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UT Institute of Agriculture

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MOOoving Discoveries into Society — How We’re Making the World a Better Place

UT Institute of Agriculture

The University of Tennessee

TENNESSEE

LANDlife & Science

Vol. 11/No. 1 2014
Dear UT Institute of Agriculture friends,

In this issue of Tennessee Land, Life and Science, we focus on one of our core values — or pillars, as we call them — delivering discoveries. As a land-grant university, we are charged with delivering discoveries that solve real-world problems the citizens of Tennessee face. We use citizen advisory groups to help guide research priorities to keep us relevant with contemporary needs. You will learn about faculty and staff involvement in several areas of discovery.

Our discoveries not only impact the people of Tennessee, but also extend to global issues experienced throughout the world. In this issue you will read about the generosity of UT alums Donnie and Terry Smith. They share our concern about solving world hunger and have endowed a faculty chair in the Institute in the area of international sustainable agriculture. We are proud that UT President Joe DiPietro has honored the Smiths as 2014 President’s Circle Philanthropists of the Year, and we thank them for their generous support of our programs and for being great partners to the Institute of Agriculture and our mission.

Thanks for the opportunity to relay some of the exciting things going on in the Institute. And we invite you to join us on our growing social media (page 5). We’d love to hear from you and to keep in touch.

Larry R. Arrington
Chancellor, UT Institute of Agriculture

ag.tennessee.edu
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On the cover: A discovery by animal scientists Neal Schrick and Lannett Edwards is expected to have big impacts on cattle producers’ bottom lines. It’s one of many ways UTIA is making the world a better place (See page 7). Photo taken by Gabriel Clemons at the UT East Tennessee AgResearch and Education Center — Blount Unit.
TN’s Top Commodity Sizzles

It’s grilling time, and the cattle industry is on fire. Demand for beef is up, and prices are the highest they have been in 25 years. The question among cattle producers is how to ensure that tailgating chefs choose burgers and steaks as their entrées.

The UT Institute of Agriculture is helping Tennessee’s $783 million cattle industry provide high-quality beef at prices that will support ranchers but are still affordable for consumers. Efforts include:

- The state’s Value-Added Beef Initiative spearheaded by the Center for Profitable Agriculture. It’s teaching producers direct marketing to consumers and retail outlets (tiny.utk.edu/ag/Value-Added-Beef).
- Cattle nutrition research using a high-tech feed measuring system. See the video! tiny.utk.edu/ag/Grow-Safe.
- Artificial insemination and reproductive management school as well as Advanced Master Beef Producer programs. Also, UT Beef and Forage Center resources: utbfc.utk.edu.
- Bull tests that strictly monitor performance.
- A new beef replacement heifer program, identification of production practices that develop superior heifers, and leadership to increase Tennessee beef cattle herd size. All are goals of the Governor’s Rural Challenge, a 10-year strategic plan to increase rural Tennessee’s capacity to produce.
New Marketing and Communications Leadership for UTIA

Lisa Stearns, UTIA Vice Chancellor for Marketing and Communications, is leading initiatives to increase the reputation and visibility of the Institute.

UTIA has tapped Lisa Stearns, an executive with more than 20 years of leadership experience, as its new vice chancellor of marketing and communications. Stearns most recently led the marketing and communications efforts for a large, multi-hospital system in East Tennessee. Previously, she was a well-known television broadcaster in the area, serving as news anchor and reporter for what is now WVLTV.

Stearns directs UTIA’s marketing and communications efforts, which will include developing a branding strategy to capture the essence of the Institute and convey the important contributions and impacts our organization makes in the lives of Tennesseans and beyond.

“The UT Institute of Agriculture is truly making a difference as outlined in our four pillars — advancing academic excellence, promoting hands-on learning, delivering discoveries and serving our communities,” says Stearns. “I am honored and excited to help promote the university’s land-grant tradition and its mission-driven work in our communities.”

Watch the next issue for an exciting new look for UTIA!
USDA Adopts UTIA Soybean Variety As High Performance Check

Congratulations to Professor Vince Pantalone of the Department of Plant Sciences on having his new UTIA soybean variety, “Ellis,” adopted as the USDA high yield check, replacing 5002T for southern regional field trials. Checks are chosen each year to serve as the benchmarks of elite performance among commercial and publicly developed varieties. This is the third time that a Pantalone soybean variety has been honored in this manner. The name “Ellis” has special meaning. Pantalone chose to name the new variety after research associates Debbie and Lee Ellis in honor of their long-standing commitment to UT AgResearch and the Institute.

Growing Veggies — and Awareness

Institute employees and generous vendors and visitors to the UT Farmers Market at the UT Gardens in Knoxville were able to Grow More and Give More this year thanks to a grant awarded from the UT Alliance of Women Philanthropists’ Giving Circle Grant Program. Grow More, Give More (GMGM) is a partnership between UTIA and the nonprofit Society of St. Andrew that focuses on feeding our hungry neighbors through donations of locally grown food. As of September, this year’s program had already provided nearly 19,500 servings of fresh produce to children and adults in the Knoxville area who have a great need for more nutritious food. Visit the GMGM website at ag.tennessee.edu/GMGM to follow the progress each week, or check out the Fall 2014 issue of the Tennessee Alumni magazine to see the full impact of a donation.

Charting Our Achievements

Learn about the Institute’s achievements, accountability and return on investments at the Institute’s metrics site. You can find it online at ag.tennessee.edu/metrics.
Delivering Discoveries

UT AgResearch Innovates to Improve Lives

W
ouldn’t it be great to have a soybean variety that out-produces all other varieties currently grown in your part of the country? And wouldn’t it be even better if the variety contained a gene conferring resistance to soybean cyst nematode and another gene that causes the plant to be resistant to drought — each of which translates into an even greater number of soybeans that can be harvested? We at the UT Institute of Agriculture have scientists developing exactly that.

Whether it’s improving agronomic crops, increasing the safety of food, or achieving breakthroughs to advance animal and human health, more than 200 scientists at the Institute deliver discoveries that move society forward. Solving problems that

Heading Off Devastating Pests

UTIA entomologist Juan Luis Jurat-Fuentes is working to solve the mystery of how insects can develop resistance to transgenic crops and methods to detect their spread, crucial issues for America’s food and fiber security.
Pioneering In Bioenergy —
Institute biosystems engineer Al Womac is pioneering handling, processes and logistics to efficiently move bioenergy crops from farm field to biorefinery input chute.

improve people’s lives is central to the Institute’s history and land-grant mission.

“We’re in the business of discovery,” says Chancellor Larry Arrington. “We have a commitment to deliver solutions to society, whether it’s to the citizens of Tennessee or more broadly to stakeholders at the global level. Delivering discoveries is one of our four pillars — or core values — and it is a commitment that the Institute of Agriculture takes very seriously.”

Operating as one of four units at the Institute, UT AgResearch is at the heart of the Institute’s research mission. Its roots stretch back even before the Morrill Acts of 1862 and 1890 that established the land-grant mission for public universities to conduct research and education that enhances society.

A Climate That Fosters Discoveries
Discovery of new information, processes and technology can be years in the making. To accelerate them, AgResearch has placed heightened emphasis on factors known to grow a culture of innovation. These include an internal grants program designed to support the development of preliminary data, excellent start-up packages for new faculty, overhead return incentives, and growth in numbers of new faculty, graduate students and postdoctoral associates. Also contributing have been new state-of-the-art labs and high-caliber greenhouses.

Undoubtedly, one of the Institute’s greatest assets in developing innovations is how its capabilities span discovery research through proof-of-concept evaluation to dissemination of research results. The evaluation stage occurs in UTIA laboratories and at 10 AgResearch and Education Centers, each sited in distinct agricultural regions of the state. There, personnel with expertise in field research implement and evaluate research protocols that test new discoveries, ideas, concepts and technologies. Dissemination occurs, in part, through public field days — this year AgResearch hosted 12 — and through UT Extension specialists and agents; the latter present in each of Tennessee’s 95 counties.
Paths to Innovation

Varied motivations inspire the work of AgResearch scientists. For biosystems engineering professor John Wilkerson, it’s solving problems experienced by producers. His precision agriculture innovations have resulted in a cotton yield monitor; a variable rate sprayer; and technology that uses sensors, algorithms and user interfaces to boost yields in greenhouses and confined production spaces.

For Racheff Chair of Excellence holder Neal Stewart, it’s solving basic science questions to speed plant molecular engineering, and also it’s the idealistic goal of creating a better world. One of his ongoing projects is developing plant biosensors that turn red when radiation or other harmful substances are present and turn green when they abate. He calls them Fukusensors, with direct applicability to contaminated land surrounding Japan’s failed Fukushima nuclear reactor.

Discoveries can represent cumulative progress across a researcher’s career, as in new, improved soybean varieties developed by Vince Pantalone, AgResearch’s soybean breeder and geneticist. Animal science researchers F. Neal Schrick and J. Lannett Edwards discovered a technique for protecting embryos during the critical first few days following fertilization. They now hold an international patent for Embryo Guard (see Fertility Focus, page 12).

One unifying thread of all research at the Institute is that funding is required to advance the work. Initially, this often comes from internal seed grants, such as the AgResearch Innovation Grants Program, followed by larger grants from the U.S. Department of Agriculture and other governmental sources. Industry and a wide range of federal and state agencies and foundations also provide funding that leverages base-level support received through federal and state appropriations funded through the university. As promising findings are identified, external funding and partners from industry are needed to accelerate the development of promising technologies through a science-based approach. While some members of the public may fear this can lead to bias, AgResearch does not favor one company exclusive of others in a given field, and results are open to peer review. An example is research focused on controlling the development of insect resistance to Bt toxins. Multiple industry partners, along with the USDA, support this important work conducted by UTIA entomologist Juan Luis Jurat-Fuentes.

Routes to Society

State governors and legislators expect land-grant universities to be drivers of economic growth. To succeed in that goal, AgResearch must make careful choices about how it delivers innovations to society.

A Tricorder? Almost —

An innovative disease detection device developed by UT Knoxville and UTIA researchers can diagnose infectious diseases in people and animals in just minutes. It can be used anywhere, from hospitals to remote areas in developing countries. The instrument compares a drop of body fluid to internal data and indicates whether the patient is infected with a known pathogen like influenza, tuberculosis or Johne’s disease (livestock). Developers Jayne Wu, Department of Electrical Engineering and Computer Science, and Shigetoshi Eda, Department of Forestry, Wildlife and Fisheries, say the newly licensed device will save lives by saving diagnosis time.
“The historical model of how a land-grant university delivered discoveries was to share them directly with the public,” says Bill Brown, dean of UT AgResearch. “When we have a finding that affects how crops are planted or grown, or how food can be made more safe, and the new knowledge is not protectable through the patent process, we still follow that model. We deliver new knowledge straight to the end user for direct application in their operations and businesses.”

Other kinds of discoveries require different paths to realize their potential. “For instance, as a university, we’re not in the business of selling seed or manufacturing farming equipment, nor are we a corporation with a developed, worldwide distribution system,” Brown says. “So, for example, when new plant varieties, a new precision agriculture technology, or a vaccine or treatment are developed from a faculty member’s program, these technologies are protected through the patent process and are then licensed to industry for development and distribution. If we were instead to put these discoveries directly in the public domain, there would be no incentive for industry to develop or market them.”

The UT Research Foundation partners with AgResearch and other units at UT to identify, protect and market discoveries that need to be realized through industry partnerships. Research can also be spun off as start-up companies, which some researchers at the Institute have launched (see above).
Discoveries also follow paths of education for the Institute’s students, who learn about innovations in the classroom and often experience them firsthand as they work side by side with researchers in the lab. Findings also are disseminated through academic literature where others in the scientific community can learn and build upon them.

**A Model to Speed Technology Transfer**

To accelerate innovation and commercialization of UTIA technologies, AgResearch is working toward establishing a for-profit company called AgInnovations. The company will also promote an entrepreneurial culture that the unit’s leaders believe will help transform Tennessee’s rural economy while providing opportunities for Institute faculty.

“Research activity at Tennessee’s institutions has steadily increased over the past five years,” Brown says. “But moving research results to the marketplace has failed to keep pace as compared to peer universities. UTIA, which accounts for approximately one-third of the invention disclosures from the statewide UT System, is effective in the development of invention disclosures and securing patent protection on its technologies,” Brown says, “and we are seeking ways to increase success at licensing and venture creation.

“AgInnovations will work directly with UTIA faculty to provide, or link to, business service providers, business mentoring and market analysis. It will also form a network through its members, who are angel investors, entrepreneurs and industry representatives interested in agricultural-based technologies. These individuals will provide capital for advancing early-stage technologies to proof-of-concept status for market development.”

Brown hopes to see the company in operation in the not too distant future. This will speed the exciting new technologies developed by Institute scientists to society and provide a much-needed avenue for UTIA entrepreneurial faculty.

**Affirming the Institute’s Mission**

The Institute’s land-grant mission is to advance the discovery, development and delivery of new information, processes and technology that improve the lives of the citizens of Tennessee and the world. Today AgResearch is working to maximize its opportunities to meet this mission. A changing society is leading to new paths in the forms of delivery the unit pursues. Partnerships with industry, Brown says, have become a model for speeding the rapid developments of technologies being developed within UTIA to meet market needs that will benefit the stakeholders UTIA serves. While these forms of delivery are taking new paths, they help to ensure that the Institute continues its long history of success in serving and advancing the lives of the citizens it serves.

**BUILDING UP FOR BIG DATA**

With the addition of bioinformaticist Meg Staton, UT AgResearch is expanding the tools and capacity for research using big data sets. “I’m here to assist Institute scientists with large-scale DNA and RNA sequencing,” Staton says. “There are so many different types of questions you can answer with this technology, and my role is to bring the software and the analysis capabilities to help them to answer those questions.” Under Staton’s guidance, AgResearch has added a computer server dedicated to agricultural research to the university’s Newton Cluster High Performance Computing Center.
Discovery Science Underway at UTIA

FERTILITY FOCUS

by David Brill

For a beef or dairy farmer, a pregnant cow is money in the bank (and, for us, the steak on our plate or the milk on our morning cereal), provided the cow carries the calf to term. Upwards of 70 percent of embryonic losses in cattle occur during the first two weeks after fertilization when a range of stressors — including heat, disease, ingestion of toxic plants or even the uterine manipulation necessary for harvesting or implanting embryos — triggers the release of the destructive hormone prostaglandin F2a (PGF2a). The embryo’s cells feature receptors for PGF2a, which, once attached, retards the embryo’s development. Animal science researchers F. Neal Schrick and J. Lannett Edwards have devised a technique for protecting the embryo during the critical first few days following fertilization. In the uterus, Embryo Guard blocks the effects of PGF2a by preemptively binding with the embryo cells’ receptors.

“It’s essentially like protective Bubble Wrap for a developing embryo,” says Schrick. He and Edwards hold an international patent for Embryo Guard and last year formed the startup company Fertility Focus Inc., with guidance from the UT Research Foundation and in partnership with the regional venture capital organization Tech 20/20. The spinoff is expected to bring the product to market by the year’s end.

SUCCESSFUL SPINOFFS
• FERTILITY FOCUS – (see below)
• GAP CONNECTIONS – a 501(c)(5) membership, agricultural organization that develops, maintains and provides leadership for agricultural standards, practices, training and other educational resources for the tobacco industry, with potential for other industrial sectors. GAP has 12 member companies representing more than 10,000 grower/farmer members.
• CREATIVE AGRICULTURAL TECHNOLOGIES LLC – a company that licenses four UT-patented dogwood cultivars and an unpatented one, collectively known as the Appalachian series. Twenty nurseries in Oregon, North Carolina and Japan are producing these trees. CAT measures its success in placing the plants in the hands of nurseries and getting the improved cultivars to the public.

INNOVATION
• Use of nanoparticles to create new physical, chemical and biological properties important to food, animal, cosmetic and pharmaceutical products.
• New uses of genes and genetic elements in plant biotechnology.
• Development of improved biological pesticides.

APPLICATION
• Development of a promising vaccine to control Streptococcus uberis, a frequent cause of costly mastitis in dairy cattle throughout the world.
• Highly portable diagnostic tests for animal and human infectious diseases, autoimmune diseases and types of cancer. One just licensed to industry is called a biofluid assay on a chip (see page 9).
• A patent-pending technology that removes 72 percent more water from clothes during the spin cycle of a washing machine, promising improved machine performance, more efficient energy use and prolonged life of clothing.

DISCOVERY
• Tests to detect insects that are resistant to transgenic crops.
• Use of new biofuel crops and process technologies to provide vital industrial chemicals and co-products. Development of novel, functional materials from fractionated biomass for high-value markets.
• New findings in molecular and genomic science that underlie important agronomic traits, including herbicide resistance and resistance to soybean cyst nematode.
• Identification and characterization of a gut bile salt hydrolase (BSH) that is critical in lipid metabolism. The research has shown that BSH inhibitors hold promise as an alternative to antibiotics for enhanced animal production, and BSH enhancers could be a novel medication to control human obesity and hypercholesterolemia.

To find out more about these or other investigations, contact UT AgResearch at agresearch@tennessee.edu.
AG RESEARCH’s Mission:

**Innovation**
Transforming knowledge into new products, procedures and processes.

**Discovery**
Generating new knowledge that solves problems.

**Application**
Applying innovations to improve your life.

**Success in Extramural Funding**

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<th>Grant and Contract Awards</th>
<th>Grant and Contract Expenditures</th>
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Includes teaching, research and extension.

From 2010-2013, 140 invention disclosures filed and patents awarded.

In 2013, UTIA patents constituted 21% of the total generated by the UT Research Foundation.

Network of AgResearch and Education Centers

**Attendance**

<table>
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Institute field days and smaller events held each year are important ways of disseminating UTIA research discoveries.
This fall, UT President Joe DiPietro honored Donnie and Terry Smith as Philanthropists of the Year. The award recognizes the profound impact a single gift can have on the university.
Agriculture is often associated with abundance, but as any practitioner will tell you, yields don’t always measure up to expectations. In many corners of the world, farmers eke out a living, and sometimes their agricultural practices do more to limit production than to enhance sustainability, much less provide prosperity.

UT Institute of Agriculture alumnus Donnie Smith (B.S. animal science ’80) and his wife Terry (B.S. elementary education ’80) are extremely appreciative of the abundance that their life in agricultural business has afforded them. As CEO of Arkansas-based Tyson Foods Inc., Smith leads the $34.4 billion global meat and poultry retail corporation. And while he and Terry do not go wanting, they have seen others who do. So they have a personal mission to fight global hunger.

The Smiths have pledged $3.2 million to establish the Donald and Terry Smith Endowed Chair in International Sustainable Agriculture through the University of Tennessee Foundation Inc. The new faculty position will help bring science-based agricultural solutions to areas of the world with struggling agricultural practices and economies, as well as provide unique opportunities for the state of Tennessee.

“Because of the outstanding reputation of the University of Tennessee Institute of Agriculture and our shared mission to seek global solutions to world hunger, we felt it was a perfect fit,” says Donnie Smith.

UTIA Chancellor Larry Arrington explains how this gift impacts the Institute, “The Smith Endowed Chair will take us to the next level in international partnerships relative to agricultural issues and providing solutions that help feed the world. We are operating more than ever in a global environment, and our faculty and students need opportunities to learn more about how people in Tennessee relate to the worldwide economy.”

The faculty member who holds the Smith Endowed Chair will work to further develop UTIA’s international programs, including research and outreach opportunities for faculty and students. The goal is to find solutions to encourage less-equipped societies to maximize available resources in an effort to provide better nutrition for a global community.

UTIA currently has ongoing international agricultural projects in Africa, Europe, South America and Southeast Asia. – Patricia McDaniels
LEARNING LARGE!

From Living Labs to Wandering Classrooms on Wheels, A Trio of Initiatives Makes for Dynamic Student Experiences

CASNR students helped construct three of wetlands located near campus last fall. These living laboratories are supporting learning in 11 courses, along with research by students pursuing an interdisciplinary watershed minor.
CHEROKEE WOODLOT WETLANDS

UT Institute of Agriculture students enrolled in a wetlands ecology class put their learning to work last fall by constructing three wetlands on a UTIA research unit located near campus. The result of their handiwork is an outdoor living laboratory with abundant opportunities to learn, conduct research and provide demonstrations for educational outreach. Tadpoles and aquatic fauna call the wetlands home, as well as wildlife and plants, and that is giving students in six different UT departments abundant opportunities for study.

Wildlife and fisheries science senior Erica Neely was on site in April to monitor migratory birds and amphibians. “We’ve seen a bunch of birds … and the plants have kind of taken over. There are a lot of tadpoles right now, so (the wetlands) seem pretty successful so far.”

Matt Gray, associate professor of wildlife ecology, says, “Over half of our wetlands have been lost in the United States, especially in urban environments. Having wetlands in areas where there are a lot of pollutants is really important for filtering those from our water sources. Understanding the importance of wetlands is key to our students’ professional development.” Gray guided the construction of the wetlands and coordinates their management and use.

The wetlands are located at the Cherokee Woodlot, which is part of the Institute’s East Tennessee AgResearch and Education Center. The U.S. Forest Service’s Center for Wetlands and Stream Restoration, the Clinch River Environmental Studies Organization, the engineering firm ARCADIS, and the Knoxville Utilities Board were involved in designing and constructing the wetlands. More information on the project can be found at ag.tennessee.edu/Cherokeewetlands.

BIOSYSTEMS LEARNING AND INNOVATION HUB

Excitement is building in the Department of Biosystems Engineering and Soil Science over a project to equip students with stellar skills. The planned Biosystems Learning and Innovation Hub will turn conventional learning on its head. Rather than classroom discussions of new technologies, students will have them at their fingertips in one highly equipped, advanced learning lab.

“Synergistic” is how project leader John Wilkerson describes it. “This will be an incredible learning experience for our students and also our faculty,” says the professor of biosystems engineering. “Instead of taking field trips, which are necessarily constrained by time and location, we will be bringing data streams and technologies into a central hub where work stations, instrumentation and flexible learning modules combine to create dynamic hands-on learning opportunities for our students.”

The dynamic Learning and Innovation Hub planned for biosystems engineering students will transform conventional classroom learning by streaming information in from a variety of instruments. This will enable students to experiment with equipment most would only encounter once they start their careers. Alumni with instrumentation that could serve the lab are encouraged to contact professor and project coordinator John Wilkerson.
To take the project into reality, Wilkerson and the Institute’s Advancement Team are seeking to raise $300,000 in funding for facility renovation and learning module development. Alumni with technologies that can be used in or linked to the facility are also of strong interest. To find out how you can help, contact Wilkerson (wilkenr@tennessee.edu, 865-974-7266) or Tom Looney, Advancement director, (tlooney@utfi.org, 865-974-1928).

Data is expected to flow in from domestic water supply systems, courtesy of alumnus Seth Rye (B.S. agricultural engineering ’98; M.S. biosystems engineering ’00); sensors on nearby Third Creek that monitor water flow and storm events; and biosensors on dairy cows at UT AgResearch’s Little River Animal and Environmental Unit — to name just a few.

“The Learning and Innovation Hub will link to other laboratories at UT Knoxville and AgResearch and also include diverse links with industry through our alumni and research contacts,” Wilkerson says.

“The hub is going to provide Institute students with exceptional experiences they would not typically get until entering the work environment. We’re excited because we know this hub and what they learn through it will truly give our students a leg up in their careers.”

Because a considerable portion of the rotation is spent traveling, Drs. Brian Whitlock and Marc Caldwell have taken advantage of the downtime by converting an ambulatory truck into a mobile HUB.

UT VETERINARY STUDENTS AND THE TRICKED-OUT TRUCK
Fourth-year veterinary students are on the road to learning — literally — for their farm animal field services clinical rotation. During the required three-week rotation, the veterinary medical team visits farms and other sites throughout East Tennessee for emergencies as well as production issues and preventative medicine.

Dr. Brian Whitlock, foreground, assistant professor, farm animal field service, guides fourth-year veterinary medicine students Brianna Potter and Jake Barnett in learning while on the road. Potter is studying a seat-mounted monitor, while Barnett uses a clicker.
UT Institute of Agriculture Assists Strategy on Gulf Dead Zone

UT EXTENSION AGENTS

and specialists with the UT Institute of Agriculture are contributing to the development of a nutrient reduction strategy for West Tennessee. With multiple state and federal agencies and farmer stakeholder groups collaborating on its development, the strategy aims to lower nitrogen and phosphorus runoff into the Mississippi River drainage basin.

The team’s work parallels similar nutrient reduction strategies in place or underway in other states whose waters flow into the Mississippi — waters that carry nutrients that contribute to the Gulf Dead Zone. The zone forms seasonally in the Gulf of Mexico, creating oxygen levels in the water too low to support life.

Sources of nutrients in the water are as varied as municipal stormwater and wastewater, runoff of lawn chemicals, and even large numbers of overwintering waterfowl. But nonpoint runoff from row crop production is acknowledged as contributing to the problem. UT Extension’s efforts are to help producers fine-tune their operations for both greater efficiency and greater environmental stewardship.

UT Extension environmental soil specialist Forbes Walker has been a part of the nutrient reduction strategy from the start. He says the key is coaching citizens to follow UT Extension recommendations. “The whole thing for us is to educate people on the importance of following University of Tennessee recommendations of managing nutrients on the land, whether it be home and garden, forage systems or row crops.”

UT Extension’s objective, science-based recommendations provide information on how to optimally use nutrients for performance, efficiency, cost-effectiveness and environmental sensitivity. For the past five years, Extension soil fertility specialist Hugh Savoy has been using field plot research at UT AgResearch and Education Centers
in Springfield and Milan to evaluate Extension’s recommended fertilizer application rates.

“I’ve found that in general we’ve done a good job of providing farmers with fertilizer recommendations that are profitable and that result in minimal potential for negative environmental impacts,” Savoy says. “For warm-season hay in Middle Tennessee and for a corn, wheat and soybean rotation in West and Middle Tennessee, reduction of our recommendations on high-testing soils has not affected farm yields of those crops and has, in fact, increased profitability by eliminating the cost of those nutrients when the soil fertility level tests high.”

Lori Duncan, UT Extension row crop sustainability specialist, is working one-on-one with farmers in West Tennessee, covering all the major cotton and soybean producing counties. Duncan is assessing current management practices to determine how improvements can be made to boost sustainability.

“I think it’s important to note that our farmers are already doing a good job. Widespread adoption of no-till production (developed by UT AgResearchers) has had a large impact because it reduces both erosion and nutrient runoff.”

But Duncan says a good job can always be made better, and the UT Extension team is working in a number of directions, from evaluating precision agriculture gains to promoting best management practices and holding on-farm demonstrations and field days.

UT Extension precision agriculture specialist Mike Buschermohle is helping farmers evaluate the cost benefit of adopting site-specific soil sampling and variable rate application of fertilizers, automatic section control for sprayers, and other precision ag technologies. He links efficiency to sustainability and environmental stewardship.

“Sustainability to me is helping producers maximize their profits and increase their production because of the need of the growing global demand for food and fiber, but at the same time we’re keeping the environment in mind as we increase production. More efficient operations are good for farmers’ bottom line and good for the environment, too.”

Jeff Hill, a row crop producer from Gates, Tennessee, says he’s on board with the emerging strategy. “Increasing our productivity and reducing our impact on water quality is important for agriculture. The West Tennessee nutrient reduction
strategy gives us the framework to accomplish that by increasing awareness and encouraging the adoption of management practices that help our profitability as well as the environment.”

Because runoff from metropolitan areas is also part of the problem, UT Extension watershed specialist Andrea Ludwig is working with communities on stormwater control and with homeowners through the sustainability-focused Tennessee Smart Yards program (ag.tennessee.edu/tnyards).

UT Extension waste management specialist Shawn Hawkins is developing models of surface water quality to evaluate how well different farm management practices, such as use of winter cover crops, can help in reducing nutrient losses. Analyzing sources and then addressing how best to reduce nutrient losses will be a complex task and an important one, Hawkins says. “This evaluation of the most effective nutrient reduction strategies is critical for successfully and cost-effectively reducing landscape nutrient losses in West Tennessee.”

In Lake County, UT Extension agent Greg Allen is working with specialists with the Department of Biosystems Engineering and Soil Science on a multiyear, EPA 319-funded project to demonstrate the benefits of variable rate applications of fertilizers. “The farming community knows fertilizers,” he says. “They know that they want to put down just what’s needed, because if they overapply, that’s money not returning to their operation. What we want to apply is just enough for the crop and just a little extra for building the soil fertility. Site-specific soil sampling and variable rate application of fertilizers give us the ability to do that.”

Echoing Hawkins, Allen says, “Some inputs are more controllable than others. Managing nutrient flow in West Tennessee and throughout the state is, and will be, a really unique balancing act.” It’s an act that the team of Extension specialists and agents, farmers and partner agencies is working to develop and advance, both for the sustainability of Tennessee farms and towns and for the environment they call home.

For more information on the nutrient reduction strategy development, contact any of these Extension specialists at 865-974-7266 and Extension agent Greg Allen at 731-253-6528.
In May, UT Knoxville named Buehler as a Torchbearer, the highest honor the university bestows on its students. It was well-deserved. Buehler entered UT as a Haslam Scholar, the highest academic enrichment program the university offers. The experience took her to Tokyo for a month to study globalization and saw her serve as a student trustee on the Knoxville Opera Board — a creative outlet that connected to her minor in viola performance. At the Institute, Buehler studied food microbiology as she prepared for a career in food safety research. Her capstone project was assessing the risk of E. coli in microgreens, an up-and-coming salad ingredient. "I’ve had a wonderful experience. Being a student in CASNR is great because you are close to your professors who care a lot about you, and I think that’s unique to CASNR. I’ve been involved in everything from the CASNR College Ambassadors to undergraduate research and really branched out to all the great opportunities UT has to offer."
At the UT Institute of Agriculture, we are committed to providing students with exceptional learning experiences. These three students — all majoring in dimensions of food science — exemplify our commitment to our pillars, or core values, of academic excellence and hands-on learning.

Reed Blackwell
Food and Agricultural Business, Class of 2014

When he learned that New York Stock Exchange Governor and CNBC market analyst Peter P. Costa (page 33) was coming to speak to his agricultural finance class, Blackwell says he was excited. Blackwell is headed into a career as a commodities trader and here was a chance to learn from a master — one who also is an Institute alum — and learn he has. Over spring break, Blackwell toured the NYSE with Costa and has received one-on-one mentoring on his career aspirations and plans for the next five years. Costa has also linked him with a contact in Houston where Blackwell intends to move after graduation. “My connection with Mr. Costa has been a valuable experience,” Blackwell says. “Visiting with an alumnus in his professional environment and having the opportunity to learn from him makes me even prouder to be a Volunteer.”

MiKayla Goodman
Food Science and Technology, Class of 2015

Like her adviser, Associate Professor Kim Gwinn (page 34), Goodman got her start in undergraduate research by volunteering to help out around the lab. Soon she was gaining lab skills and is now conducting original research on the antimicrobial properties of plants. That experience, and the thesis she will write based upon it, is central to her studies as both a Chancellor and Dean’s honors student. “The research has been a stepping stone for me in my classes,” she says. “It’s much easier to go into them and know what to do and be successful at it.” Goodman plans to pursue her interest in food microbiology in graduate school.
UT Gardens Gala celebrates State Botanical Garden status

Guests attending the second annual UT Gardens Gala, “A Rainbow of Iris,” were not disappointed with the beautiful array of colors that adorned the UT Gardens in Knoxville. Presented by HGTV HOME, the gala, held on April 25, celebrated the UT Gardens’ first full year as the official State Botanical Garden of Tennessee. “With the iris being the state flower of Tennessee, it just seemed fitting to theme the event around this beautiful flower,” says Sue Hamilton, director of the UT Gardens.

And they did. From the reception on the Beall Family Rose Garden terrace, to the hors d’oeuvres and silent auction tent, to the beautifully lit dinner tent – irises were everywhere.

Vern Yip, HGTV host and designer and emcee for the evening, mingled with guests — many starstruck — before dinner as the sounds of the UT Faculty Jazz Trio floated through the air. To the delight of all, he was dressed in spirited orange-and-white attire, right down to his orange-and-white striped socks, which he was quick to show off!

Before Yip took the stage to entertain the crowd with his stories, Tom Parkhill, an award-winning tall-bearded iris breeder, was honored for his horticultural contributions. Parkhill is a graduate of UTIA’s animal science program (’49) and has introduced more than 19 varieties of tall-bearded irises to the gardening industry, including a Wister Award winner named ‘Chief John Jolly’ and a UT orange iris appropriately named ‘Volunteer Pride.’

Through sponsorships, the live and silent auctions, and ticket sales, supporters of the event raised $30,000 for the Gardens. These contributions are being used to fund student internships, which are imperative to maintaining the Gardens, and to aid the Gardens in its ability to serve Tennesseans. Next year’s gala is planned for May 1, 2015. More photos of the event may be viewed at tiny.utk.edu/UTGardens-Gala.

– Jean M. Hulsey

2. Fresh-cut vegetables placed in mini flower pots add a fun and festive flair to the hors d’oeuvres table. Students from the UT Hotel, Restaurant, and Tourism Management program and the Pellissippi State Community College Culinary Arts Program planned, prepared and served the evening’s menu.

3. HGTV host and designer Vern Yip congratulates Donna Davis after she won a very spirited live auction battle for a home design consultation by Yip.
Neal Eash, associate professor
DEPARTMENT OF BIOSYSTEMS ENGINEERING AND SOIL SCIENCE
“My philosophy is that students really seek the truth, and it’s our job to present that truth in a way that’s interesting and in a way that forces them to think beyond their comfort zone. I want them to think about who they are, how they fit into this world, and how they can make it a better place. UTIA gives faculty the opportunity to be the best they can be and to make an impact not only in Tennessee, but also throughout the world. I think that is pretty dang cool!”

Sharon Jean-Philippe, assistant professor
DEPARTMENT OF FORESTRY, WILDLIFE AND FISHERIES
“Urban forestry is an ecosystem function in an urban area. Yes, trees give aesthetic benefits to people, but there are also ecological and biological benefits that trees have specifically in urban areas. Our urban forestry concentration gives students training in both urban and traditional forestry, so it will provide them with a little more leverage when they enter the job market. They can work in an urban environment or in a natural forest, so they have the best of both worlds.”

Amy Elizer, UT Extension agent and county director
MADISON COUNTY
“The great thing about working for UT Extension and teaching in the area of family and consumer sciences is that you can use your background, your training and the things you’re passionate about to teach people ways to make improvements in their lives. I enjoy seeing people when something clicks, when they figure out that they can do this, whether it’s making changes to get out of debt or tasting a new food that’s more healthful than they’re used to eating. I really feel our Extension people become leaders in their communities and can make the connections that really make things happen.”
“I know a good school with an ag program.”

That’s the insider advice Isaac Bennett received after telling good friend Sam Burris (M.S. computer science ’71) that he was interested in majoring in agriculture. The school happened to be the UT College of Agricultural Sciences and Natural Resources (CASNR), and indeed that’s where he headed.

Now, nearly 30 years since his graduation, Bennett (B.S. agricultural education ’84) is vice president of Capital Markets with Farm Credit Bank of Texas. He manages 12 people and a portfolio of $6.4 billion. He travels throughout the country financing agricultural ventures and making dreams come true.

Looking back on his tenure with Farm Credit, Bennett says he’s been able to finance local farms and rural country homes, many for first-time homeowners. He’s also provided capital to multibillion dollar companies. Helping family-owned businesses and farms has been particularly rewarding.

Bennett, who hails from South Carolina, says that the education he received at CASNR prepared him well for the world of finance. “I was fortunate to have a great adviser in Dr. John Todd and great support from CASNR Dean Glenn Hall. They prepared me for a career in agriculture and, to this day, I still maintain a friendship with Dr. Todd. He’s a great man.”

Friendships also come along when least expected. “On a business flight to Minneapolis 10 years ago, I was sitting next to a total stranger who noticed my Tennessee ring,” says Bennett. “That person happened to be Lynn Murray (B.S. ornamental horticulture and landscape design ’68, M.S. agronomy ’69), who recently retired from Bush Beans and is a fellow CASNR graduate. We struck up a conversation, and as they say, ‘The rest is history.’”

While Bennett is proud of his accomplishments in his 28-year career with the Farm Credit System, his family is an even greater source of pride. His wife, Vivian Ross-Bennett, is a 1986 graduate of the UT College of Business Administration and is an attorney in private
Family Matters — For Bennett, family comes first, always. He takes great pride in his wife, Vivian Ross-Bennett, who is also a UT alum, and daughter Kristin, now a sophomore in college.

practice. Their daughter, Kristin, is a sophomore attending the University of Houston majoring in nutrition and nursing.

Bennett says that he’s looking forward to the next phase of his life. “The Farm Credit System has been a great career, and my goal is to always be connected to it,” he says. “I hope to eventually serve on the board of an association or district bank.”

Because of his professional reputation and his personal respect for the University of Tennessee, Bennett has recently been invited to join the UTIA Advancement Board in order to help move the Institute forward. “I want to make a difference and represent the UTIA in any way I can,” says Bennett. “This gives me a chance to do just that and serve my alma mater.”

With his outstanding support for U.S. agriculture, agribusinesses and public utilities, Bennett will be sure to continue making a difference in countless people’s lives wherever his future takes him. — Doug Edlund

Bullish on Agriculture — Bennett’s career in finance assesses both the present and future promise of the agricultural and agribusiness enterprises he funds. In his position with Farm Credit Bank, he also finances food and fiber entities, telecommunications and utilities throughout the U.S.
SQUEEZED!
Youth Face Tough World of Adult Finances
In a financial simulation for students at Lawrence County High School — part of a UT Extension program called On My Own — teens fast forward to age 26, get a hypothetical job and bills to pay, and face the financial ups and downs of adulthood. The transformation can be tough.

“I think it’s important that they learn there are a lot of demands on your money, and there’s a lot of responsibilities. It gives them a very practical base for all of the decisions they’ll be making later,” says agent Tracy Hagan with UT Extension in Lawrence County, Tennessee. UT Extension is a unit of the UT Institute of Agriculture.

High school senior Victoria Davis had to deal with the difficult responsibility of being the sole earner for her family. “The cellphone bill, Internet and utilities. That got me, and the groceries. I didn’t know you spent that much on groceries,” Davis says.

Student Lauren Gilbert says On My Own taught her some valuable lessons — mainly that life itself can be expensive. “It’s very beneficial. I would say, anybody please do it because it’s going to make you realize that you’re about to hit … life! Stuff is really high, and you don’t realize how much it is until you experience this.”

Teens also learn that your salary and paycheck are often two different amounts. “I made $2,558 dollars a month, but after taxes and all that, I only made $2,075 a month. It was rough,” says student Chase Brewer. He added that $2,000 didn’t last long when he started paying bills.

UT Extension specialists and agents with the Department of Family and Consumer Sciences have taught the On My Own curriculum statewide to more than 200,000 students, with plans to increase that number this year. Recently, the program received some upgrades, including giving students permission to barter and trade services. As an example, at one booth called Community Cares, youth could exchange yard work for child care or tutoring. UT Extension leaders say bartering is an important skill to learn in today’s world, where the tight economy often limits spending on services.

New features of the program include updated graphics and adjustments to hypothetical salaries that are more in line with today’s economy in Tennessee. On My Own also meets new state standards adopted by the Tennessee Department of Education for teaching financial literacy.

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The UT Foundation has partnered with Family and Consumer Sciences to help fund On My Own presentations across the state. Readers interested in educating youth through this important program can do so by making a small gift. For more information, contact the UTIA Office of Institutional Advancement at 865-974-5779 or UTIAadvancement@tennessee.edu.
As a veterinarian and wildlife biologist — both engaged in dairying — this power couple balances agriculture with conservation, environmentalism with animal production, and say a harmonious relationship between these interests is possible for everyone concerned.

Hatcher is part of Hatcher Family Dairy, a fifth-generation operation in College Grove, Tennessee. She is a second-generation graduate of the College of Veterinary Medicine, ’05, and works on the property at Rock N Country Veterinary Services, which has a strong commitment to livestock farmers.
Her husband, Yoest (B.S. wildlife and fisheries science ’02), coordinates the management of white-tailed deer, elk and wild hogs for the Tennessee Wildlife Resources Agency.

“Chuck and I have learned a lot from each other,” Hatcher says. “Sometimes agriculturalists don’t realize you need to be conservationists as well. These interests can live together in harmony. As agriculturalists, we need to be mindful of wildlife, and the wildlife groups mindful of us.” Yoest says, “I have a huge interest in both agriculture and wildlife. Fortunately my job allows me to have a hand in both worlds.”

As members of the Tennessee Farm Bureau Federation’s Young Farmers and Ranchers program, these two have made it their goal to make a difference in how community members view agriculture. “We let people know we need agriculture in this country to feed their family and community and how important it is to sustain that for everyone,” Hatcher says.

PETER P. COSTA,
New York Stock Exchange Governor and CNBC analyst

As a forestry graduate (B.S. ’80), Costa took an unlikely path to Wall Street. He chalks it up to a recession-fueled decline in jobs in the paper and lumber industries. “Most of my friends worked on Wall Street and suggested that since I always had a fascination with stocks and business in general, to come down to the NYSE trading floor and give it a shot,” Costa says. “Thirty-four years later, I guess they were right.”

Following senior trading positions at Lehman Brothers, Bear Stearns and other brokerage firms, he is president of Empire Executions Inc., a boutique trading firm on the floor of the exchange. He shared his experiences with Institute students on a recent visit to campus (page 23). While he initially sought out forestry for the opportunity to work alone, his career has seen him interact with thousands of people and thrive doing it. “Each day brings fresh challenges and fresh ideas. I can honestly say that I enjoy every day I come to work.”

Peter P. Costa, third from left, showed Institute Farm Credit (FC) scholars the New York Stock Exchange during their New York study tour in September. With Costa are, from left, Agricultural and Resource Economics professor Bill Park; former FC scholar Peyton Graham, ’14; current FC scholars Forrest Duncan and Billy Rochelle; and David Lynn (B.S. agricultural education ‘74; M.S. agricultural education administration and supervision ‘78) and Mark Wilson (B.S. animal science ’76) of FC.
WHAT DO UNDERGRADUATES GAIN FROM RESEARCH EXPERIENCES?

Studies have found that having the opportunity to work side by side with a professor on research heightens students’ interest in their disciplines, teaches them persistence and enhances their career preparation. Research opportunities for youth of all ages, whether in high school, undergraduate or graduate studies, give students greater readiness for more demanding research and for professional careers in the sciences, professional socialization and opportunities for networking. They also help students clarify or confirm their interest in or choice of a career path. It’s hard to underestimate how valuable these research experiences are for students.

HOW DO STUDENTS REACT TO THESE OPPORTUNITIES?

The most rewarding thing is when a student comes into my office and excitedly says, “Hey, guess what I found!” That ability to know that you’re the only person who has ever seen this finding so far is incredibly exciting. It’s something they’ve discovered that nobody else has found before. Those discoveries are exciting for our students, just as they are for our scientists.

WHAT WAS YOUR OWN UNDERGRADUATE RESEARCH EXPERIENCE LIKE?

My opportunity came because I was really interested in plants and basically hung out with the professors involved in plant research, so it just happened naturally. A professor needed some slides of the lower fungi and asked if I could help him put together a collection. It was wonderful because first of all it gave me
some microscopy skills that I did not get in coursework, and it also provided an opportunity to go out and see where and how these fungi live. I gained a better understanding of this group of organisms as a whole, which I found tremendously interesting.

**YOUR RESEARCH AREA OF BIOACTIVE NATURAL PRODUCTS AND BIOLOGICALLY BASED CONTROL OF PLANT DISEASES IS VERY TRENDY RIGHT NOW. IS THIS A NEW FIELD?**

In a way it is, but it also isn’t. We’ve made tremendous strides in recent years, but the use of plants for beneficial purposes also is quite ancient — reaching back into prehistory, even. If you look at food preservation, it’s been going on since we started doing more than being hunter-gatherers, and herbal medicine has been going on that long or even longer. We have always used plant products for what we need, but the idea that we might be able to do that in larger scale production agriculture is new. We can supply new treatments for diseases and insects that can be used to grow food and fiber in the more sustainable and more natural manner that is being demanded by consumers. I think that’s really why this appears to have just taken off, but the body of work and the body of knowledge has been there for centuries. One example I like to share is that if you look at cultures in hot climates, they have a history of using hot spices and very, very rich flavors in their food. Some of that is because very early on they found that meat products did not spoil when they were highly seasoned. That cultural learning connects to what we see in our research today about the power that plant compounds have to not only enhance nutrition but also to preserve food, protect plants and animals from disease and pests, and enhance flavors to keep food interesting.

**WHAT SURPRISES YOU THESE DAYS?**

One thing that does is how everything that we’re supposed to be doing today in terms of health — eating healthy produce and growing it in our gardens — is how I grew up. We had our own garden, we had our own farm and our own small herd of animals. Everything was very local and pretty much hand-raised. And it suddenly dawned on me the other day as I was buying organic produce for my family that this was actually how I was raised. The Institute’s Grow More, Give More program of sharing produce (see page 6) was how our community responded back then. If someone had too much, they gave it to their neighbors. I often call my work on bioactive plants “things my grandmother knew, but I was probably not smart enough to ask.” Going back to my roots, I can see my family did things that now are considered to be cutting edge.

Essential oils have many beneficial properties that Gwinn is exploring.

To view an online resource Gwinn created to match Institute students with faculty research opportunities, visit tiny.utk.edu/ag/CASNR-research.
Advancing Academic Excellence
Achieving academic excellence throughout UTIA requires investments in students, faculty and programs. Resources to support efforts in new and emerging areas are critical to advancing the Institute. Within UTIA, our programs, people and resources are committed to providing students in the College of Agricultural Sciences and Natural Resources and the College of Veterinary Medicine with opportunities to stretch their academic abilities while expanding and enhancing research and outreach.

Delivering Discoveries
UTIA scientists generate numerous technologies that address global problems, but UTIA needs to better support faculty to facilitate the development from startup to market place. Private industry partnerships will help to accomplish this and deliver our inventions and intellectual property to Tennessee producers.

Promoting Hands-on Learning
Our graduates and 4-H youth face a fast-changing society and must develop skills to adapt to and drive the change. Providing outside-the-classroom experiences affords them with relevant, real-life opportunities to put the knowledge gained via traditional methods to practical use. This prepares them for the real world, heightens their status for potential employers, and helps UTIA achieve its mission of advancing society.

Serving Our Communities
Community access to the resources and programs of UTIA are vital to our state. We will continue to work with our partners in communities throughout Tennessee to provide quality programs that address the unique needs and issues of each community we serve, whether we’re talking about geographic communities or communities of shared interests.

Responsibility Matters
Energy saved is approximately enough to power one home for one year and four months.

Greenhouse gases prevented is equivalent to taking approximately one car off the road for nine months.

Wastewater recycled is approximately enough to supply 311 people with drinking water for an entire year.

This issue of Tennessee Land, Life and Science is printed on 80-pound Sappi Opus cover and text, which is 10 percent postconsumer waste. In using this paper, the Institute of Agriculture affected the environment in the following ways:

- Wood/trees used: 68 trees
- Trees planted: 144 (net gain of 76 trees)
- Greenhouse gases generated: 20,681 lbs. CO₂ equivalent
- Greenhouse gases prevented: 5,791 lbs. CO₂ equivalent
- Solid waste generated: 8,021 lbs.
- Solid waste not generated: 2,704 lbs.
- Wastewater used: 73,041 gallons
- Wastewater recycled: 65,737 gallons
- Energy consumed: 115 million Btu
- Energy saved through use of renewable resources: 90.2 million Btu

One hundred percent of the electricity used to manufacture Opus sheets is Green-e certified renewable energy. Sappi reported a 9.8 percent overall reduction of water consumption and a 31.3 percent reduction of solid waste generated across the past five years. Local farmer use of solid waste as a soil amendment increased by 16.5 percent for the same period.

Data provided by Mac Papers