

FALL 2011

THE

magazine

UNIVERSITY OF KENTUCKY

COLLEGE OF AGRICULTURE

The Bear Facts

from the dean



WHAT MAKES US DIFFERENT?

The College of Agriculture welcomes a new leader of our undergraduate teaching and learning programs this fall, Associate Dean Larry Grabau. While talking about future directions, we came to the question, "What makes the College special for students?"

When Larry and I started at UK in the 1970s and 80s, the answer was obvious. Most of our students were preparing for careers in farming, in ag-related businesses or industries, or in other plant/animal/food enterprises. A majority of them grew up on a farm or closely connected to one.

This is still a great place to prepare the agricultural leaders of the future, but like American agriculture and rural Kentucky, the College has changed.

Over the last 10-15 years, our undergraduate programs have become more diverse, encompassing almost all aspects of biological, environmental, and social sciences. Our merger with Human Environmental Sciences early in the last decade brought hundreds of students to the College with career interests other than agriculture. The scope of fields we offer to our majors is now as wide as those in the College of Arts and Sciences, and much broader than the other colleges at UK.

Our undergraduate programs have become more diverse, encompassing almost all aspects of biological, environmental, and social sciences.

Well over half of our students are women; way less than half have a connection to farming when they arrive on campus. The majority grew up in suburban or urban homes. A large fraction may still be interested in animals, but for companionship or recreation, not as livestock. This is not your father's College of Agriculture.

So when prospective students ask us why they should attend our College, or what distinguishes us from other colleges, what will we tell them? I would like to hear what alumni think, but I believe:

- Our College still fosters direct interaction between faculty and students.
- We are committed to experiential and hands-on learning, and expect our students to take advantage of many opportunities to go beyond the lecture hall.
- The College heavily supports student clubs and organizations, treating them as a key part of a college education, not just a social venue.
- Even the majors in social and human sciences in the College are "grounded" by linkage to the natural and life sciences.
- Our majors are structured not as entrées to academic disciplines, but as preparation to engage in practical problems and real issues. This approach opens up an enormous variety of career options for our graduates.

These values honor our agricultural heritage and commitment, but apply just as well to our changing student population and the changing world they must lead.

The challenge for Dr. Grabau, his staff, and our entire faculty will be to find new and innovative ways to sustain these qualities for a new generation of students.

M. Scott Smith

Dean, College of Agriculture

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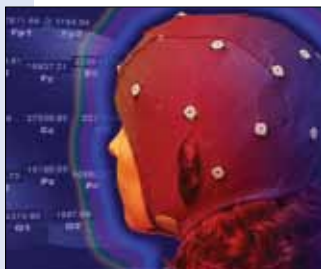
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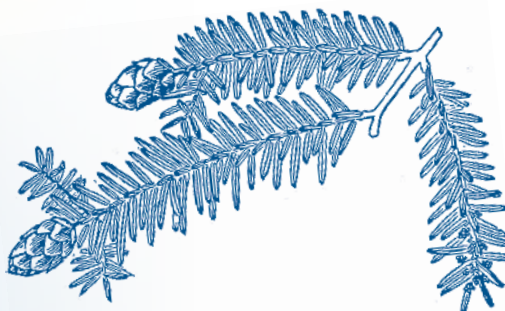
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SHORT ROWS



Carbs for Abs

Fall's cooler weather entices many a hot weather couch potato to exercise more. Want to get the most out of your workout? Athletes eat foods rich in complex carbohydrates and protein to beef up endurance and burn calories, Nutrition and Food Science Senior Lecturer Tammy Stephenson says. Eating a whole-grain bagel with peanut butter or low-fat yogurt topped with almonds or walnuts before that run will help. And drink plenty of water before, during, and after physical activity.

Wild Turkey

KENTUCKY'S WILD TURKEY population is large, thanks to abundant food sources. In the summer, the young need protein to set feathers, so insects are prized. In the fall and winter, turkeys switch to a broader diet of acorns, other nuts, leaves, clover and other legumes. They even pilfer from agricultural fields, though damage is slight. "We have lots of oaks in Kentucky, and acorns become very important," says Tom Barnes, UK extension professor for wildlife.



A Great Pumpkin Patch

With an average of 1,500 acres planted each year, pumpkins are the second most planted horticultural crop in Kentucky, second only to sweet corn. That's a lot of jack-o'-lanterns. Light on labor, "pumpkins are harvested in one or two passes and don't require constant monitoring like some other crops," says Tim Coolong, extension vegetable specialist in the Department of Horticulture.



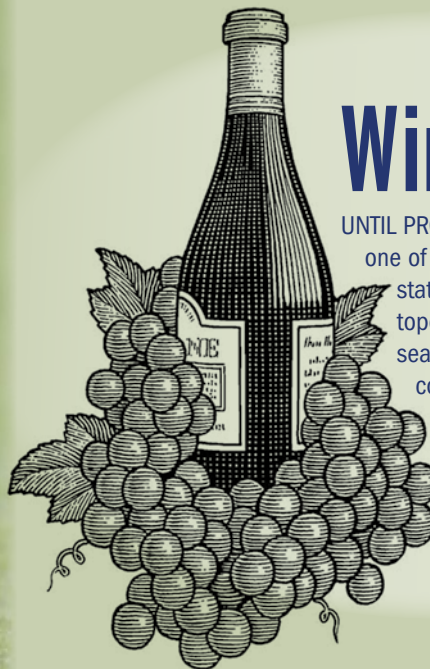
It's all about the "mattress"

Turns out cows like a comfy place to snooze, too. Compost bedded pack barns use a composted cover of organic matter over a large, open resting area. CBP barns have become increasingly popular housing for lactating dairy cows in Kentucky. A study by the departments of Animal and Food Science and Biosystems and Agricultural Engineering shows the CBP system has reduced white blood cell counts, improved reproductive performance, and reduced culling rates, says Randi Black, a graduate research assistant in Animal and Food Sciences.



Wine and Vine

UNTIL PROHIBITION reared its head, Kentucky was one of the top three grape and wine producing states. Well, history repeats itself. Kentucky's topography and climate, with its long growing season, make it well suited to once again "become a high contender in grape production," says Patsy Wilson, UK Extension specialist in viticulture. From 1999 to 2010, the number of acres devoted to wine grapes grew from 68 to 560, and licensed wineries rose from 10 in 1997 to 61 today.



Termites: A Gutsy Approach to Biofuels



Driving a car powered by insects may seem far-fetched, but it could be a future reality if UK College of Agriculture researchers Xuguo “Joe” Zhou and Ling Yuan have anything to do with it.

Zhou, an entomology assistant professor, studies the digestive tracts of wood-feeding cockroaches and termites.

These insects turn wood into glucose faster and more efficiently than any organism or machine on the planet, including current industrial biofuel production methods.

“Both termites and woodroaches can efficiently convert over 90 percent of woody materials into fermentable sugars in their tiny bioreactor hindguts within a day,” he said.

Zhou is compiling a comprehensive list of the digestive enzymes of these two insects. The wood-feeding cockroach is the ancestor of termites and provides a unique reference point for the termite research. Once Zhou has the list, he will look for the common enzymes between the two insects. This will tell him which are vital to the wood digestion process.

The current biofuel pretreatment process relies solely on chemo-thermal energy to break down woody materials.

Once Zhou identifies the enzymes, Yuan, a protein engineer and associate professor in the Department of Plant and Soil Sciences, will select the right proteins within the candidates and engineer them to be more suitable for biomass pretreatments.

“One of the major problems with the biomass conversion industry is the enzymes they are using aren’t cost effective,” Yuan said. “My lab will take the enzymes Joe identifies and engineer them to reduce the number needed for bioprocessing and make them more efficient in terms of sustaining the harsh conditions such as high heat or extreme pH required by the bioprocessing industry.”

Current biofuel production uses high levels of energy to convert biomass into biofuels and the chemicals used to break down the material are emitted into the environment. Ultimately Zhou would like to see insect enzymes controlling the entire biofuel production process.

“If these insect-derived enzymes can work with some of the chemicals currently used in the biomass pretreatment process, or if they can perform under industrial conditions, we can reduce energy input and pollution,” Zhou said.

Rainy Days and Memories



“Dottie” and her husband spent every summer in France. Years later, when the progression of Alzheimer’s disease forced her into an assisted living facility, her family hung a painting of the French countryside over her bed. It made sense. They knew those memories were important to their mother.

But when she spoke to Amy Hosier, “Dottie” didn’t remember those trips. What she did remember was taking her first car ride in her grandparents’ LaFayette. She’d never shared that story with her family, so they had no way of knowing that pictures of Dottie’s grandparents or the car itself might have been a better choice for the room.

“That experience (with ‘Dottie’) has always remained in the back of my mind,” said Amy Hosier, assistant extension professor in the College of Agriculture’s Department of Family Sciences. She has created a pilot program called Memory Banking with Professor John Watkins, Assistant Professor Faika Zanjani, graduate student Brian Downer, all in the Graduate Center for Gerontology in the UK College of Public Health.

The idea behind the project is to help people record or “bank” their memories in a variety of ways, which could in-

clude journals, photographs, and drawings, and to have a better understanding of what those memories mean.

In four workshop sessions, people begin to think of their life history along eight “life domains,” family/friends, health, spirituality, home/place, historical contexts, education, work/volunteering, and recreation/leisure.

Participants work in two-person teams with spouses, family members, or friends. Hosier said that when a memory bank is shared, it can help build or maintain quality relationships and also be used as a caregiving tool.

“Memory Banks help individuals build legacies and exercise the mind,” she said.

“The process might uncover some events you never talk about, but they shaped who you are and affected your behavior and your decision-making,” Hosier said. “In return, if you know your loved one a little bit better, then you as a caregiver can make better decisions for that person.”

In a survey taken after the workshops concluded, one of the participants commented, “Doing the lifeline makes you remember things you had not thought about in years. The program is a motivation to start a Memory Bank for future generations.”



Steve Higgins explains his BMP for livestock around streams.

TEACHING BY EXAMPLE

Four of the College's farms now have demonstration projects in place to show producers how to protect natural resources as they deal with environmental issues related to production agriculture.

These projects are visual proof that proven methods, called best management practices or BMPs, can go a long way toward assuring that our streams, lakes, ponds, and other water bodies, all of which supply drinking water, are clean.

"Not only do these practices help the environment, but clean water for livestock can improve production," said Steve Higgins, the College's director of environmental compliance.

Higgins and his team have set up project sites at UK farms across the state—at North Farm in Lexington, the Oran C. Little Research Center in Woodford County, the UK Research and Education Center at Princeton, and at Eden Shale Farm in Owen County. They are part of an agriculture water quality plan for each farm. The sites are a model to show producers methods to comply with the Kentucky Agriculture Water Quality Act.

Having demonstration sites at all the experiment stations allows the College to use a regional system to showcase water quality best management practices, Higgins said. Producers learn techniques for controlling, trapping, and filtering contaminated runoff before it reaches a stream. The sites display a variety of BMPs such as vegetative buffer zones; fencing with gated livestock crossings; clean water diversions for livestock use; structures, such as grade stabilization structures, gutters and downspouts on roofs; composting and manure storage facilities; winter feeding and rotational grazing structures; and nutrient management plans.

Numerous producers, educational groups, state and federal agencies, and special interest groups have already seen these practices in action at field days and tours, through the Master Cattleman and Master Stocker programs, as well as other events.

"It used to be producers would go to one (private) farm and see one BMP, and to another farm to see another one," Higgins said. "Now, we can take them to one paddock and show them eight to 10 BMPs."

LOCAL beef: it's in your freezer

IN CAMPBELL COUNTY, twelve farmers banded together to market antibiotic- and hormone-free beef directly to consumers. Don Sorrell, the county's agriculture and natural resources extension agent, credits members of a 2008 Agriculture Council planning meeting, along with UK extension specialists, the Kentucky Center for Agriculture and Rural Development, and local farmers for creating the Campbell County Beef Association to offer a local, natural product.

Sales are promising. Since its inception one year ago, the co-op has sold 22 animals to 121 individuals, some of them repeat customers.

"We are in the service business, catering to consumers in Northern Kentucky and greater Cincinnati," Sorrell noted.

This city-based clientele has led them to explore different options, among them processing the finished product into smaller sizes, as well as offering a sampler box that suits households that do not have the necessary freezer space. The grain-finished beef is USDA-inspected and graded by the Kentucky Department of Agriculture. A whole or half beef costs \$3 per pound hanging weight, quarters are \$3.15 per lb. and the 30-lb. sampler is \$3.50 per lb.



LEFT TO RIGHT: Steve Martin, Ron McCormick, Vince Rowe and Don Sorrell participate in the Campbell County Beef Association, which connects local ranchers with consumers.



The Kentucky Children's Garden

WHERE PLAY INSPIRES LEARNING

After years of planning, fundraising, and labor, the Kentucky Children's Garden at The Arboretum opened in 2011 to much fanfare. The garden provides a place for the whole family to discover the environment in a fun, interactive way. Families experience different Kentucky landscapes and geology and encounter footprints of the state in child-themed gardens and along winding sidewalks, connecting paths, and streams. Interactive exhibits inspire visitors to learn about nature and the cycle of life; comfortable benches provide places to pause and reflect.



Graduate student Claire Kimberly uses a blunt syringe to inject gel into the electrode cap worn by a study participant.

Imagine what it would be like to see into another person's mind. University of Kentucky Family Sciences researchers Ronald Werner-Wilson, Trent Parker, and Nathan Wood aren't mind readers, but individuals and couples come to them, strap on something that looks like a swimmer's cap, and let the professors watch their brainwaves in action.



Ronald Werner-Wilson

"Humans are immensely sophisticated, complicated creatures, which means we need to use more sophisticated ways to collect data about them," said Werner-Wilson, Kathryn Louise Chellgren Endowed Professor for Research in the College of Agriculture's School of Human Environmental Sciences.

In the Family Interaction Research Lab, researchers collect social, neurological, and physiological (heart rate and skin conductance) data from individuals, couples, and families as they communicate.

"The laboratory brings a new research methodology to our faculty," said Ann Vail, director of the School of Human Environmental Sciences. "The entire scientific community is considering the changes of the brain and how they impact human behavior. It is only natural that our faculty would be interested in the impact on relationships and family functions. The potential impacts on individuals and families are numerous."

In the lab, that "swimmer's cap" participants wear is covered with electrodes that measure brainwaves as they travel from neuron to neuron across synapses in particular areas of the brain. Along with the cap, participants are fitted with equipment that measures heart rate and skin conductance, or sweat.

"The areas we're most interested in are the emotion processing areas, which are on the front and right side of the brain," Werner-Wilson said. "For example, people who tend to exercise the right side of their brain more tend to have symptoms of depression and are withdrawn.



People who use the left side of their brain tend to be more relaxed and more engaged in conversation."

The lab allows them to get a more accurate picture of positive and negative factors influencing a relationship. Other forms of research, such as questionnaires, may be clouded by how people picture themselves or want others to perceive them.

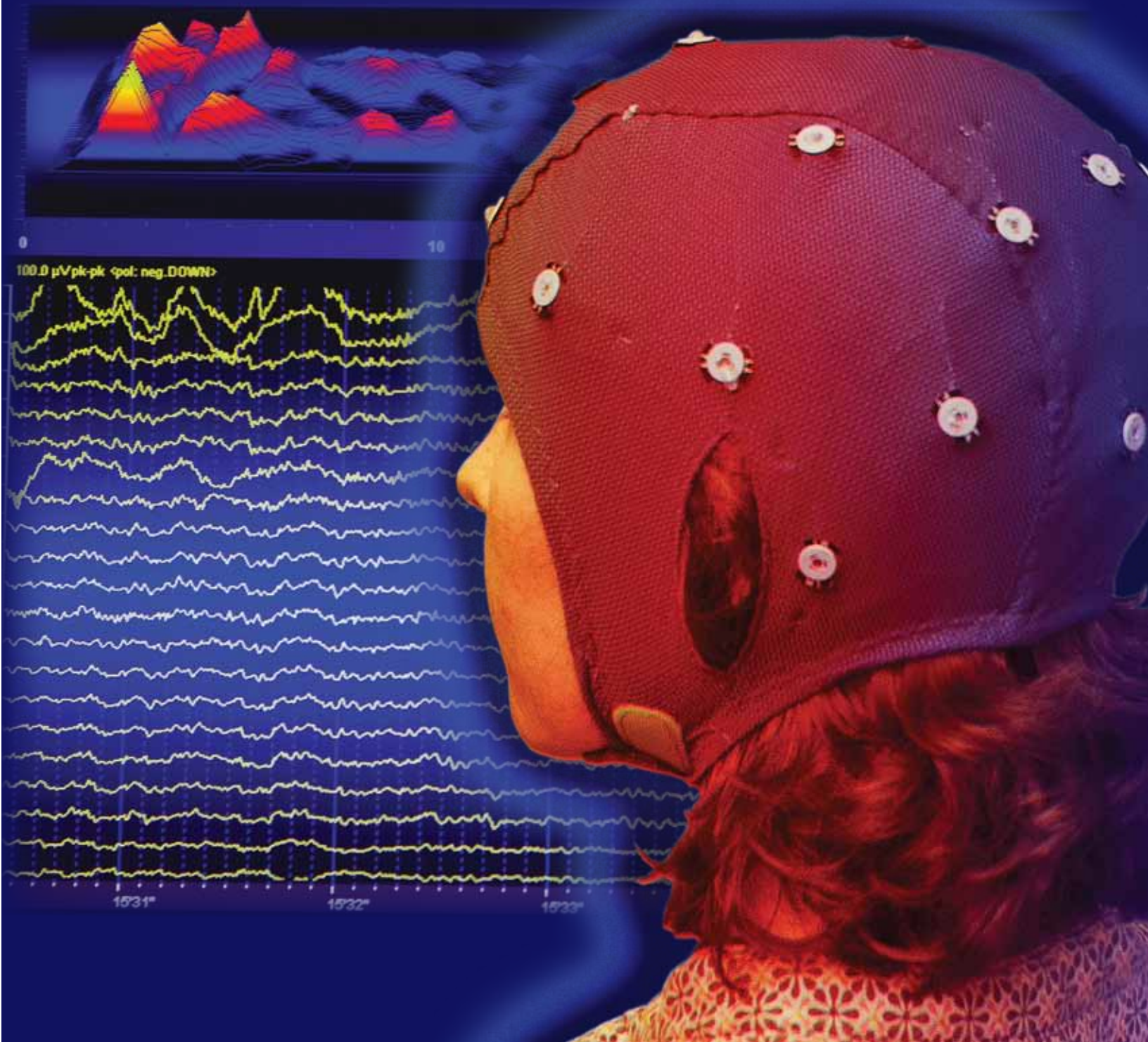
"This cuts out the social desirability, so you are able to see what's really going on with people," said Parker, a family sciences assistant professor.

Ashley and Andy, both 24, had been married for only eight months when they decided to participate in one of Parker's studies. He wanted to find out if engaging in a warm interaction before discussing a relationship problem reduces stress. Participants discussed interactions that were warm, such as how they first met, or neutral, like the events of the day. In the study, each couple was alone in the lab while they discussed two problems in their relationship. Researchers recorded the conversations on video and analyzed them later.

"We've had similar conversations in the past at home," Andy said, referring to the problems they discussed. "The whole experience was relaxed and easy. They made it easy."

Waves of Communication

by Katie Pratt





Doctoral candidate and lab coordinator Martha Perry believes the lab provides “a unique graduate school experience” that gives her the opportunity to publish in new areas. (R) Kelly Webber partnered with Nathan Wood in the lab to examine family and couple dynamics.



This is only one of several studies conducted since the lab opened in 2010. Werner-Wilson has conducted research on how military couples are affected by deployment. He particularly focused on couples who have stayed together despite more than one deployment. He’s also conducted research about the

impact a traumatic brain injury has on a relationship. Currently, he’s collecting data on communication between parents and children and how young people are influenced by video games.

The lab also has games that can help people strengthen a particular area of their brain. In these games, participants move objects on a computer screen by activating a particular part of their brain. The cap captures where the brain is the most active and relays that information to the computer.

“Twenty or 30 years ago, something like this would seem like magic,” Werner-Wilson said. “It’s like being able to play a game without using a joystick. Think of the brain as a muscle. Studies have shown that we can make these muscles stronger and in some cases reduce mental disorders, such as ADHD (attention deficit hyperactivity disorder).”

Wood partnered with Kelly Webber, assistant professor in UK’s Department of Nutrition and Food Science, to study how couples affect each other’s eating habits.

“This lab gives us the opportunity for bio-psycho-social research so we can look at inter- and intrapersonal reactions and emotions,” said Wood, an assistant professor in family sciences. “It’s pretty rare to be able to look at families and couple dynamics at this level.”

He’s also conducted a study to determine if a person’s background can help them predict what happens next in a sequence of events. For this intuition study, he solicited graduate students training to become therapists, professional therapists, and people outside the profession. Each research participant was shown a series of photographs of couples interacting. Subjects were asked to predict the intensity level of the next image in the series. They also viewed videos to evaluate different kinds of interactions, like angry or humorous ones.

Parker’s interest in physiological research and its relationship to family communications began in graduate school, and the lab has given him the opportunity to delve further into this area.

In addition to the warm interaction study, he conducted research during actual therapy sessions. It is a common theory among therapists that if a client’s and a therapist’s heart rates increase during a session, the



LEFT TO RIGHT: Graduate student Joann Lianekhammy and Ronald Werner-Wilson watch how the brain responds as his son, Will Werner-Wilson, plays video games.

client sees the therapist as empathetic. In this study, professionals and clients with UK's Family Center volunteered to be research participants. Parker analyzed how clients reacted to the therapist and how the clients rated the therapist after the session.

He presented his findings about clients' self disclosure, and therapist physiology and the empathy theory at the American Association for Marriage and Family Therapy Conference in September in Fort Worth, Texas.

"The lab has opened a whole new world for me," he said. "It's giving me a really unique perspective on therapy."

In addition to the researchers, graduate students in family sciences are using the lab for master's theses and doctoral dissertations.

Martha Perry, a doctoral student who is the lab coordinator, is interested in a career as a family sciences professor. She completed a study comparing face-to-face communication to online communication for her master's thesis in 2010. She discovered that the majority of couples found online chatting as satisfying as face-to-face communication. Some couples preferred to problem solve and resolve conflicts over the computer, as it gave them more time to think about what they wanted to say, resulted in fewer interruptions in the conversation, and lowered the chance of the interaction escalating.

"Having a unique graduate school experience like this one could help me make myself more marketable to potential employers," she said. "It's an opportunity to publish in areas that haven't been published in."

Parker has utilized the lab equipment to demonstrate to some of his undergraduate students the difference between the brainwaves of people with and without ADHD.

"It's been a really valuable teaching tool," he said.

While the lab has only been active for a short period of time, the researchers plan to use it to advance family sciences research and improve family and couple communication.

"UK has a great name in family sciences. The lab just gives us another way to show we're on the cutting edge," Wood said. ♦



Trent Parker



THE BEAR FACTS

by Carol L. Spence

TUCKED IN AGAINST A ROCK out-crop and sheltered from January's frozen cold by a fallen tree and a nest of leaves, the female black bear gives birth to twins—a black-coated female weighing between 8 and 12 oz. and a male who is a bit smaller than his sister and ginger-headed (one of the breed's color variations).

Six weeks later, on a day when the sky and breeze promised spring, researchers from the College of Agriculture's Department of Forestry go bear hunting.

Not with rifles but with an antenna. Not to kill but to count.

IN THE 18TH CENTURY, BLACK BEARS in Kentucky outnumbered deer, elk, and other large predators. By the end of the next century, they were essentially gone from the state. Habitat loss due to human development, overhunting, and overzealous logging practices drove bear populations into the most rugged and remote parts of the Appalachians in Virginia, West Virginia, and Tennessee.

But as new growth forests have matured in Kentucky's craggy Appalachian foothills, habitat has returned and with it the bears. Since the 1980s, first males, then females have eased back into the southeastern and northeastern regions of the state. The largest population can be found around Pine Mountain, but they also are coming across the Tennessee border into McCreary County, descendants of 14 females and cubs seeded in 1996 by the U.S. Park Service along the Tennessee part of Big South Fork.

The recolonization process is a slow one. Females expand the breeding population, and they do it in increments. That female cub born back in January will eventu-

ally set up a home range adjacent or overlapping her mother's. Her brother will be the explorer, leading the colonization, spending 95 percent of his time alone far from his birth territory.

John Cox, adjunct assistant professor in the UK Department of Forestry, has been studying black bears in Kentucky and Florida for the past nine years, working first for David Maehr, a UK forestry professor, and then taking over the project after Maehr died in a plane crash in 2008.

In 2009, Cox and graduate student John Hast, using genetic testing, determined that the bears coming into the state from Pine Mountain and the bears in McCreary County are two distinct populations.

"What we found is that all of the bears in Eastern Kentucky were genetically related to bears in West Virginia and Virginia, while those in McCreary County were largely descendants of the original Tennessee founders," Cox said. "So either they haven't reached the density where they've spread out to interact, or I-75 remains a significant barrier to these populations."

John Cox holds a VHF antenna aloft, as he listens for the transmitted beep from a collared black bear.

GPS collars placed on some of the Pine Mountain bears help Cox track the males' extensive travels.

Male black bears make major movements, particularly during the breeding season. For that reason, they've been seen as far west as Henry County, along the Palisades, and in the Knobs area. As far as Cox has been able to determine, the core of the actual breeding population, the females, currently is restricted to a four- or five-county area in southeast Kentucky.

THE BEEPS GROW LOUDER as Cox, graduate students Joe Guthrie, Sean Murphy, and Shane Tedder, and Kentucky Department of Fish and Wildlife biologist Mike Strunk follow graduate student

Ben Augustine into the woods as he tweaks the VHF receiver. The terrain is ankle-twisting steep. The company's progress is further hampered by a vast stretch of deadfall, pine trees killed by the southern pine beetle in the 1990s. There are no paths this deep into the woods, so traveling in most places means scrambling over or tight-rope walking along barkless tree trunks. In some cases, it can take hours to reach a den.

THIS FINAL PHASE of the hunt is called denning. The previous summer, Murphy set up camp in the Daniel Boone National Forest and surveyed McCreary County's black bear population by using a hair snare, a triangular-shaped piece of barbed

In the 18th century, black bears in Kentucky outnumbered deer, elk, and other large predators. By the end of the next century, they were essentially gone from the state.





Sean Murphy and Ben Augustine hold four-week-old cubs. This male and female will be microchipped so they can be identified throughout their lives.

wire with a doughnut or other food item in the center. Murphy estimated the county's population at 40 bears, but because it's such a small sample, there's a confidence interval of 30 to 90. Murphy also placed VHF transmitter collars on some captured bears. These lead the team to females in their dens the following spring.

"What it tells us is those bears that were reintroduced into Tennessee have made their way into Kentucky," Cox said. "The interesting thing that reflects the colonization phenomena was that most of

the hits we got in the northern parts or the outskirts of McCreary County were from males. All the female hits were down near the reintroduction site. So the bears are expanding, but they're not growing a lot in numbers, given they have one of the slowest reproductive rates of any mammal."

THE FEMALE IS SITTING LETHARGICALLY beside her den—in this case more of a nest against a rock outcrop, sheltered by a fallen tree. The men get lucky this time. They can tranquilize her from a distance.

Sometimes the female is tucked back in a small cave-like opening that leaves the men little room to maneuver.

This mother doesn't run. A few will take off and return later, but about 80 percent of the mothers will stay with their cubs.

Her body's metabolism is so slow at this time of year that the drug takes awhile to work. Cox and crew wait silently below her, hidden from her line of sight by a rock wall. A woodpecker's call is the lone sound in the late winter woods. The team speaks only when necessary and then in whispers. They want to keep the female calm. Though the tranquilizer immobilizes her, she still can see and hear.

BLACK BEARS ARE SMART, opportunistic creatures. They lead solitary lives spent mostly in the search for food. Humans are often a good source, with their unsecured garbage cans and dumpsters, deer feeders, and beehives. But mixing bears and humans is not a good idea, and the bears are usually on the losing end.

Cox is studying how nuisance behavior affects the long-term fitness of black bears. He currently is monitoring two sets of females in the Pine Mountain area. One set is clearly dumpster diving, which he knows from their GPS data. The other set typically is staying up in the woods, away from people.

"How does that kind of behavior affect the long-term survival of those bears?" he wonders. "Does it affect the number of cubs they have? Can the cubs learn that kind of bad behavior from their mother? Is it socially transmitted?"

Through long-term GPS tracking of these individuals and their offspring, he hopes to understand better how bears and humans are interacting.

"It's really taken the local population and some of the resource personnel some time to adjust," he said, "in terms of people's attitudes changing and becoming more comfortable with bears, but not going to the other extreme and trying to feed them."

Strunk agrees. He works with schools to educate students about black bears. It's important, he says. "They're adapting to us faster than we're adapting to them."

CHARACTERIZED AS CARNIVORES, bears are actually omnivorous, taking advantage of a variety of food sources. They eat berries and nuts (called mast), spreading soft mast from one place to the next.

"Bears are seed trucks, perhaps more so in places like Florida, where they often rely more on soft mast," Cox said. "Here in Kentucky, they eat a lot more hard mast, like acorns."

They also consume larvae, occasionally scavenge a carcass and, if they feel up to it, Cox said, they'll kill a deer fawn or elk calf.

COX GIVES THE ALL-CLEAR from the top of the outcropping, and the team scrambles to join him. It's steep and requires finding a toehold, grabbing an exposed root and heaving up and over.

They move quickly and quietly. No one wants to stress these animals more than is necessary, because every individual is critically important in such a small, recovering population.



A quick check of the female. She's lying peacefully, though her eyes are alert. They cover her face to keep her calm. She weighs nearly twice what she weighed when Murphy collared her the previous summer. Her coat is thick and only slightly softer than pig bristles, surprisingly. She has a thick undercoat at this time of year. She'll lose that in warm weather; Cox says they can look quite bald during the summer shed.

Check her teeth. She's missing a molar and an incisor, but otherwise they look healthy. Cox estimates she's somewhere between 8 and 12 years old, a good age and obviously an experienced mother.

Pluck a few hairs for DNA analysis.

And then Strunk pops up, holding her two cubs wrapped in his coat. The female is plucky

and curious, the ginger-headed male is shaking and crying for his mother—wee things weighing no more than a few pounds, but with claws already an impressive length.

The cubs' sex is quickly determined, hair plucked, and a microchip injected under each one's scruff. In the future, if that bear is ever recaptured, a scanner will help researchers ID it.

The mother stirs a bit; the tranquilizer is wearing off. Murphy and Guthrie tuck the cubs against her belly, and the company quietly retreats the way they came.

Cox will continue his studies—investigating the influence of roads and human activity on black bears and monitoring their population growth—all the time hoping his work will help ensure our peaceful coexistence with this returning Kentucky native. ♦

LEFT: Sean Murphy outfits a female black bear in Harlan County with a VHF collar.

RIGHT: Mike Strunk holds a female black bear cub while researchers collect data from her mother and brother.

by Carol L. Spence

Back to the Farm



Denise and Jody Hamilton are teachers who dream of retiring to their own farm to grow organic vegetables and keep bees.

Mark Thomas recently graduated from UK in agricultural economics and returned to his family farm in Hardin County where he grows corn, soybeans, alfalfa, grass hay, and raises cattle and a few chickens. They are part of a new trend in this country, spurred no doubt by the fact that more and more people are taking an active interest in the origin of their food. Because of this, young people are beginning to stay on the farms where they were raised, and some non-farmers are jumping at chances to leave urban careers for life on the land. According to the U.S. Department of Agriculture, approximately 20 percent of the 2.1 million U.S. farms are classified as beginning farms—operated by people who have farmed for 10 years or less. This is a good thing, though still not enough, considering that the average age of farmers in this country is still rising. The latest census shows that 40 percent of U.S. farmers are 55 or older.

Bringing new people into farming and keeping the next generation on the farm is essential for the future health of agriculture.

That's the idea behind the USDA National Institute of Food and Agriculture's funding of beginning farmer/rancher programs at 29 universities and organizations in 2009. The UK College of Agriculture and Kentucky State University received nearly \$750,000 for KYFarmStart, a two-year whole-farm management education designed to give beginning farmers the tools they need to be successful. Now beginning its third cycle of classes, UK and KSU threw a wide net to attract a diverse group of farmers to the program. KyFarmStart has been offered in counties from as far west as Land-Between-the-Lakes to Ashland in northeast Kentucky and has provided

Those who enroll in KYFarmStart learn from experts like Extension Soil Specialist Edwin Ritchey.

The Ag Magazine



Chad Lee teaches a group of beginning farmers how an ear of corn can open their eyes to the crop's needs.

The training and education provided through these grants will help ensure the success of the next generation of farmers and ranchers as they work to feed people in their local communities and throughout the world.

—KATHLEEN MERRIGAN,
Deputy Secretary of Agriculture



Bhutanese refugees Sita and Tanka Adhikari discuss their pepper crop with Wayne Long.

more than 255 participants with one source for a wide variety of information.

“The training and education provided through these grants will help ensure the success of the next generation of farmers and ranchers as they work to feed people in their local communities and throughout the world,” Deputy Secretary of Agriculture Kathleen Merrigan said when announcing the grant winners.

A farmer’s success isn’t confined to his or her own family.

“Successful beginning farmer programs might be the key to preserving agricultural land and rural communities,” said Lee Meyer, extension professor in the UK Department of Agricultural Economics. “Watching our beginning farmers gain confidence in their decisions has been very inspiring and gives me hope for the future of Kentucky agriculture.”

KyFarmStart includes face-to-face educational sessions and on-farm demonstrations covering topics such as enterprise evaluation, land-labor resources, nutrient management, farm recordkeeping, agriculture water quality plans and marketing plans, among others. During the second year of the program, Kentucky

Beef Network and Kentucky Women in Agriculture help connect program participants with mentor farmers who have similar enterprise interests. With their mentors’ help, beginning farmers can take what they learned in the classroom and put it into practice on their own farms.

A PRACTICAL IMPACT

“We have a range of participants,” said Linda McClanahan, agriculture and natural resources extension agent in Mercer County. McClanahan was one of the agents to lead classes in the first cycle of the program. “Some of them do have farm backgrounds, but we also have a lot of people who have had other careers. They’ve bought a farm, and they’re trying to figure out what to do with it.”

Denise and Jody Hamilton fit that category to a tee. Teachers in the Jessamine County School District, they have big plans to sell their current home on a golf course and build a log home on 25 acres they own in Garrard County. There, on land that came complete with a barn and pond, they plan to get into organic production—primarily by planting a “salsa garden”—as a supplementary income for retirement. They’ll sell some produce through a farmers market and make salsa out of the rest to sell as a value-added product. It sounds easy.

It might sound too easy. Farming, whether it’s on a large or small scale, is a business enterprise, often with a limited staff and cash flow. Farmers need to be bankers, accountants, electricians, veterinarians, marketers, agronomists, general laborers and even chefs.

“The biggest challenge beginning farmers face is that they don’t have any idea what they’re getting into, especially when there are so many rules and regulations thrown at them, plus marketing and everything else about the enterprise,” said Louie Rivers, Jr., director of the Small Farmer Outreach Training and Technical Assistance Program at Kentucky State University. “It gets complicated fast.”

Mark Thomas said he’s learned quite a bit in the eight months he’s been involved with KyFarmStart.



Participants at a KyFarmStart field day examine an ear of field corn at BLT Farm in Hardin County.



Successful beginning farmer programs might be the key to preserving agricultural land and rural communities.

—LEE MEYER,

UK Department of Agricultural Economics extension professor

On a day in August, participants from the three-county region of Hardin, LaRue and Meade counties, met with UK extension specialists Chad Lee and Edwin Ritchey for a field day at the Thomas family farm near Elizabethtown. Lee took them through the cornfields, sharing techniques for improving yield and growing healthier plants. Ritchey, a soil specialist, talked about the importance of soil tests and how to avoid throwing good money after bad by adding unnecessary supplements.

This is one of the advantages to the program, said Matt Adams, Hardin County agriculture and natural resources extension agent, who heard about the program and thought it would be beneficial for a lot of people in his area.

“FarmStart lets the participants interact with our extension specialists,” he said. “It gets their foot in the door, so they can have a closer working relationship with the specialists as well.”

Thomas said the program has given him many ideas on how to survive when prices might be down or weather or disease take part of that year’s crop. He also has learned how to be more efficient.

“Don’t throw fertilizer out there that we don’t need, don’t use products that we don’t need,” he said, referring to a few things he’s picked up in the classes. “It’s like Edwin (Ritchey) said, it’s not about bushels in the bin, it’s about money in the bank. If I can produce a few less bushels and get more money, it’s all about the money in the end. So long as we can keep it in the black, we’ll be fine.”

Meyer said the KyFarmStart program is having a practical impact.

“Participants tell us that they have dramatically increased their knowledge and skills,” he said. “For example, only about half considered themselves knowledgeable or expert in business planning before the program, compared to about 90 percent after the program.”

NEW FACES

Tanka Adhikari is a refugee from the tiny Himalayan country Bhutan. There he farmed 32 acres of buckwheat, corn, okra, sweet potatoes, and more. Here he lives within Louisville’s city limits.

The inner city might not be the image most people think of when they picture farming, but Wayne Long, Jefferson County agriculture and natural resources extension agent, saw KyFarmStart as a great opportunity for refugees who had farmed in their homelands, but now found themselves living in an urban environment. He teamed up with Lauren Goldberg, project coordinator for Catholic Charities, and with the help of translators, offered KyFarmStart to more than 50 people from nine countries on four continents. During their second session at the Americana Community Center, UK horticulture specialist Tim Coolong spoke to a gathering that sounded a bit like the Tower of Babel. They learned about organic farming and composting, and compared vegetables they were familiar with to those suitable for Kentucky’s growing season.

“We’ve tried to develop this more in line with the needs of the refugee group,” Long said, referring to their particular curriculum. “This is what they did in their home countries. This is what they’re used to. And now we have the opportunity to introduce them here to that same opportunity.”

This past summer, Adhikari, his wife Sita, and sister-in-law Ajuda grew corn, beans, okra, cucumbers, and potatoes in a sizeable community garden plot on 7th Street. He’ll sell some at a local market, and use the rest to help feed his family.

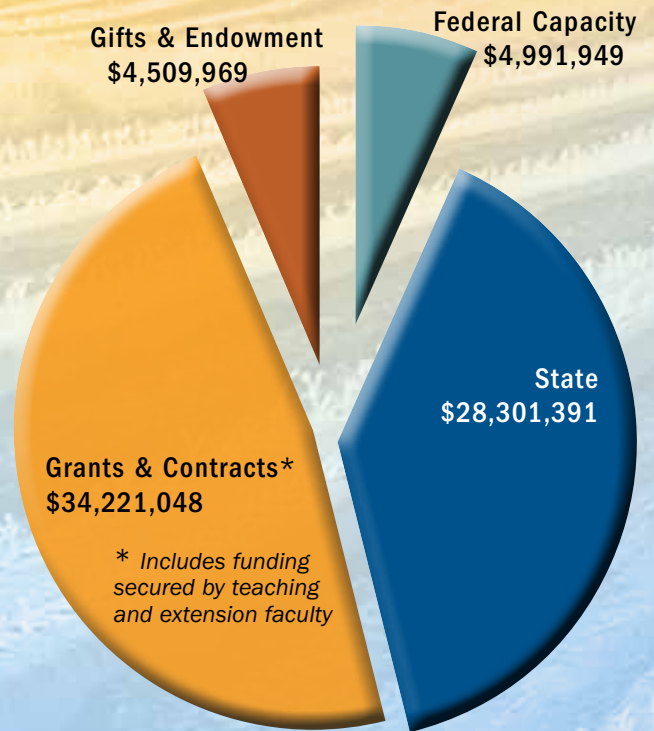
“This has been a wonderful opportunity for Kentucky’s two land-grant universities to bring together their resources to provide our clientele with tremendous support and the most up-to-date research,” said Kim Holmes, associate director of KSU’s land grant program. ♦



TOP: Lee Meyer helps refugees decide what to plant in their gardens.
BOTTOM: KyFarmStart participant Mark Thomas, of BLT Farm in Hardin County, hosted a field day at his farm.

Kentucky Agricultural Experiment Station

RESEARCH FUNDING



GRANTS & CONTRACTS

Awarded to the UK College of Agriculture through the UK Research Foundation

2010	\$34,221,048
2009	\$23,829,306
2008	\$30,972,002
2007	\$31,488,174
2006	\$31,527,814
2005	\$23,492,755

RESEARCH

ANNUAL REPORT 2010

AGRICULTURE has more challenges than ever before: feeding a predicted world population of 9 to 10 billion by 2050, using fuel crops to increase energy security, and sustaining a healthy environment. This means that global agriculture demand is projected to grow by 70 to 100 percent in the next 40 years or so. So it is useful to take a look at how we at UK are doing at the national and state level in terms of agricultural research and its benefits.

Several studies by prominent economists have estimated the return on U.S. public investment in agricultural research to be as high as \$25 for every \$1 invested. This makes sense as we reflect on the last century's gains in crop and animal productivity. Recently however, the Economic Research Service (ERS) has reported that growth in agricultural productivity has slowed in association with declining investments by the federal government.

There must be more growth to keep up with increased food and fuel demands. A recent ERS report stated that raising research and development spending by 3.73 percent annually would increase U.S. agricultural output by 73 percent by 2050, whereas if public R&D investment stays the same, the annual output would increase by only 40 percent. Under the latter scenario, the authors envision a need for more land, labor, capital, and other resources into production.

How are we doing in Kentucky? In the past year we have seen federal cuts of approximately \$2.5 million in special grant funds and a loss of \$9 million reserved for a building project. We are very fortunate to have maintained better state funding than many states, realizing only an 8 percent cut since 2005. Many states have cut

higher education in the double digits. In spite of these reductions, the College of Agriculture reported a banner year in many ways. UK Ag faculty worked on 149 research projects covering every type of agricultural and food enterprise and many other ventures in Kentucky, and they garnered slightly over \$34 million in external awards—a new record for the College!

Taxpayer investments made for the college in fiscal year 2010 (July 1, 2009 through June 30, 2010) included the "Federal Capacity" investment of almost \$5 million from the U.S. Department of Agriculture as part of its formula funds (we don't compete for these) and a state investment of \$28 million, for a total of approximately \$33 million. Additional funds attracted through grants (\$34 million) and gifts (\$4.5 million) exceed state and federal taxpayer investments. This tells us that our faculty and staff are very competitive and are doing their best to serve Kentucky; they are returning hard dollars, in real time, at more than the combined state and federal investment.

But what is the long-term payoff, the return on investment that hits the ground in Kentucky? We see in this issue many examples of that payoff on crop and animal research. We also see payoffs for Kentucky's environment that truly may be priceless, as our faculty work very hard to conduct research on keeping our forests healthy. Our research on plant disease is second to none, ensuring the best defense against emerging pests. And in one of the most complex new fields of research, biofuels, we have a strong statewide team investigating Kentucky's niche in this exciting new area.

We are proud of the College's work, and we hope you, our stakeholders, share the excitement about the return we give to your investment in agricultural research.

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WHO WE TRUST

A safe food supply is arguably one of the most important factors in a society's health and success. Safe food production, transportation, distribution, and handling are all paramount to gaining and keeping consumers' trust. UK agricultural economist Sayed Saghaian has been studying consumer response to food scares for many years. Recent work he completed with Jonathan Shepherd, UK area extension specialist in farm business management, focused on how consumers would respond to a hypothetical food-safety incident in produce markets.

"We know that food safety incidents are one of the most challenging issues in marketing and policy

channels of agricultural products today," Saghaian said. "We also have reason to believe that food-safety incidents will cause a demand shock, or essentially lower demand for products in the short run."

Food-safety events are inevitable, and since food is essential to life, Saghaian said learning how consumers respond to these events is vital.

The researchers began their study with the belief that consumers would be less likely to purchase fresh produce following a hypothetical food-safety scare occurring in that market.

They distributed a survey to a random sample of Kentucky households asking them two key questions—

who they would trust more when they heard food safety scare rumors and where they would turn for more information during a food safety scare.

"What we found was a large number of those surveyed would trust university scientists, public authorities, media, and family more than producers," Saghaian said. "That is probably because consumers tend to feel producers have a vested interest in minimizing their economic loss during a food-safety incident."

Respondents also indicated their first choice for information during a food-safety scare would be the Internet, followed closely by family and friends, newspapers, and television.

"This is important information to know because it can help policy and decision makers know who consumers trust in the wake of a food-safety scare," Saghaian said. "It will allow them to better communicate important information to the consumers in the most efficient way."



THE VALUE OF A TREE

If we lose the battle, what will our eastern forests look like, sound like, feel like?

A number of non-native invasive species have raided our woods. Insects such as the hemlock woolly adelgid and emerald ash borer and the pathogen responsible for sudden oak death threaten Southern Appalachian woodlands.

Entomology Professor Lynne Rieske-Kinney, with her research team, is focusing on the effects and management of the tiny hemlock woolly adelgid, native to Asia, hard to detect, deadly to eastern hemlocks, and now in twelve Eastern Kentucky counties. She believes that the elimination of hemlocks from our forests will have sweeping consequences.

"There is no replacement in Kentucky or in the South for this tree," she said.

Eastern hemlock is considered a foundation species in Kentucky forests, because it regulates its ecosystem.

"If you walk into a hemlock forest, the temperature is different, the smell is different, the sound is different. It really does define our forests," Rieske-Kinney said.

Hemlocks help regulate water temperature, stream flow, and runoff, and influence the soil chemistry. Hemlock foliage decomposes at a different rate than other tree species, and a number of sensitive species rely on it for year-round cover. Without hemlocks, Rieske-Kinney predicts the forest canopy will be lower and thinner and will let in more sunlight.

"It's hard to say what the value of a tree is," Rieske-Kinney said, "but certainly the characteristics of that forest are going to change quite

drastically—all those things the foundation species dictates will be altered."

Josh Adkins is an entomology doctoral student and one of Rieske-Kinney's team of researchers. Examining the characteristics of headwater streams where hemlocks are abundant, he discovered that from the smallest to the largest organisms in that ecosystem, all are influenced by hemlock in some way.

"With every study we do, we find another organism associated with hemlock that, if we did nothing, would be gone," he said. "It starts out with predators like spiders and goes to caddisflies in a stream, and then it goes on to fish and bird and mammal communities. They all are linked."

Rieske-Kinney and State Entomologist John Obrycki, have been studying biological control using *Laricobius nigrinus*, a tiny beetle that preys on the adelgid in all its stages. Along with approved pesticides, the beetle can be another arrow in their quiver.

"We may lose hemlocks, but we're going to go down fighting," Rieske-Kinney said.



POWER FROM THE FOREST

The U.S. Department of Agriculture asserts that climate change is having serious impacts on the nation's forests and rangelands. Because of that, USDA officials say that demand for renewable energy and biofuel products is exponentially increasing. The USDA believes the U.S. market for woody biomass could be up to 368 million dry metric tons per year. UK forestry specialist Jeff Stringer said Kentucky could realistically supply up to 2 to 5 million metric tons.

"A large potential exists for Kentucky landowners to improve their woodlands and increase the renewable fuel supply," said Jeff Stringer, UK forestry specialist.

When trees are harvested, sometimes only the bottom part of the main stem proves useful for conventional purposes, leaving a large part of the tree unused. And sometimes no part of the tree is suitable for harvest. UK researchers are studying ways to use the traditionally unwanted parts of the tree as biofuel.

"It allows those landowners an opportunity to make money for some woods that would normally be left standing just because they didn't have any good sawlogs in them," he said.

"Maybe landowners are in a situation where they don't have marketable land as far as traditional forest products go, but growing biomass markets give those lands value," Stringer said. "The growing market also has the obvious implication of job creation because we'll need people to do the processing. It may well provide opportunities for people living in Kentucky forest areas."

Stringer said that removing undesirable trees from the woods that have possibly been degraded by forest fires, high-grade logging, or grazing also benefits the environment by reducing the risk of future damage from wildfire, insect attack, disease, and severe weather.

Stringer and his colleagues are in the process of developing guidelines for harvesting wood for multiple purposes including biomass.

"Obviously we don't want people to go out there and start cutting everything down," Stringer said. "If you do that, you're removing all the nutrients and causing other potential problems. The guidelines, among other things, are going to help keep a certain percentage of the nutrients in place, so there's mulch and organic matter left for the next forest and to provide habitat for wildlife."



SHEDDING LIGHT ON DISEASE RESISTANCE

Barley yellow dwarf and wheat streak mosaic are two wheat diseases that cause a great amount of damage in Kentucky every five and 10 years, respectively. No wheat varieties are resistant to these diseases, though cultural practices can control them. However, they must be in place to be effective. In between outbreaks, many producers forget and aren't prepared when the diseases return.

This is one group that University of Kentucky plant pathologists Pradeep and Aardra Kachroo hope to help. The Kachroos, who are husband and wife, are discovering the key components of plant disease resistance and how they interact.

In two studies funded by the National Science Foundation's Division of Integrative Organismal Systems, the Kachroos and their research team identified three regulating factors for plant growth and development that are critical components of disease resistance pathways.

"Plant pathologists have always looked at different disease resistance pathways separately, but now we see more and more that they're all integrated," said Aardra Kachroo. "We have pieces of the puzzle, but we have to know how everything fits to get the big picture."

Plants have an internal clock that alerts them when it's about to be light. Disrupting the clock makes the plants more susceptible to viruses. The Kachroos found cryptochromes and phototropins, blue light sensors that regulate stomatal (pore) openings, root growth, and phototropism (bending towards light), play critical roles in pathogen resistance. The two proteins signal the plant to retain the disease resistance protein, rather than recycle it.

Plant pathologists have long suspected light played a critical role in plant disease resistance, but this study is the first demonstrating a mechanism at the molecular level.

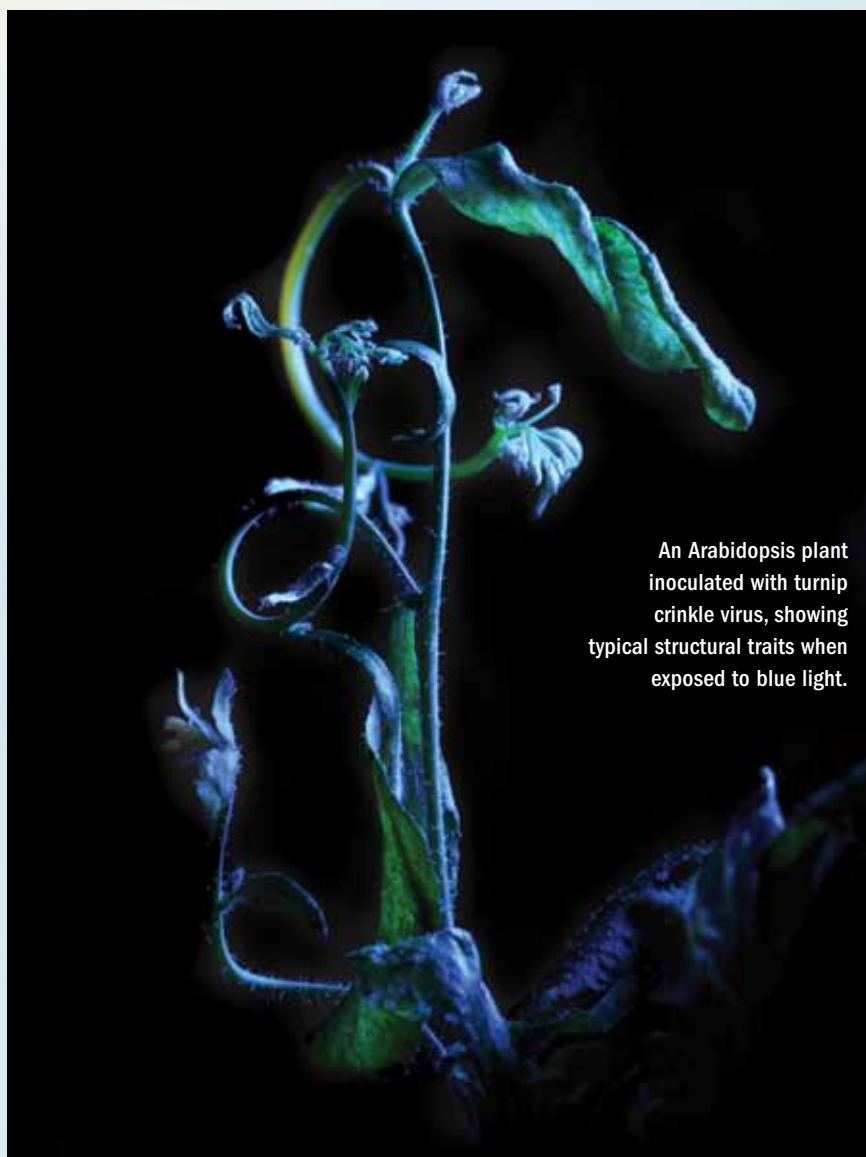
"Viruses spread very quickly inside the plant. Once they get into the plant's vascular system, the plant has very limited ability to prevent its spread. Resistance proteins prevent viral spread before they reach the vascular tissue," Pradeep Kachroo said. "Now we can begin to understand how this is regulated."

In another study, the Kachroos and their team identified a substance formed by plants' metabolism

that helps them build systemic immunity to fend off future infections, much the way vaccines do in humans.

"If you can generate systemic immunity, you can have great benefits in disease resistance," Pradeep Kachroo said.

Identifying these components is just the start for the Kachroos. They will continue to piece together the disease resistance puzzle, so perhaps one day Kentucky producers will have the upper hand on diseases.



An Arabidopsis plant inoculated with turnip crinkle virus, showing typical structural traits when exposed to blue light.

DOLLARS FOR DOLLAR



Don Halcomb, a Western Kentucky producer, knows what kind of impact the College's research can have for producers; he's seen its effect on his wheat crop. He talks about the late 1990s, when ag researchers from several departments formed a wheat science group to help the state's wheat farmers continue the production improvements they began making a decade before.

"With any crop, you have multiple variables, and you won't see improvements until you're working on all of them together," said Halcomb, partner in Walnut Grove Farms in Logan County. "The genetics is part of it, but you also need a plant pathologist to tell you when to spray and a soil scientist to help you with fertility."

The result of this team approach? Wheat yields in Kentucky continue to go up, and they outstretch yields of surrounding states.

In a difficult economy, when funds for agricultural research are on the chopping block, it's important to remember Halcomb's story and others like it. "Reports have shown at least \$10 returned on average for every ag research dollar invested," said Nancy M. Cox, Agricultural Experiment Station director and associate dean for research.

The value of red clover in Kentucky grew from about \$3.5 million in 1995 to nearly \$7 million in 2002, largely as a result

of College research that showed better varieties more than paid for themselves with increased yield.

In 1998, Kentucky farmers were bringing back \$518 per acre for bell peppers. Ten years later, that figure had skyrocketed to \$2,651 per acre. It's hard to quantify how much of that increase was due to College research, but some of it certainly was, including work on varieties resistant to leaf spot.

According to a Purdue University study, every dollar invested in veterinary diagnostic research yields a minimum of \$6 in economic benefits for animal agriculture. And, of the 10 vaccines now used for horses around the world, six were developed at UK's Gluck Equine Research Center. The economic impact of not having those vaccines? Devastating.

The Kentucky Agricultural Development Board has worked closely with the College, providing grants to demonstrate research that is particularly valuable for Kentucky.

This local approach is crucial, Halcomb said, "because production problems are unique by location."

Agricultural research makes economic sense, but it's important to remember why we're doing that research in the first place.

"We've got to feed a world of 9 to 10 billion people in 2050," Cox said. "It's taken the best science we have to accomplish the production improvements we've made so far. We need to continue supporting ag research to that level."



“This is my domain!” says June Johnston, a 23-year member of the team at the UK Research and Education Center in Princeton. Keeping the grass mowed throughout the orchard, pulling weeds in the research/demonstration gardens, and picking and recording fruit harvests is just a short list of all that keeps her busy as a horticulture technician on the research station. But Johnston doesn’t pause when she clocks out. On her 50th birthday she slalomed 50 miles on Lake Barkley. And every weekend finds this 78-year-old on the dance floor.

“They don’t come any better than June,” says Win Dunwell, extension horticulture specialist and her supervisor. “She works every minute of every day.” Plus, according to Dunwell, she’s developed her own schedule to get to everything that has to be done.

“I get paid for something I like to do,” she says.

And she intends to keep on doing what she loves. Go June!





Carmen Agouridis visits a local stream restoration project with her class.