oli, an associate professor in the wildlife ecology and conservation department of UF's Institute of Food and Agricultural Sciences; Virginie Rolland, a post-doctoral research associate; Franklin Percival, leader of the Florida Cooperative Fish and Wildlife Research Unit; Tommy Hines, a retired FWC wildlife biologist; and retired University of Tennessee professor Ralph Dimmick, discovered several factors responsible for the decline and have formulated recommendations for effective management. They found that hunting at the current rate has a large negative impact on bobwhite quail populations in the Webb management area, especially during periods when rainfall is heavy. Additionally, they noted that only a small fraction of hatchlings survive to breed because they are harvested during hunting season. Prescribed burning purposefully clears away underbrush on the forest floor to enhance forest quality by encouraging new growth. The practice can help bobwhites by making room for potential food plants to grow as long as some areas of underbrush are left to provide nesting cover, the researchers said.

To better manage the quail, the researchers recommended to the FWC that bobwhite hunting be scaled back substantially to allow the population to recover. They also recommended that hunting be reduced even more during times of heavy rainfall. These recommendations could be implemented before the 2010 hunting season.

The researchers discovered their findings by combining long term field data with state-of-the-art analysis and modeling techniques. To gather the data, over 2,000 bobwhites were trapped and equipped with radios during the study period. Using radio telemetry, the birds were located every two to three days. Measurements of home range, habitat use, nesting attempts, nesting success, hatchability and predation rates were recorded. During hunting season, the recovery rate of harvested, radio-equipped bobwhites was recorded. Back on campus, collected data on survival, reproduction, harvest, weather and other factors allowed the researchers to draw conclusions about the declining population as well as develop projection models. These models will allow wildlife managers to predict population outcomes by simulating different scenarios using combinations of rainfall levels, harvesting pressure, temperature and more.

FWC officials will use the research data to make future management decisions to bring back bobwhite quail populations, Percival said.

Bobwhite quail nest with eggs.

New insect repellent could aid citrus greening battle

With citrus greening disease threatening to destroy Florida's nearly $4-10 billion citrus industry, new research has discovered an environment-friendly chemical to assist in battling the scourge.

University of Florida researchers Lukasz Stelinski and Russell Rouseff found that a chemical produced by guava trees is effective at repelling the insect that transmits citrus greening. Ebenezer Onagbola, a postdoctoral researcher, assisted with the research.

The Asian citrus psyllid transmits the bacterium *Liberibacter asiaticum* by feeding on the leaves and stems of citrus plants. Once the bacterium infects a citrus tree, the taste of the fruit is altered, and the fruit never fully ripen. Greening is fatal to citrus trees. In Florida, citrus greening first was detected in a few counties in 1998 and now is a statewide problem.

"It's certainly the most important disease affecting citrus production in Florida," said Stelinski. "And most think it's likely the most important disease affecting citrus production worldwide."

The discovery began when Rouseff, intrigued by Vietnamese farmers planting guava trees between citrus trees to repel Asian citrus psyllids, decided to find out why the practice worked.

"When I started looking at the problem, I said 'It has to be something that is not obvious,'" Rouseff said. "If it was obvious, somebody else would have already seen it and reported it."

As a food chemistry professor, Rouseff suspected that equipment and techniques he used to analyze processed citrus juice volatiles could be adopted to detect the unknown repellent. By using an air sampling device, the researcher discovered that when guava leaves are wounded, the plant releases new sulfur compounds, including dimethyl disulfide. He then conferred with Stelinski, an entomologist, who confirmed that dimethyl disulfide can affect insects.

Dr. Lukasz Stelinski, assistant professor of entomology and nematology, Citrus Research and Education Center.

Asian citrus psyllid adults (*Diaphorina citri*), feeding on citrus.

Stelinski then began looking at how the chemicals affect Asian citrus psyllid behavior. Olfactometer mazes were constructed to determine if the psyllid was attracted or repelled by chemical scents pumped into different corridors. He proved that dimethyl disulfide and related chemicals are potent repellents of Asian citrus psyllids, even in the presence of citrus. These results led to the development of a prototype formulation of the repellent, which when used in field tests in citrus groves, confirmed the laboratory results.

The new chemical repellent is an environment-friendly pesticide alternative. Lab data indicated the repellent does not affect wasps that are beneficial in citrus groves. Researchers are working to improve the duration of the chemical because current formulations only are effective for about three weeks. Stelinski said he hopes an improved version of the repellent, which could be used as part of an integrated approach to managing the Asian citrus psyllid, will be released in the near future.

The State of Florida, the Florida citrus box tax and the Florida Department of Citrus funded the research.

Mosquito larval ecology affects dengue fever transmission

Dr. Philip Lounibos, professor, Florida Medical Entomology Laboratory (FMEL), examines water from an experimental tire on the FMEL grounds for larvae and pupae of the Asian tiger mosquito.

Recent research on mosquito ecology has discovered factors that influence the transmission of a disease that affects Florida and the world – dengue fever.

Induced by the dengue virus, dengue fever annually afflicts nearly 50 million people worldwide, especially in the tropics, and cases have appeared in Florida as recently as November 2009. Symptoms include fever, headaches and severe muscle and joint pains.

The Asian tiger mosquito, *Aedes albopictus*, and the yellow fever mosquito, *Aedes aegypti*, are the most important transmitters of dengue virus. For years, yellow fever mosquitoes populated and threatened the U.S. as the main transmitter of yellow fever and dengue. However, since the accidental introduction and subsequent spread of the Asian tiger mosquito into the Southeast in the mid-1980s, yellow fever mosquito populations have decreased rapidly.

"Lots of mechanisms were postulated to explain why the arrival and spread of *Aedes albopictus* led to the demise of *Aedes aegypti*, but no compelling evidence was available for any one particular mechanism," said Philip Lounibos, a professor at the University of Florida Medical Entomology Laboratory (FMEL) in Vero Beach. The FMEL is a part of UF's Institute of Food and Agricultural Sciences.

Working with Illinois State University distinguished professor Steven Juliano, Lounibos found that competition between the two species during the larval stage is a factor in the displacement. The researchers showed that Asian tiger mosquito larvae use habitat resources more successfully and that the yellow fever mosquito larvae survive poorly in their presence. The researchers studied the mosquito larvae in aquatic containers such as water-filled tires and cemetery vases that are commonly used by the species. Correctly identifying the more widespread species can result in better prevention programs.

Lounibos found through research with Barry Alto, a former FMEL graduate student, that larval competition also results in mosquitoes becoming better hosts and transmitters, or vectors, of dengue. Past research never considered competition as a factor, Lounibos said.

The researchers monitored larval competition between the Asian tiger mosquito and the yellow fever mosquito until adulthood. They recorded size measurements, time to adulthood and survival. Adult females were given blood meals containing dengue virus using a silicone membrane feeder system. They were held for a 12-day incubation period, and survivors were individually stored at minus 80 degrees Celsius. The researchers later examined the mosquitoes to determine the amount of dengue virus infection.

Mosquitoes that faced intense competition in the larval stage were smaller and became better dengue vectors, the researchers discovered. Alto and Lounibos hypothesized that smaller mosquitoes emerged with fewer internal defenses, such as a midgut barrier, which can help block viral passage.

The findings could prompt future studies into the larval environment's impact on the transmission of other vector-borne diseases such as malaria or filariasis, Lounibos said.

The National Institute of Allergies and Infectious Diseases and the Fogarty International Center, both part of the U.S. National Institutes of Health, funded the research.

A bloodfed female Aedes albopictus, now the most common day-biting mosquito in much of Florida. **PHOTO BY LE MUNSTERMANN, YALE UNIVERSITY**

New species of lady beetle may help control cycad scales

Controlling a major Florida landscape pest may become easier thanks to a recent discovery by a University of Florida researcher.

Ronald Cave, an associate professor of entomology at UF's Indian River Research and Education Center in Fort Pierce, discovered a new species of lady beetle whose specialty is feeding on cycad aulacaspis scales.

The cycad aulacaspis scale, which appeared in Florida in 1996, infects the popular cycad tree and causes unsightly damage to leaves. The insects usually appear in large numbers, and infestations often kill the tree. Current pest management strategies do not provide adequate control.

Cycads are prized in urban landscapes for their unique beauty and low maintenance requirements. Due to their slow growth, large ones can become quite valuable.

Cave is now petitioning the U.S. Department of Agriculture's Animal and Plant Health Inspection Service (APHIS) to release the lady beetle for the biological control of the cycad aulacaspis scale. Approval could take more than a year, Cave said.

An important component of petitioning for a biological control release is determining what the organism eats. To establish this, Cave and Ru Nguyen, an entomologist with the Florida Department of Agriculture and Consumer Services, conducted non-target studies using many different organisms as potential food sources. In the tests, lady beetles weren't fed for 24 hours. Then they were placed in separate petri dishes, each containing a potential prey organism such as an aphid, psyllid or scale. The researchers found that by far, the lady beetle's preferred food was armored scales, such as the cycad aulacaspis scale. The study results indicate the new lady beetle is host specific, meaning it only feeds on one type of organism. This fact helps support the petition for release.

Adult *Phaenochilus* n. sp. feeding on cycad aulacaspis scales.

Dr. Ronald Cave, associate professor of entomology, examines a cycad for *Phaenochilus* n. sp. in quarantine at the Indian River Research and Education Center's Hayslip Biological Control Research and Containment Laboratory.

"It's such a voracious predator of the scale," Cave said. "Our problem in the lab was giving it enough food. Sometimes we didn't have enough cycad scales to give all the beetles all the food they need. They just eat so many scales and so quickly."

In 2007, Cave and Nguyen were looking for the scale's natural enemies in cycads in Asian countries where previous biological control agents had been found. After searching through cycad plants in Thailand, the researchers eventually found an orange lady beetle that was feeding on cycad aulacaspis scales. They brought it back to be reared in quarantine facilities in Fort Pierce and Gainesville. They also sent specimens to the USDA's Systematic Entomology Laboratory where the insect was identified as being in the genus *Phaenochilus* and as an undescribed species.

Cave said the lady beetle could be used to control scales in other countries, such as Guam, where the native cycad is being devastated by the cycad aulacaspis scale.

The Indian River REC is part of UF's Institute of Food and Agricultural Sciences. APHIS funded the research.

Research finds noninvasive nandina varieties

Dr. Gary Knox, professor of environmental horticulture, North Florida Research and Education Center, kneels behind the colorful winter foliage of Firepower nandina, a dwarf type recently discovered to be noninvasive in Florida.

Invasive organisms are typically nonnative species that can disrupt local ecosystems. However, a new study has found that a popular but invasive plant, the nandina, actually has some noninvasive varieties – making them safe for Florida landscapes.

Gary Knox, an Extension specialist and environmental horticulture professor at the North Florida Research and Education Center in Quincy, researched the nandina's invasive potential in Florida. He found that the varieties Firepower and Harbour Dwarf, while part of the invasive nandina genus, can be safely grown in landscapes and sold by Florida nurseries.

Firepower earned its name because its leaves turn brilliant shades of red and orange with yellow highlights during cool winter temperatures. Harbour Dwarf is so-called because it is a compact and dense version of a regular nandina, with only about a third of the height. Nandinas, valued in landscapes for their beauty and toughness, are native to Asia.

Collaborating with Knox on the research was Sandra Wilson, an environmental horticulture associate professor at the Indian River Research and Education Center in Fort Pierce. The research and education centers are part of the University of Florida's Institute of Food and Agricultural Sciences.

Working with funding from the Florida Department of Environmental Protection and the Florida Nursery, Growers and Landscape Association, the researchers planted 44 varieties of nandinas in North and South Florida to test the plants' likelihood to flower and produce viable seed. These traits are important because plants that produce more seed are more likely to escape into the wild. The plants used were varieties common to the nursery market. Researchers assessed the plants' visual quality and growth throughout the two-year study. After the plants flowered, seeds were collected, and Wilson evaluated their viability and tested their germination potential. Upon completing the study, the researchers determined Firepower and Harbour Dwarf were least likely to become problematic in the state due to their low fruiting potential. The researchers also noted differences in locations, as nandinas grown in the South Florida climate bore less seed than those in North Florida.

"As it turns out, nandinas do not seem to be as invasive in South Florida as they are in North Florida," Knox said.

The researchers used the Infraspecific Taxon Protocol, a tool developed by UF/IFAS to evaluate invasiveness, to guide their research. The protocol uses a series of questions and answers to determine a plant's invasive potential.

The study's findings allow homeowners, landscapers and nursery owners to use Firepower and Harbour Dwarf safely. The varieties will not escape into Florida's natural areas and force the need for herbicide control, Knox said.

"It is very important to the function of our natural ecosystems to maintain the diversity of plants that we have already," Knox said. "Introducing nonnative plants can displace our natives, and we can end up losing some of them."

The standard type of nandina, shown here, is a nonnative ornamental plant. Its bright red berries are eaten by wildlife, which spread the plants into Florida's natural areas. UF research found that some new types of nandina are not invasive.

Bacterium discovered to control golf course pest

The discovery of a new bacterium has led to a green solution for controlling microscopic roundworms that damage golf course turfgrass.

The bacterium, Candidatus Pasteuria usgae, specifically attacks and kills underground roundworms known as sting nematodes. These worms feed on roots and lead to plant discoloration, disease and often death. Sting nematode damage is a multimillion dollar problem for Florida golf courses, and past control options have been limited, expensive and toxic.

Robin Giblin-Davis, nematology professor and interim associate director for UF's Fort Lauderdale Research and Education Center, discovered the bacterium while sampling golf course soil for nematodes.

"While I was doing survey work, in a few golf areas in South Florida, there seemed to be something that was attached to the sting nematodes," he said.

Giblin-Davis identified the organism as a new species of bacterium. To do this, he used ultra-structural techniques in which nematodes displaying different bacterial infection stages were preserved and sectioned into ultra-thin components. The researcher then stained the organisms with heavy metals and viewed them through an electron microscope to describe developmental, reproductive and physical characteristics. Through further research, Giblin-Davis and his collaborators discovered that the bacterium only infects sting nematodes and must do so to complete its life cycle.

Giblin-Davis also tested the bacterium by inoculating sting nematode-infested golf courses. He documented that a relatively small amount of soil inoculum reduced sting nematode densities to low, and in some cases, undetectable levels over a period of 13 to 18 months.

Scanning electron micrograph of a sting nematode male (*Belonolaimus longicaudatus*) encumbered by the new pathogenic bacterium, *Candidatus Pasteuria usgae*, named for the United States Golf Association.

Drs. Dorota Porazinska, courtesy assistant professor, and Robin Giblin-Davis, professor, Fort Lauderdale Research and Education Center, study roots of a plant damaged by microscopic plant-parasitic nematodes (roundworms).

To produce the bacterium on a commercial scale, a Gainesville-based company, Pasteuria Bioscience, Inc., developed a new mass cultivation method. The company released the bacterium to the public in February 2010 as a product called Econem™. The product is a bio-nematicide that is an environmentally safe way to control sting nematodes in turfgrass.

The researcher said unlike current treatments for sting nematodes, the bionematicide can be reapplied if needed and is not a risk to golfers or residents near courses.

"Up until now, the kinds of things we've had available for control for nematodes, or mitigating the damage of nematodes in turf ecosystems, have been relegated to very toxic materials," Giblin-Davis said. "And with the advent of this bionematicide, we are moving forward into a greener environment."

The product is specific to treating sting nematodes and does not attack other turfgrass pests such as lance nematodes and root-knot nematodes. However, Giblin-Davis said current research into different Pasteuria bacteria species may lead to future products for lance and root-knot control.

The Fort Lauderdale REC is part of UF's Institute of Food and Agricultural Sciences. The U.S. Golf Association funded Giblin-Davis' research.

UF releases high-yielding subtropical bahiagrass

Dr. Ann Blount, associate professor of agronomy, North Florida Research and Education Center, displays UF-Riata during the official IFAS release of the new grass during a program to honor the late UF Extension agent Ed Finlayson, a pioneer in promoting bahiagrass as a forage grass for the southern U.S.

With the development of a new bahiagrass variety from the University of Florida, winter pastures in the south are now greener!

UF-Riata offers increased yields and better cold tolerance than other bahiagrasses. Current varieties in the Southeast incur yield losses as available daylight declines in late fall and early spring. UF-Riata, however, continues to grow as the days grow shorter, until a substantial frost. While the major users of bahiagrass include the beef and equine industries, grazing dairies are reevaluating the grass as a potential forage in their rotational grazing systems.

"In all our trials that we've done so far, UF-Riata will give you a 10 percent or greater increase in yield over Tifton 9," says Ann Blount, the plant breeder who developed UF-Riata.

UF-Riata also out-yields the most popular bahiagrasses in Florida – Pensacola and Argentine, Blount said. Additionally, the variety offers deep rooting and some improved disease resistance to dollar spot.

Blount is a forage breeding and genetics associate professor at UF's North Florida Research and Education Center in Marianna. Working with her on the project were Thomas Sinclair, a crop physiologist in UF's agronomy department, Paul Mislevy, professor emeritus at UF's Range Cattle Research and Education Center in Ona; and Ken Quesenberry, a plant breeding and genetics professor and assistant chair of the agronomy department.

To develop UF-Riata, Blount started with bahiagrass seed collected throughout the southern U.S. and from populations from Dr. Glenn Burton, a USDA-ARS scientist at the Coastal Plain Experiment Station in Tifton, Ga.

UF researchers used relay breeding between two locations in Florida to evaluate photoperiod and cold response in the new population that they were selecting. Cold tolerance testing was done in North Florida at Marianna and winter growth was evaluated at Ona, Florida. During the winter months when crossing is done in the greenhouse, Blount used artificial light to trick the plants into flowering as if it was summertime. Selecting the top 20 percent of the plants each year and only crossing the very best plants in the greenhouse eventually lead to the final population, UF-Riata. The University of Florida released UF-Riata in 2007. Seed is now available for planting in the Southeastern U.S.

Blount cautions that pastures of UF- Riata should be rotationally grazed and that overgrazing is not recommended. UF-Riata, like Tifton 9, has a more upright growth habit than Pensacola and if not properly managed under grazing, stand losses might occur.

"With UF-Riata, you get the benefit of increasing your yield, but at the cost of not being able to abuse the plant," Blount said. "It takes more management, but basically the management is the same as Tifton 9."

Blount said UF-Riata may be grown in subtropical regions in the southeast U.S. and in other parts of the world including Japan, India, Australia, Southern Brazil and Argentina.

The Research and Education Centers at Marianna and Ona are part of UF's Institute of Food and Agricultural Sciences.

Co-developer Dr. Ken Quesenberry, professor, Department of Agronomy, teaches plant breeding students about the bahiagrass research that led to the development of UF-Riata.

Flavorful, healthy Tasti-Lee™ tomato released

Consumers who love tomatoes may soon have a flavorful and nutritious new choice with the release of Tasti-Lee™ by the University of Florida.

Tasti-Lee tomatoes offer excellent flavor, deep red inner fruit and around 25 percent more of the healthy compound lycopene than ordinary varieties. Lycopene is an antioxidant that may protect body cells from damage.

"I think the strength of the variety is the ability to produce tomatoes with good flavor over a wide range of environments," said J.W. Scott, the plant breeder who developed Tasti-Lee™.

Scott is a horticultural sciences professor at UF's Gulf Coast Research and Education Center in Wimauma. He bred Tasti-Lee™ to help field-tomato growers compete with greenhouse tomatoes in the supermarket. Consumers often choose greenhouse tomatoes because of their color, fresh appearance and perceived better taste.

Scott started development in the late 1990s using a tomato line that emerged from heat tolerance tests with a noticeably sweet flavor. He recorded the line, known as Florida 7907, as a potential parent for making better flavored tomatoes.

Later, during trials to increase firmness, Scott found a line, Florida 8059, that had firmness and full flavor, two traits not often found together. In 2002, Scott crossed Florida 7907 and 8059 and planted their hybrid offspring. During variety trials, Scott found the hybrid had superior flavor. Combining the best traits of its parents, this variety would eventually be called Tasti-Lee™, in honor of Scott's late mother-in-law, whose name was Lee.

Display of branded Tasti-Lee™ tomatoes being sold at a Whole Foods supermarket. It is hoped that the variety will be more widely available in the near future.

Dr. J.W. Scott, professor of horticultural sciences, Gulf Coast Research and Education Center, examines Tasti-Lee™ tomato crop growing in a recent variety trial.

During the next four years, the variety went through yield trials and seven taste panels.

"The variety came out consistently well, more consistent than any variety I had seen before," Scott said. "So that was kind of the stimulus to go ahead and release the variety."

UF released Tasti-Lee™ in 2006, and seed is available from its exclusive producer, Bejo Seeds, Inc.

Scott hopes the new variety will increase consumption of Florida tomatoes and provide more market share for the state's field-tomato producers. He said low germination issues in the seed gave the variety a slow start shortly after its release, but by mid-2010, there should be plenty of high germinating seed available. Some Tasti-Lee™ tomatoes grown by a Florida producer already have appeared in Whole Food grocery stores in the state, Scott said.

Collaborators who helped develop Tasti-Lee™ include Liz Baldwin, a horticulturist with the U.S. Department of Agriculture in Winter Haven; Jeff Brecht and Harry Klee, a postharvest physiologist and a molecular biology professor in the horticultural sciences department, respectively; Steve Olson, a horticultural sciences professor at the North Florida Research and Education Center; Jerry Bartz, a plant pathology associate professor and Charles Sims, a professor in the food science and human nutrition department.

Research Foundation Professors (UFRF)

ADEGBOLA ADESOGAN, PH.D.

Associate Professor of Animal Sciences

Adegbola Adesogan is an internationally recognized ruminant nutritionist whose basic and applied research efforts have focused on using forages and feed additives to improve the quality, safety and shelf life of animal feeds and the efficiency of livestock production.

His research has focused on using fibrolytic enzymes to improve highly productive but poorly digested tropical grasses in Florida and several tropical/subtropical countries. Adesogan showed that application of a certain fibrolytic enzyme to tropical grasses during haymaking improved their intake and digestion by beef cattle substantially. The enzyme treatment proved to be as effective as ammoniation, the conventional treatment method, but was less hazardous and environmentally harmful.

A second major research area developed by Adesogan involves using bacterial inoculants to improve the fermentation, quality and shelf life of fermented animal feeds (silages). Adesogan's early work showed that although Lactobacillus buchneri could be used to improve the shelf life of silages and prevent the growth of mycotoxin-producing molds, it also resulted in nutrient losses. Subsequent experiments showed that the addition of homolactic bacteria to L. buchneri in inoculants prevented the nutrient losses while maintaining the beneficial effects on shelf life and mold inhibition. These studies culminated in the commercialization of microbial inoculant preparations that are now marketed in U.S. and Europe for preservation of fermented animal feeds.

Because of his work, he has been an invited speaker at various national and international conferences and over 40 researchers from Egypt, Jamaica, Nigeria, Peru, South Korea, and Guyana have visited his laboratory for short-term training in the last five years.

Adesogan's research program was recognized by the American Dairy Science Association with his receipt of the 2007 American Dairy Science Association Pioneer Hi-Bred International Inc. Forage Award for significant research contribution in the areas of forage production, processing, storage, and utilization.

EMILIO M. BRUNA, PH.D.

Associate Professor of Wildlife Ecology and Conservation

Emilio Bruna strives to understand the impact of human activities on tropical ecosystems. Much of his work is conducted in the Amazonian rain forest and the Brazilian savannas known as the Cerrado. Understanding the inherent complexity of these ecosystems and investigating the consequences of the myriad threats they face requires creative, multidisciplinary and collaborative approaches.

Many studies have found that plant species go extinct in the fragments of forest that remain following deforestation. Although the mechanisms responsible for these extinctions are usually unknown, reductions in seedling establishment are thought to be among the most important. Bruna and his collaborators found that reduced recruitment could indeed lead to population declines. However, they also found that elevated seed dispersal by birds into forest fragments appeared to help populations overcome the negative consequences of isolation. With support from the National Science Foundation, Bruna and his colleagues are integrating detailed data on plant reproduction, the diet and movements of birds, and genetic paternity analyses. They expect their research will help resolve whether seedling abundance is limited by the availability of suitable habitat or the abundance of seed dispersers.

The combustion of fossil fuels and the application of chemical fertilizers have more than doubled the quantity of nitrogen in terrestrial ecosystems. This increase can have profound consequences for ecosystems, but how it influences plant populations remains unknown. With support from NSF and the Packard Foundation, Bruna and his collaborators are investigating how nitrogen enhancement influences plant populations and communities in the Cerrado. Furthermore, anthropogenic nitrogen deposition is widely recognized as an emerging threat to ecosystems throughout the developing world – one that is likely to worsen as the global demand for biofuels increases. Because the Cerrado is an increasingly important producer of sugarcane used for ethanol, this work will also have important implications for conservation in this region.

JEAN-PIERRE EMOND, PH.D.

Professor of Agricultural and Biological Engineering

Jean-Pierre Emond's research in areas such as packaging, cold chain management and tracking technologies and transportation modes are essential to ensuring the quality and safety of food and pharmaceutical products. In the last five years, Emond has secured more than $8.5M in research,which has funded 16 graduate students, six of them at the Ph.D. level. He has published 23 articles and book chapters and has been an invited speaker at more than 30 local, national and international events.

Currently, Emond is the Principal Scientific Advisor for the International Cool Chain Association (CCA) and International Air Transport Association (IATA), an organization including 97 percent of all airlines. He is also the Principal Scientific Supervisor for the Canadian government and Food Mail, a program that provides the transportation of nutritious food to 70,000 people in 80 communities across the Northern and Arctic regions of Canada.

As the Founder and Director of the Food and Pharmaceutical Products RFID Laboratory, Emond supervises projects dealing with everything from the tracking of foods being shipped to retail stores to monitoring temperatures of pharmaceutical products via satellite. He is a founding member of the Global RF Lab Alliance (GRFLA), which collaborates with the top 10 RFID labs in the U.S., Europe and Asia. He is also a founding member of the editing board for the International Journal of RF Technologies: Research and Applications. Currently, he is leading the RFID sector of a $4.1M project with the U.S. Department of Defense to monitor the supply chain of military rations using RFID.

Among Emond's other accomplishments are co-founding the University of Florida/IFAS Center for Food Distribution and Retailing (CFDR), and hosting the University of Florida Academic Pharmaceutical Cold Chain Conference, which brings together leading pharmaceutical companies to learn the newest breakthroughs in cold chain management.

ZHENLI L. HE, PH.D.

Associate Professor of Soil and Water Science

The development of agriculture in harmony with the environment is the continuing research goal of Zhenli He. Agriculture is the chief suspected nonpoint pollution source leading to the eutrophication of surface water and the degradation of native ecosystems in Florida. Fertilizer applications and irrigation used to achieve desired crop yields and fruit quality often result in the runoff and leaching of unused nutrients or chemicals.

Therefore, research is needed to develop scientifically sustainable agriculture practices that also protect our environment. It is essential that we minimize the transport of nutrients, heavy metals, and pesticides from land to waters, using phytoremediation integrated with natural and man-made wetlands to filter nutrients or contaminants in stormwater before it is discharged to surface water systems. He has worked closely with federal and state agencies and industry to develop such technologies. The phosphorus slow-release fertilizers He developed by combining dolomite phosphate rock, a waste from phosphate mining, with sewage sludge (biosolids) can meet phosphorus (P) requirements for crops while significantly reducing P loss in surface runoff.

He's studies also demonstrate that Ca-water treatment residuals (Ca-WTR) are useful in acidic soils to reduce P loading in surface runoff while improving crop yield and quality. By using Ca-WTR, which is clean and safe, instead of limestone, growers can reduce production costs, water their crops, and minimize disposal costs.

He's research has also developed new phytoremediation technologies for water detention systems and stormwater treatment areas. Results indicate that water lettuce can be useful in remediating eutrophic water in a confined environment, such as a detention system, as it can remove both nutrients (N, P) and contaminants such as heavy metals and pesticides.

Research Foundation Professors (UFRF)

ANDREW V. OGRAM, PH.D.

Professor of Soil and Water Science

Andrew Ogram's research is focused on understanding how ecosystems respond to human impacts through changes in the structure and function of soil microbial communities. The work produced by his laboratory has transformed current concepts of the ways that southern wetlands function and how they differ from other wetlands.

Ogram's contributions to the study of microbial controls on wetland biogeochemistry have been recognized internationally and locally. He has been invited to present his work at several international conferences and has delivered a keynote lecture at the International Association of Landscape Ecology. He has organized symposia on microbial ecology at international ecology and biogeochemistry conferences in Europe and the U.S., and has presented lectures in the U.S., Europe and Asia.

Ogram has served on review panels for the National Science Foundation, the Water Environment Research Foundation, and the U.S. Department of Energy. His contributions to the American Society for Microbiology (ASM) include membership on the editorial board of Applied and Environmental Microbiology, and he convened and chaired a symposium on alternative routes to methanogenesis at the 2008 General Meeting of the ASM. He has been awarded two ASM Indo-U.S. Professorships for organizing and conducting short courses with Indian colleagues. In addition, he is a member of the editorial board of one of the premier methods journal in his field, Journal of Microbiological Methods.

Ogram is committed to education and mentoring students, who have received departmental awards for excellence in graduate studies at both the Ph.D. and M.S. levels. He has been active in international education, and is currently mentoring one of the first three University of Florida distance education graduate students in Africa. His students and postdocs have excelled since leaving the University of Florida, serving on the faculties of universities in the U.S. and abroad.

NAN-YAO SU, PH.D.

Professor of Entomology and Nematology

Nan-Yao Su is recognized internationally as an authority on termites and is known for his innovative approach to the management of their population. He has authored and co-authored over 180 peer-reviewed articles on termite biology and control. His research results on the population ecology of subterranean termites and slow-acting toxicants led to the development of a monitoring-baiting system for termite population control. Commercialized as the Sentricon system, it has been marketed in 18 countries since 1995 to protect over two million homes, and is widely used in historic monuments.

The Sentricon system received the Presidential Green Chemistry Challenge Award by the U.S.Environmental Protection Agency in 2000. Su has also served as a consultant for the Hong Kong government to draft control guidelines for termite control, as an advisory member for the Termite Forum of the Ministry of Agriculture and Forestry, New Zealand, and is currently the chief technical advisor for the Chinese Environmental Protection Agency. For his achievements, he received the U.S. Secretary of Agriculture's Honor Award for Individual Achievement in Research in 1996 and the Urban Entomology Award by the Entomological Society of America in 2001. In 2007, he was honored as the Distinguished Alumnus of the Year by the University of Hawaii, and was elected a Fellow of the Entomological Society of America. He is the recipient of the Distinguished Achievement Award in Urban Entomology 2008. In 2009, he established the Nan-Yao Su Award for Innovation and Creativity in Entomology of the Entomological Society of America.

Since the development of the Sentricon system, Su's research has focused on more fundamental aspects of termite behaviors. Recognizing the key to better control strategies lies in the understanding of termite foraging behavior, he has conducted a series of studies to examine the characteristic branching geometry of termite tunneling structures.

Richard L. Jones **New Faculty Research Awardees**

DR. RICHARD JONES

DR. MATIAS KIRST

DR. KATI MIGLIACCIO

We hold our future in the energy, commitment and dreams of our youngest faculty. To honor them, UF/IFAS presented the second annual Richard L. Jones Outstanding New Faculty Research Award at the May 12, 2009 Florida Agricultural Experiment Station Awards ceremony. This competitive research award is presented to untenured faculty who have begun developing a distinguished record of research. The purpose of this award is to recognize research program development and recent contributions, and to provide incentives for continued excellence in research.

DR. RICHARD JONES served as Dean for Research from 1995 to 2004. In recognition of his outstanding service to the Experiment Station and to UF/IFAS, the award was endowed and initiated in his name. This year's awardees were Dr. Matias Kirst and Dr. Kati W. Migliaccio.

DR. MATIAS KIRST is an assistant professor in the School of Forest Resources and Conservation. Kirst represents the leading edge of UF/IFAS research in natural resources – a critical area where UF/IFAS science makes a difference. He's garnered nearly $4 million in grants, currently mentors four graduate students and a post-doc, and has published in prestigious journals such as Genetics, the Journal of Heredity and Science. His comprehensive research program is off to a strong and productive start.

His research areas include:

- Quantitative genetics and tree breeding
- Genomics of tree species
- Genomic technology and analysis methods

Some recent projects:

- Genomic mechanisms of carbon allocation and partitioning in poplar.
- Association genetics of natural genetic diversity and complex traits in pine.
- Genes for more efficient land use and conversion of forest trees into wood products.
- Genetic diversity contribution to errors in short-oligonucleotide microarray analysis.

DR. KATI MIGLIACCIO is an assistant professor in the Department of Agricultural and Biological Engineering. Located at the Tropical Research and Education Center in Homestead, Migliaccio's water sciences research program is off to an excellent start with five graduate students and over half a million dollars in grants. She has published in prestigious journals such as Water Resources Research, Hydrologic Engineering and the Journal of Environmental Quality.

Some of her research areas include:

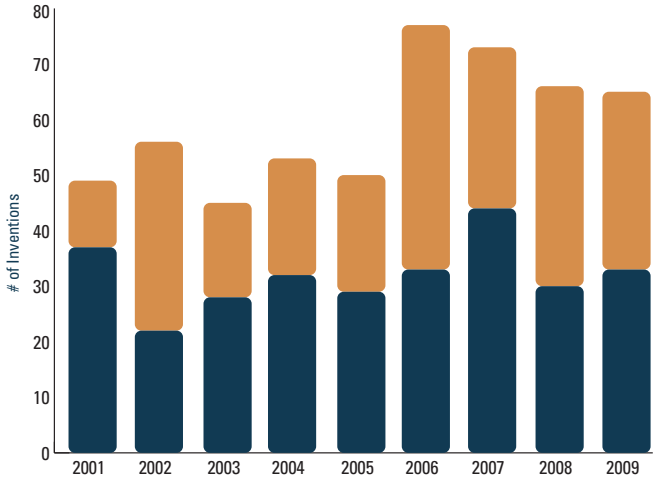
- GIS and watershed modeling
- Water conservation
- Water quality
- Irrigation

Some recent projects:

- Characterization and analysis of water quality data in the Indian River Lagoon.
- Assessment of water savings using soil moisture sensors in residential areas.
- Biscayne Bay watershed water quality analysis.
- Spatial distributions and stochastic parameter influences in SWAT flow and sediment predictions.

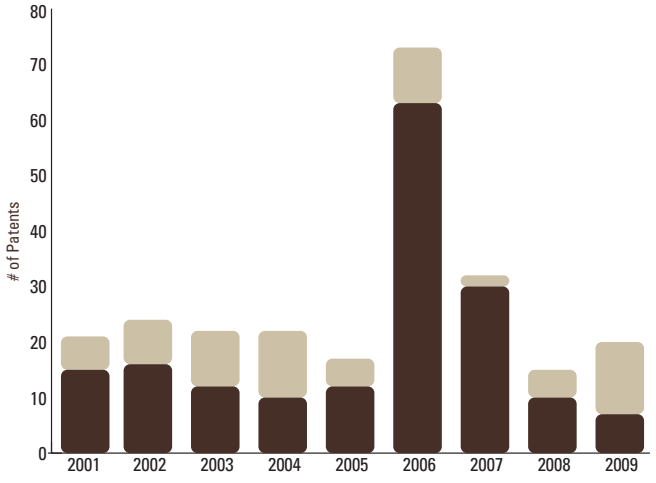
IFAS Patents and Licenses

IFAS Inventions



Fiscal Year	OTL Invention Disclosures	FFSP Cultivar Releases	TOTAL
2001	37	12	49
2002	22	34	56
2003	28	17	45
2004	32	21	53
2005	29	21	50
2006	33	44	77
2007	44	29	73
2008	30	36	66
2009	33	32	65
TOTAL	288	246	534

IFAS U.S. Patents Issued



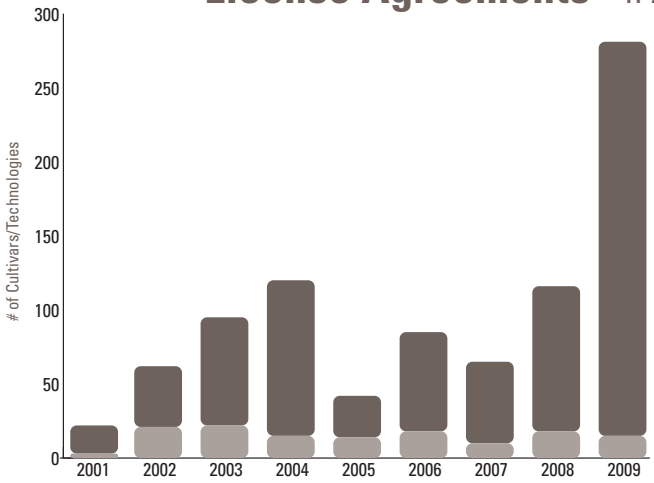
Fiscal Year	OTL Patents Issued	FFSP Plant Patents/ PVPs/ TMs Issued	TOTAL
2001	15	6	21
2002	16	8	24
2003	12	10	22
2004	10	12	22
2005	12	5	17
2006	63	10	73
2007	30	2	32
2008	10	5	15
2009	7	13	20
TOTAL	175	71	246

JOHN C. BEUTTENMULLER Assistant Director, Research Programs

UF/IFAS faculty and plant breeders currently work in over 40 different crop areas. John C. Beuttenmuller, Germplasm Manager for the Florida Agricultural Experiment Station (FAES) and the Intellectual Property and Licensing Director for Florida Foundation Seed Producers, Inc. (FFSP), is responsible for the marketing and licensing of all germplasm discovered and developed in the experiment station. FFSP and UF's Office of Technology and Licensing (OTL) facilitate invention and technology transfer to the agriculture industry. The majority of plant germplasm and inventions developed at UF/IFAS are protected through the U.S. Patent and Trademark Office and/or the USDA's Plant Variety Protection Office. All U.S. plant patents, plant variety protection certificates, and international plant breeder's rights certificates are managed and licensed by FFSP using an Invitation to Negotiate (ITN) process. All U.S. utility patents are managed and licensed by OTL. FFSP and OTL work collaboratively in the management of inventions that are licensed under multiple forms of intellectual property protection.

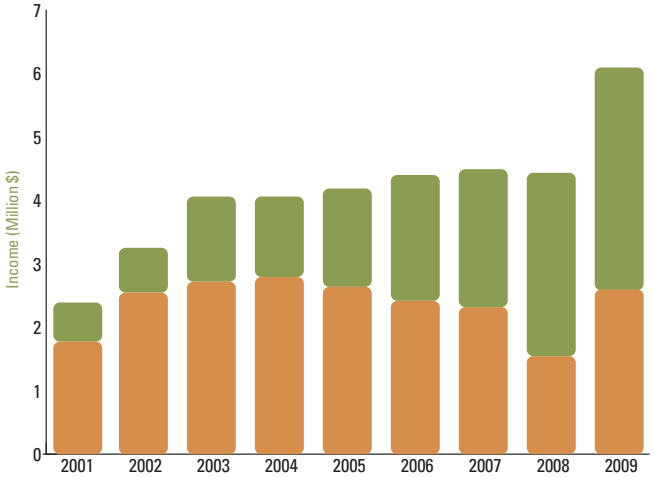
Over the past year, FAES has released 33 plant cultivars, and OTL reported 33 invention disclosures from UF/IFAS faculty. IFAS revenue from licensed inventions was over $6.4 million

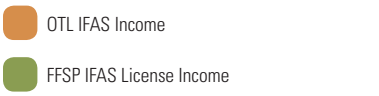
License Agreements - IFAS Technologies



Fiscal Year	OTL Licenses	FFSP Cultivars Licensed	TOTAL
2001	3	19	22
2002	21	41	62
2003	22	73	95
2004	15	105	120
2005	14	28	42
2006	18	67	85
2007	10	55	65
2008	18	98	116
2009	15	266	281
TOTAL	**136**	**752**	**888**

License Revenues - IFAS Technologies





Fiscal Year	OTL IFAS Income	FFSP IFAS License Income	TOTAL ($)
2001	$1,772,585	$616,953	$2,389,537.81
2002	$2,545,765	$705,805	$3,251,570.13
2003	$2,716,928	$1,341,354	$4,058,282.04
2004	$2,789,435	$1,269,660	$4,059,095.36
2005	$2,635,258	$1,549,547	$4,184,804.86
2006	$2,415,470	$1,982,585	$4,398,055.00
2007	$2,316,242	$2,172,482	$4,488,724.46
2008	$1,543,030	$2,888,456	$4,431,485.66
2009	$2,593,607	$3,509,952	$6,103,558.91
TOTAL	**$21,328,320**	**$16,036,794**	**$37,365,114.23**

in 2008-2009 and over $26.6 million in the past five years. IFAS research programs continue to benefit and grow because of technology transfer with private/commercial company partners.

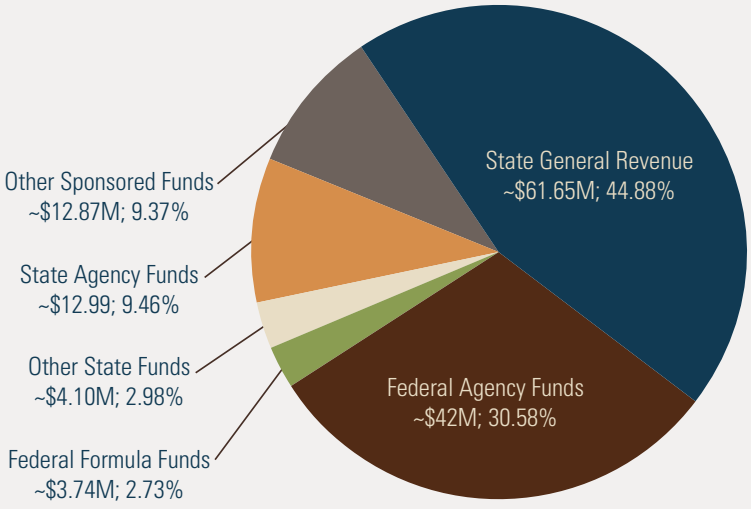
FAES has been extraordinarily successful in directing and maintaining world-class plant breeding programs in support of Florida agriculture. Much of this success can be attributed to the financial support which FAES breeding programs receive from FFSP's licensing of released cultivars. FAES is proud to maintain one of the most aggressive reinvestment programs for royalties generated from cultivars released by FAES, with 70 percent of revenues going back to the developing breeding program. The FAES strawberry breeding program, under the direction of Dr. Craig Chandler, has developed new strawberry varieties that have fueled the expansion of the Florida strawberry industry and have allowed Florida strawberry growers to remain competitive in a global marketplace. As a result of the commercial success of strawberry varieties developed by Dr. Chandler, licensing revenues provided by FFSP back to the FAES strawberry breeding program have allowed Dr. Chandler to run an active, multifaceted research and development program. "Without the regular stream of royalties into the strawberry breeding program, there would not be a continuing output of new cultivars," says Dr. Chandler. "The 70 percent royalty distribution has been absolutely essential to my success and that of the FAES strawberry breeding program."

Director's Financial Report

EXPENDITURES BY SOURCE OF FUND

State Fiscal Year 2008-2009

(NOTE: This is not an accounting document)



CATEGORY Source of Funds	Expenditure	Total
Federal Formula Funds		
Animal Health	$0.05M	
Hatch	$1.82M	
IFAS Smith Lever	$0.71M	
Mult-State	$0.41M	
McIntire-Stennis	$0.75M	
		~$3.74M
State General Revenue		
General Revenue	$61.65M	
		~$61.65M
Federal Agency Funds		
Federal Flow Through – State of Florida Agencies	$0.44M	
National Aeronautics and Space Administration (NASA)	$0.80M	
National Institutes of Health (NIH)	$4.00M	
National Science Foundation (NSF)	$4.96M	
U.S. Army	$3.09M	
U.S. Department of Agriculture (USDA)	$19.72M	
U.S. Department of Commerce	$1.10M	
U.S. Department of Energy	$2.60M	
U.S. Department of Interior	$3.31M	
U.S. Environmental Protection Agency (EPA)	$1.31M	
All Other Federal Agencies	$0.67M	
		~$42.00

CATEGORY Source of Funds	Expenditure	Total
State Agency Funds		
Florida Department of Agriculture and Consumer Services (FDACS)	$6.90M	
Florida Department of Citrus (FDOC)	$1.55M	
Florida Department of Environmental Protection (FDEP)	$2.31M	
Florida Department of Transportation	$0.28M	
Florida Fish and Wildlife Conservation Commission	$1.91M	
All Other State Agencies	$0.04M	
		~$12.99M
Other State Funds		
Water Management Districts	$3.86M	
Other	$0.24M	
		~$4.10M
Other Sponsored Funds		
Counties	$2.07M	
Foreign Governments	$0.09M	
Foreign – Other	$0.33M	
Foundations	$1.51M	
Corporations	$3.47M	
Miscellaneous – Other	$1.73M	
Non-Profit Organizations	$2.23M	
University of Florida Research Foundation (UFRF)	$1.44M	
		~$12.87M
GRAND TOTAL		**~$137.35M**

Research Awards FY 2008-2009

SUMMARY OF IFAS-SPONSORED RESEARCH ACTIVITY

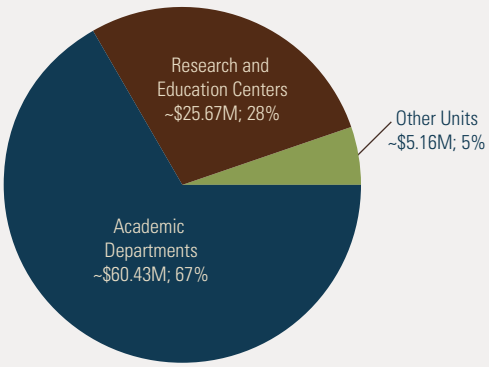
Proposals Submitted	1,296
Awards Received	938
New Awards	681
Renewals	20
Continuations/Supplementals	237

Total Research Awards for FY 08-09

~$91.26M

IFAS Sponsored Research Awards by Unit

(~$91.26M Total)



Academic Departments ~$60.43M; 67%

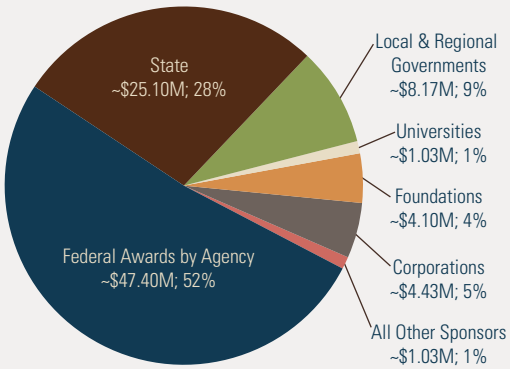
Agricultural and Biological Engineering	$3.98M
Agricultural Education and Communication	$0.04M
Agronomy	$2.33M
Animal Science	$0.87M
Aquatic and Invasive Plants	$1.22M
Entomology and Nematology	$2.67M
Environmental Horticulture	$1.28M
Family Youth and Community Sciences	$8.48M
Food and Resource Economics	$0.84M
Food Science and Human Nutrition	$5.00M
Forest Resources and Conservation	$6.24M
Horticultural Sciences	$10.24M
Microbiology and Cell Science	$8.12M
Plant Pathology	$2.53M
Soil and Water Sciences	$3.18M
Statistics	$0.33M
Wildlife Ecology and Conservation	$3.08M

Research and Education Centers ~$25.67M; 28%

Citrus	$10.43M
Everglades	$1.02M
Florida Medical Entomology Lab	$0.96M
Ft. Lauderdale	$1.42M
Gulf Coast	$1.38M
Indian River	$3.56M
Mid Florida	$0.68M
North Florida	$2.01M
Range Cattle	$0.27M
Southwest Florida	$1.88M
Tropical	$1.85M
West Florida	$0.21M

Other Units ~$5.16M; 5%

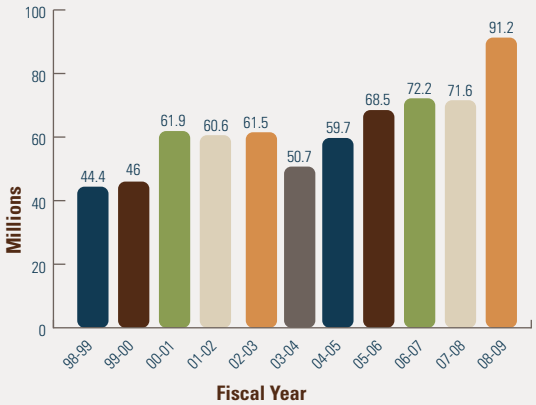
IFAS Research Awards by Sponsor



Federal Awards by Agency ~$47.40M, 52%

National Aeronautics and Space Administration	$0.99M
National Science Foundation	$4.15M
U.S. Department of Agriculture	$22.74M
U.S. Department of Commerce	$1.54M
U.S. Department of Defense	$5.67M
U.S. Department of Energy	$1.73M
U.S. Department of Health and Human Services	$4.62M
U.S. Department of Interior	$2.71M
U.S. Environmental Protection Agency	$2.54M
Other Federal Agencies	~$0.71M

IFAS Sponsored Research Awards



UF/IFAS Statewide Research and Education Network

ACADEMIC DEPARTMENTS
(GAINESVILLE, FL)

Agricultural and Biological Engineering
Agricultural Education and Communication
Agronomy
Animal Sciences
Entomology and Nematology
Environmental Horticulture
Family, Youth and Community Sciences
Food and Resource Economics
Food Science and Human Nutrition
Horticultural Sciences
Microbiology and Cell Science
Plant Pathology
Soil and Water Science
Statistics
Wildlife Ecology and Conservation

ACADEMIC SCHOOLS

School of Forest Resources and Conservation
School of Natural Resources and Environment
- Academic Programs
- Research and Outreach/Extension

GRADUATE RESEARCH PROGRAMS

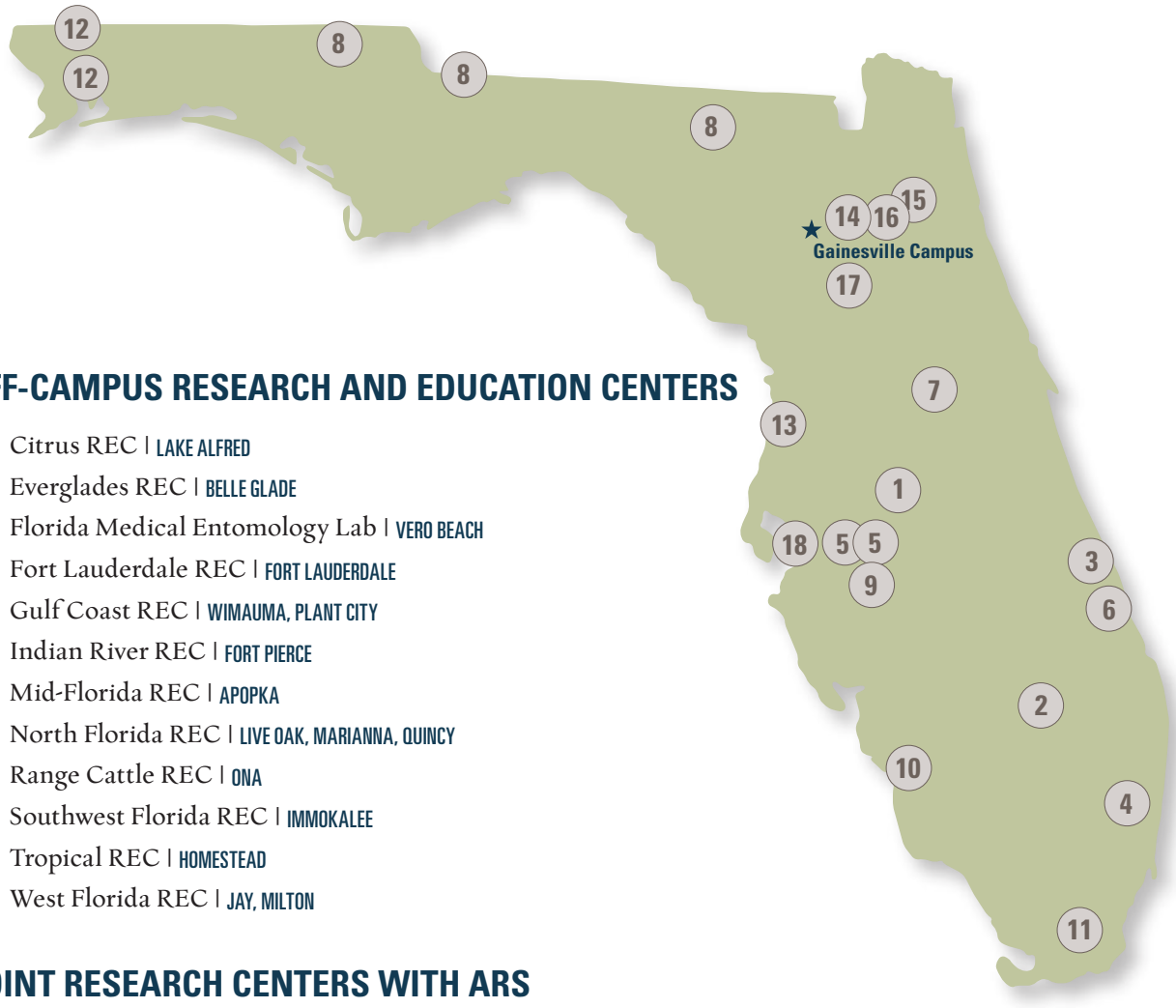
Plant Molecular and Cellular Biology Graduate Program
Animal Molecular and Cellular Biology Graduate Program

MULTIDISCIPLINARY PROGRAMS
(GAINESVILLE, FL)

Agricultural Law Center
Carbon Resources Science Center
Center for Aquatic and Invasive Plants
Center for Cooperative Agricultural Programs | FAMU
Center for Food Distribution and Retailing
Center for Nutritional Sciences
Center for Organic Agriculture
Center for Remote Sensing
Center for Renewable Chemicals and Fuels
Center for Subtropical Agroforestry
Center for Tropical Agriculture
Energy Extension Service
The Florida Climate Institute
Florida Organics Recycling Center for Excellence | FORCE
Florida Sea Grant
Interdisciplinary Center for Biotechnical Research | ICBR
International Agricultural Trade and Policy Center
International Programs
Program for Resource Efficient Communities
Tropical and Subtropical Agriculture | T-STAR
UF Juice and Beverage Center
UF Herbarium | FLAS
Water Institute
Wedgworth Leadership Institute for Agriculture and Natural Resources

SUPPORTED COLLEGES
(GAINESVILLE, FL)

College of Agricultural and Life Sciences
College of Veterinary Medicine



OFF-CAMPUS RESEARCH AND EDUCATION CENTERS

1 Citrus REC | LAKE ALFRED
2 Everglades REC | BELLE GLADE
3 Florida Medical Entomology Lab | VERO BEACH
4 Fort Lauderdale REC | FORT LAUDERDALE
5 Gulf Coast REC | WIMAUMA, PLANT CITY
6 Indian River REC | FORT PIERCE
7 Mid-Florida REC | APOPKA
8 North Florida REC | LIVE OAK, MARIANNA, QUINCY
9 Range Cattle REC | ONA
10 Southwest Florida REC | IMMOKALEE
11 Tropical REC | HOMESTEAD
12 West Florida REC | JAY, MILTON

JOINT RESEARCH CENTERS WITH ARS

13 Subtropical Agricultural Research Station (USDA–ARS) | BROOKSVILLE

RESEARCH AND DEMONSTRATION SITES

14 Austin Cary Memorial Forest
15 Florida Partnership for Water, Agricultural and Community Sustainability | HASTINGS
16 Ordway-Swisher Biological Station (OSBS)
17 Plant Science Research and Education Unit | CITRA
18 Tropical Aquaculture Laboratory | RUSKIN

UF UNIVERSITY of FLORIDA
IFAS

PRODUCED BY IFAS INFORMATION AND COMMUNICATION SERVICES | FLORIDA AGRICULTURAL EXPERIMENT STATION
INSTITUTE OF FOOD AND AGRICULTURAL SCIENCES | UNIVERSITY OF FLORIDA