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LOUISIANA Agriculture

Assuring Our Future Through Scientific Research and Education

Research boosts *Louisiana cattle industry*

Lessons from hurricane aftermath

Teaching rural youth entrepreneurship

LSU AgCenter Research & Extension

LSU AgCenter employee knowledge of genetically modified (GM) products

Heli J. Roy

In the United States, genetically modified crops include corn, soybeans, cotton, canola, squash and papaya. Nearly all of the soybeans and cotton grown in Louisiana are genetically modified.

LSU AgCenter researchers use genetic modification (GM) and genetic engineering (GE) methods to improve yield and characteristics in plants and animals. They are familiar with GM and GE and find these methods acceptable; however, the attitude of the larger AgCenter community toward the use of GM and GE methods was not known. A survey of AgCenter employees was conducted to determine basic knowledge about biotechnology and genetic modification, and the acceptance of GM and GE methodology.

The terms biotechnology, genetic modification and genetic engineering are sometimes mistakenly used interchangeably. They are not the same. Biotechnology is a broad term that refers to the use of a living organism or its components, such as enzymes, to make products. Genetic modification can involve alteration by conventional crossbreeding or other methods. Genetic engineering is a process in which an organism's genetic material is altered using recombinant DNA technology. In this process, recombinant deoxyribonucleic acid (rDNA) is used to insert a gene from any species into an organism's genetic material to achieve its subsequent expression in a new food crop or species. Recombinant DNA technology allows genes to be inserted in an organism to produce combinations that would not otherwise occur in nature. GE foods are derived from plants or animals created through the process of DNA recombination, in which genes are transferred from one plant or animal into the genetic code of another plant or animal.

GM and GE are used to improve traits in animals and plants to increase herbicide resistance, to increase crop yield, improve plant survival in harsh climates, reduce fat accretion, improve meat production and increase shelf life. About two-thirds of all GM crops grown worldwide are grown in the United States. Some people find GM and GE food products controversial. Production of GM products in Europe has been met by consumer demonstrations. In the United States, more than three-fourths of consumers polled (77%) are aware that methods of modifying genes exist, and 56 percent say they have heard about GM foods. The majority of Americans (52%) are not aware that GM foods are in grocery stores, and only about a third believe they have consumed GM products.

Survey of AgCenter employees

The LSU AgCenter Institutional Biosafety Committee conducted a survey through e-mail of all AgCenter employees (1,412) in March 2005. The purpose was to:

- Assess the knowledge of AgCenter employees about biotechnology, GM and GE products.
- Find out their attitudes about biotechnology.
- Use the survey results to guide in preparation of educational materials to be produced on the use of biotechnology and GM and GE in modifying food crops to improve human health.

There were 338 replies for a rate of return of 24 percent. The majority of the respondents were between 46 and 55 years of age (36%), male (60%) and

(Continued on page 19)

Heli J. Roy, Associate Professor, School of Human Ecology, LSU AgCenter, Baton Rouge, La.

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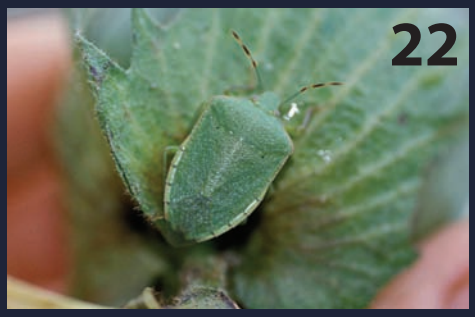

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Assuring Our Future Through Scientific Research and Education

ON THE COVER: Brahman cattle are useful to cattle producers in the South. Don Franke, shown here with his research herd at the LSU AgCenter's Ben Hur Farm in Baton Rouge, has dedicated his career to improving Brahman genetics and boosting the economics of Louisiana's cattle industry. See pages 6-10.

What's New?

Ville Platte man named 2008 best farmer, other finalists from Hamburg, Ponchatoula

Photo by Johnny Morgan

Richard Fontenot of Ville Platte was named the 2008 Louisiana Farmer of the Year. Other finalists were Tommy LaBorde of Hamburg and Eric Morrow of Ponchatoula. From left, Sarah LaBorde, daughter of Laborde; Ann LaBorde, his wife; Rhonda Fontenot, wife of Fontenot; Fontenot; Eric Morrow; and Natalya Morrow, his wife.

Richard Fontenot can't sit still. With more than 2,500 acres to farm, he can't afford to. But his efforts and contributions to Louisiana agriculture led to his being named the 2008 Louisiana Farmer of the Year.

"Agriculture provides opportunities and lifestyles second to none in my opinion," Fontenot said. "In addition to that it also allows me the opportunity to work with my family on a daily basis."

Fontenot was one of three finalists recognized for their accomplishments as part of the Louisiana Farmer of the Year competition, which is sponsored by Louisiana Network Inc., the Louisiana Farm Bureau Federation, the LSU AgCenter and the Louisiana Department of Agriculture and Forestry.

The other finalists were Tommy LaBorde of Hamburg and Eric Morrow of Ponchatoula.

Fontenot, who resides just outside of Ville Platte, is a fifth-generation farmer. He has a diverse operation that includes rice, soybeans, wheat, crawfish, cattle, hay and a land-leveling business. He says that with today's volatile markets, it is necessary to spread risk and plan for the future.

"When we look at crop rotations and crop decisions, we try to look at a three-year plan. If you chase the markets, you'll get into trouble," Fontenot said. "You have to find something that works on your ground, in your rotations, and not just for this year. You have to look two or three years down the road."

LaBorde farms nearly 4,200 acres in Avoyelles Parish. He produces cotton, corn, milo, soybeans and wheat. He also manages a herd of more than 700 cattle, and he has implemented a variety of conservation practices to protect the environment.

"We've gone to different cultural practices over the years to use less insecticides through Bt varieties, and we are using more efficient practices to stop soil erosion and runoff," LaBorde said.

Morrow's first occupation was as a securities trader in Chicago. When he got an opportunity to return to the family farm – one that that has been in his family since 1859 – he jumped at the chance.

"Once the market closed you couldn't do anything about it afterwards," Morrow said. "Here it is more like a lifestyle than a job. I really don't consider this my job. I consider this a lifestyle and what I want to do."

Morrow's primary crop is strawberries. He also grows seasonal vegetables and fruits, such as sweet corn, broccoli, potatoes, tomatoes, blueberries and blackberries.

Morrow says he enjoys the direct interaction he has with his customers.

"I just love seeing our customers purchasing our fruits and vegetables," he said. "You build up a relationship with your customers, and it's great to see them come back." ■ **Craig Gautreaux**

Weed Tenacity

Photo by James L. Griffin

James L. Griffin, an LSU AgCenter weed scientist, discovered this golf ball in a sugarcane field in Youngsville, La., where he was conducting an experiment. As he was removing crop residue, he noticed that a weed, which is named *Poa annua*, is actually growing out of the golf ball.

What's New?

Pecan seminar helps growers prepare for 2008

The LSU AgCenter Pecan Research and Extension Station in Shreveport hosted a seminar on pecan growing on Feb. 28, which was attended by 35 growers.

John Pyzner, LSU AgCenter pecan and fruit specialist, addressed desirable traits of a cultivated variety. Those include large nut size, ease of shelling, increased yield and good disease resistance. Early-maturing varieties he mentioned are Barton, Pawnee and Candy. The best cultivars for sprayed orchards, according to Pyzner, are Sumner, Moreland, Oconee, Pawnee, Caddo, Candy, Elliott and Kiowa. The best pecan cultivars for home planting are Sumner, Elliott, Candy, Jackson, Stuart, Moreland and Owens. Pyzner said growers need to know what their customers want. For instance, the gift box trade needs early-maturing varieties and pretty, bright kernels.

LSU AgCenter horticulturist Charlie Graham said lime increases soil pH, improves microbial activity and generally improves soil structure, but he cautioned that all liming materials are not created equal.

"Understand what you are purchasing," Graham said. Liquid applications can provide better uniformity, but the down side is that growers must haul both water and lime across the field, he explained.

Alternative liming sources are marl or Selma chalk, finely ground oyster shells, egg shells, blast furnace slag and paper mill lime. Agricultural lime's effectiveness depends on the degree of fineness because the reaction rate depends on the surface area in contact with the soil, Graham said.

Because the cost of limestone increases with fineness, materials that require minimal grinding yet contain enough fine material to change pH rapidly are preferred, Graham said.

David Boethel, vice chancellor of the LSU AgCenter, updated the group on the status of the Interstate 69 interchange proposed to go through the Pecan Station. He said the state Department of Transportation and Development was surveying a month ago and talked about the possibility of clipping a southern corner of the station rather than constructing right through it. "If they can move it that far, they can move the whole highway," Boethel said. ■ **Mary Ann Van Osdell**

Louisiana can gain from move to biofuels

MONROE – As competition between food and bioenergy drives up prices of corn, soybeans and other farm commodities, Louisiana has untapped land that could be put into production for alternative crops, according to agricultural industry observers.

Louisiana can take advantage of these resources to participate effectively in the move toward growing new plants as raw materials – or feedstocks – to produce biofuels, said Kelsey Short, director of agriculture, forestry and food industries with Louisiana Economic Development.

"Alternative feedstocks place Louisiana in a strong competitive position," Short told a gathering of nearly 200 agricultural producers and representatives of industry, government and higher education for the 2008 AgOutlook Conference Feb. 25-27 here.

The conference on agriculture and renewable energy opportunities was sponsored by the LSU AgCenter, Louisiana Department of Agriculture and Forestry (LDAF), Louisiana Farm Bureau and U.S. Department of Agriculture agencies USDA Rural Development and Natural Resources Conservation Service.

The purpose of the conference was "bringing factions of agriculture together and discussing important topics," said LSU AgCenter Chancellor Bill Richardson.

"Energy is the new gold exchange," said Mike Strain, LDAF commissioner.

Energy policies have joined the farm bill as important factors in U.S. agriculture, said Dr. Abner Womack, senior economist with the Food and Agricultural Policy Research Institute at the University of Missouri.

"Easy oil runs out about 2025," he said. Then, fossil fuel suppliers will begin turning to tar sands in Canada and coal and oil shale in the United States.

"We have plenty of energy in front of us, but it's going to cost more to get," Womack said. "The secondary level of energy becomes more expensive."

Womack called the energy bill "far more important than any farm bill we'll ever pass." ■ **Rick Bogren**

Photo by Mary Ann Van Osdell

H.Y. Hanna concluded the 12th annual tomato field day with a visit to the greenhouses at the LSU AgCenter's Red River Research Station in Bossier City. The 60 participants braved the rain to see the outdoor displays.

Red River holds 12th annual tomato seminar

Intermittent rains didn't stop commercial tomato growers from viewing outdoor exhibits and touring the greenhouse tomato operation during a tomato field day at the LSU AgCenter's Red River Research Station in Bossier City on Feb. 29.

H.Y. Hanna gave 60 growers at the 12th annual event hands-on experience. Hanna is an LSU AgCenter researcher at the station who is in charge of the greenhouse tomato project.

The free four-hour event covered a variety of subjects on greenhouse tomato production and management.

Hanna encouraged growers to use perlite, which he has been doing for 12 years. "It is as good as or better than the first day we bought the material," he said about recycled perlite, which has produced better yields than other media.

Hanna recommended the Quest tomato variety, which had the best shelf life in a research study, with one week of marketability when kept at a room temperature of 68 degrees day and night.

"It is a shiny fruit and at the very minimum has only fine cracks on the shoulder," he said. ■ **Mary Ann Van Osdell**

Calpastatin and calpain genetic marker influence

Donald E. Franke, Thomas D. Bidner, Manuel A. Persica III, Trent Smith and Joshua D. Domingue

Consumption of beef in the United States last year was about 67 pounds per capita. Many surveys have shown that tenderness of beef is important for consumer satisfaction. One of the primary factors influencing beef tenderness is breed of animal. Genetic differences among individuals within breeds also influence variation in tenderness. While the Brahman breed has contributed significantly to increased maternal and reproductive performance in crossbred beef cattle in the subtropical region of the United States, it also has tougher meat than non-Brahman cattle.

Recent work in the LSU AgCenter suggested that additive genetic influences account for between 20 percent and 30 percent of the variation in meat tenderness of Brahman steers. In addition, the necessity to progeny-test sires to identify those that transmit more favorable genes for tenderness is time consuming.

Enzymes produced by many pairs of genes are involved in the tenderization process. Pairs of genes with the largest effects are called major genes. Research in molecular genetics has identified genetic markers for several major genes that influence tenderness.

A genetic marker is a section of DNA that can be identified by a simple laboratory procedure and is closely linked to a major gene or is located within the molecular structure of the gene. When genetic markers are associated with particular major genes, they can be used to study how the major genes influence traits such as meat tenderness. Research reported here involves the association of known genetic markers for tenderness with shear force of steaks from Brahman steers.

Donald E. Franke, Professor, Thomas D. Bidner, Professor, Manuel A. Persica III, Research Associate, Trent Smith and Joshua D. Domingue, former graduate students, School of Animal Sciences, LSU AgCenter, Baton Rouge, La.

Procedure

Over a five-year period, 445 Brahman bull calves that had known parents were purchased at weaning from purebred Brahman breeders in Louisiana and managed as stockers for feed lots. DNA samples were collected from all steers at purchase and stored for future use. Following grazing on ryegrass for 120 days, the steers were transported to south Texas for feeding. Steers were harvested when they reached industry standards of 1,100 pounds to 1,400 pounds with 0.4 inches to 0.6 inches of backfat (for weight and degree of fatness) and processed at a beef processing plant in Corpus Christi, Texas. Loin steaks from each carcass were returned to the School of Animal Sciences Meats Laboratory to measure tenderness after they were aged for seven days or 14 days and then cooked. Six half-inch cores from each cooked steak were tested for tenderness using shear force – a measurement of the force required to cut each core of meat. Shear force averaged 10.1 pounds for seven-day aged steaks and 8.5 pounds for 14-day aged steaks. Steaks that have a shear force of 8.5 pounds or less are considered tender.

Through a cooperative effort with Bovigen LLC, a biotechnology company in Harahan, La., genetic markers associated with genes that produce calpastatin and calpain enzymes were identified from the DNA of each steer. Calpain enzymes are directly involved in the tenderization process. Calpastatin enzymes tie up the enzymes produced by the calpain genes and reduce tenderness. Thus, reducing calpastatin enzymes and increasing calpain enzymes will increase tenderness.

An allele is the form of a gene that contains characteristics from both parents at the same position – or locus – on a chromosome. Because genetic information comes from both parents, the selection of a parent with a genetic marker with both favorable alternatives assures it will be passed on to its progeny.

The calpastatin genetic marker has two forms: T and C. The TT genetic marker genotype for calpastatin is more desirable for meat tenderness than genetic markers TC or CC. Two genetic markers are located in the calpain DNA structure. CAPN-316 has allelic forms C and G whereas CAPN-4751 has allelic forms C and T. Genotype CC at both genetic markers is more favorable for tenderness than other genetic marker combinations.

Results

Frequencies of the genetic marker genotypes were determined. The genotypic marker genotypes at the calpastatin locus had frequencies 11 percent for CC, 46 percent for CT and 43 percent for TT, giving genetic marker allele frequencies of 34 percent for C and 66 percent for T. These frequencies are similar to those found in other breeds of cattle and indicate the Brahman has a higher frequency of the favorable marker.

Frequencies for the CAPN-316 genetic marker genotypes were 0 for CC, 6.3 percent for CG and 93.7 percent for GG while the genotypes at the CAPN-4751 position were 0 for CC, 10 percent for CT and 90 percent for TT. Frequencies of the favorable alleles for tenderness in these cattle were very low, at 3.1 percent and 5 percent for C alleles at the two positions. Low frequencies of the favorable genetic markers at these two positions suggest the genes they are associated with are responsible for a proportion of the higher shear force – or tougher meat – found in these cattle.

The influence of the favorable genes on the reduction of shear force for steaks aged for 7 days and 14 days was measured using statistical analyses. The favorable calpastatin genetic marker, C, was associated with a reduction in shear force of -0.11 pounds after seven-day aging and -0.22 pounds after 14-day aging of steaks. The reduction in shear force for the CAPN-316 favorable genetic marker was -0.46 pounds after seven-day aging and -0.66 pounds after 14-day aging. For CAPN-4751, the reduction in shear force was -0.44 pounds for steaks aged seven days and -0.60 pounds for steaks aged 14 days.

Combining the results from favorable genetic markers from both the CAPN-316 and CAPN-4751 positions,

on shear force in Brahman Steers

the reduction in shear force for steaks aged 7 days and 14 days would be approximately 2 pounds compared to steers with no favorable genetic marker alleles at these two positions. This lower shear force is very important and is similar to that found in non-Brahman breeds of cattle with similar genetic marker composition.

Differences in tenderness of fed animals can be predicted before feeding by the combination of favorable genetic markers. While feedlot managers are interested in tenderness of fed animals, cattle breeders who produce feeder calves are more interested in the complement of favorable tenderness genes that sires and dams can transmit to their offspring. Sires and dams with four favorable genetic markers at the calpain positions will transmit two of these favorable markers to each of their progeny.

The total genetic effects of a trait transmitted from parents to offspring are called EPDs – expected progeny differences – which are measures of genetic merit for specific traits, such as tenderness (measured by shear force). EPDs are a measure of what is transmitted to progeny, which is half the breeding value, hence the name "Expected Progeny Difference." EPDs are expressed from the mean, so we have + EPDs and – EPDs. For shear force, we would want EPDs with a minus value, which would be interpreted as lower shear force, or more tender beef. An EPD is a function of all the individual genes that influence a trait, whereas genetic markers are associated with a single gene or gene pair. Genetic markers tend to be identified when they are linked to a "major gene" for the trait. It is hard to identify a genetic marker when it is linked to a minor gene for a trait because it is not statistically relevant.

Knowledge of genetic markers for tenderness in prospective sires along with EPDs for tenderness will allow cattle producers to use marker-assisted selection to improve genetic potential for tenderness in Brahman cattle. ■

Acknowledgment
This research was funded in part by Federal Hatch and state funds through the Louisiana Agricultural Experiment Station and grants from the Louisiana Brahman Association and the Louisiana Beef Industry Council. Bovigen LLC determined the genetic markers for each steer from individual steer DNA.

Illustration by Frankie Gould

LSU AgCenter researcher improves cattle breeding and helps Louisiana industry grow

For the past 40 years, Don Franke has been studying ways to improve beef cattle in the South, particularly the Brahman breed.

The east Texas native grew up on a cattle farm. After he earned his bachelor's degree in animal science and vocational agriculture at Stephen F. Austin University in Nacogdoches, Texas, in 1961, Franke began teaching high school agriculture.

It wasn't long, though, before he ventured to LSU to earn his master's degree and on to Texas A&M for a doctorate. Then it was off to the University of Florida, where he started his career in animal genetics, working with beef cattle.

"In the process, I became associated with the Brahman breed," Franke says. It's a relationship that led to his career path.

After eight years in Florida, Franke joined the faculty at LSU, where he's been since 1976. In the process, he's developed a reputation for studying ways to improve Brahman genetics.

"The Brahman has been very useful to cattlemen in the Southeast," he says.

Originating in India, Brahman cattle were brought to the United States in the mid-1800s. They adapt well to the hot, humid conditions in the South.

The primary beef cattle operation in Louisiana and the rest of the Southeast is a cow-calf enterprise. Producers raise calves generally sold at weaning and sent to feed lots to be finished for the consumer market.

Most cow-calf herds in Louisiana contain crossbred cows – at least 80 percent – and nearly all contain some percentage of Brahman breeding. The Brahman influence produces cattle that adapt to Louisiana's subtropical climate and tolerate internal parasites. Other benefits of Brahman crossbred cows include good milk yield and strong maternal instincts.

"On the other hand," Franke says, "the greater the level of Brahman genetics in an animal, the more temperamental they can be and the tougher the meat."

Breed background – the percentage of other breeds in an animal's heritage – can make a difference on how buyers perceive an animal.

"Recent evidence suggests that beef from feeder cattle with a high percentage of Brahman parentage has lower marbling and is less tender on average than beef from other breeds," Franke says. "This has led the cattle industry to impose discounts ranging up to 15 percent on feeder steers and heifers that show high Brahman inheritance."

Don Franke at the Ben Hur Research Farm in Baton Rouge, La.

These determinations are based on observations – such as long ears, a bit of a hump or other characteristics associated with the Brahman breed.

"Brahman influence appears to have declined throughout the southern states because of discounts," Franke says.

Over the years, research done with crossbreeding has shown that when cows that are half Brahman and half of another breed – Angus or Hereford, for example – are mated with a bull of a breed other than Brahman, a one-quarter Brahman calf is acceptable to buyers.

"If a calf is one-quarter Brahman or less, buyers don't discount very much," Franke says.

Franke recommends a structured system of mating cattle to take advantage of Brahman traits without introducing too many Brahman disadvantages to the offspring. "If you know genetics and manage it, you can improve your animals," he says.

He and his graduate students have evaluated a system of "rotational crossbreeding" – matching different breeds of sires and cows. A two-breed system, for example, mates Brahman bulls with Angus cows and Angus bulls with Brahman cows. Then the daughters of one breed are mated with bulls of the other breed. Other rotational patterns use three or four breeds.

Rotational crossbred cows produced calves with a higher average weaning weight than straightbred cows, and cows from three- or four-breed rotations produced calves with higher average wean-

Photo by John Wozniak

ing weights than cows from two-breed rotations. Management requirements increase as the number of breeds increases.

Because cattle with an Angus background are generally black and are known to produce good meat, Southern cattle producers are interested in black calves, which won't be discounted at sale. Spotted or calves of other colors won't sell for as much.

Franke says he's most proud of his work validating the mating system of matching part-Brahman cattle with non-Brahman cattle to produce meat acceptable to consumers. He has worked with researchers from other states including Florida, Texas and Nebraska.

In the mid-1990s, Franke and several other researchers became interested in seeing "what we could do to make meat more consistently accepted in Brahmans," he says.

They first looked at genetic variation and found that the amount of variation for meat tenderness and for carcass grade in Brahman cattle was the same as the variation in other breeds. The difference, however, was that the average tenderness and grade was still less than in other breeds.

"This suggested that progeny testing could be used to identify bulls that sired acceptable progeny for carcass traits," Franke says. "Unfortunately, it takes two to three years until you know a bull is acceptable. That's a time constraint."

This effort led to the prediction of EPDs – expected progeny differences. This method estimates differences among sires in the quality of meat from their calves.

To get enough Brahman calves to predict sire EPDs, Franke worked over a five-year period with the Louisiana Brahman Association to obtain 430 weanling bull calves sired by 68 bulls from about 27 different Brahman breeders.

After the calves were weaned, they were brought to the LSU AgCenter's Central Research Station, grazed on ryegrass and then consigned to a feedlot near Corpus Christi, Texas. Then, they were moved to a packer, who sent Franke the loins for tenderness analysis.

The results have allowed Franke to predict Brahman sire EPDs for tenderness and quality grade. These results led the American Brahman Breeders Association to set up a Brahman steer-feeding program to predict sire EPDs for other Brahman breeders.

More recently, Franke and his colleagues have begun looking at genetic markers for meat tenderness and quality grade to determine if they're associated with these traits in Brahman steers.

"The results," Franke says, "appear positive."

Genetic markers are determined from DNA extracted from blood samples and can cost as much as $50 per animal. Some producers get genetic markers run on their calves, most haven't bought into this new technology.

"So far, most purebred breeders say they cannot get more money for their bulls that have desirable genetic markers for tenderness," Franke says.

The King Ranch in Texas, however, uses genetic markers to identify cattle they want to use to maintain their herds, Franke says.

> He's most proud of his work validating the mating system of matching part-Brahman cattle with non-Brahman cattle to produce meat acceptable to consumers.

Franke says his greatest challenge is to identify cattle that will perform efficiently – cows that will be fertile, have good maternal abilities and produce progeny that have meat acceptable to consumers.

"We're gradually making some headway," he says.

Cattle producers want cows that calve early in the season so the calves are heavier when they're sold and cows, that breed easily and are good mothers. One of his students has been looking at genetic markers for leptin, a protein associated with cows that calve early and produce abundant milk.

Predicting EPDs for Brahman bulls probably has more potential than genetic markers at the present time to help Louisiana cattle producers, Franke says.

"Now, Brahman-Angus and Brahman-Hereford crossbred cows are about as good a commercial producer can get," he says. "If we can improve tenderness, they're hard to beat."

And that tenderness improvement will most likely come from selecting the right bulls to produce feeder calves.

Franke says the largest amount of his financial support comes from state and federal sources through the AgCenter. Other funding comes from check-off funds from the Louisiana Beef Industry Council and from breed associations such as the Louisiana Brahman Association and the Beefmaster Association.

In addition to direct financial support, producer organizations donate semen and animals.

"Breeders in the state help out," Franke says. "We trade bulls sometimes; it's an exchange of germplasm. Any success like this is due to a lot of people, including supportive administrators, staff at the farm and hard-working graduate students."

Over the years, Franke has been major professor for about 20 Ph.D. students and about 45 master's degree students.

"I'm pretty proud of these students," Franke says. "They're spread across the United States and Canada, and some are in South America and Africa."

One of those students is D.H. "Denny" Crews Jr., a senior research scientist with Agriculture Canada in Lethbridge, Alberta, in beef quantitative genetics/genomics. He also holds the University of Alberta AAFC Chair Professorship in Beef Genomics.

"I work in the area of genetic evaluation and improvement of beef cattle," Crews says. "On several levels, all of this is due to Don's influence on my career.

"During my doctoral studies, Don encouraged me to expand my horizons and really encouraged my developing interest in the area of genetic prediction," he adds. "This, I found, was one of his enduring strengths – to support and encourage students."

Crews calls Franke "one of my biggest professional champions. Almost entirely due to his help, I was able to spend three months as a visiting scientist at the University of Nebraska while completing my dissertation."

Another of his former students is Trent Smith, an assistant professor of animal and dairy science at Mississippi State University in Starkville, Miss.

"Dr. Franke has been a true mentor to me in my career," Smith says. "He is well respected in his field. He set a great example for me by being someone that always worked hard and was at all times professional. He has never failed to help when asked and has always strived to make sure that his research was done accurately." ■ **Rick Bogren**

Post-hurricane research

Population displacement dynamics *in South Louisiana*

Mark J. Schafer and Makiko Hori

To help understand the dynamics of the displacement of Louisiana's population following hurricanes Katrina and Rita in 2005, LSU AgCenter researchers analyzed data from a survey commissioned by the Louisiana Department of Health and Hospitals and the Louisiana Recovery Authority. The Louisiana Health and Population Survey was designed by the Centers for Disease Control and Prevention, with input from the U.S. Census Bureau and LSU AgCenter researchers affiliated with the Louisiana Population Data Center. The survey was conducted in 18 parishes in southern Louisiana in 2006. The results led to new information on the extent of displacement (1) out of the most devastated regions, (2) into the capital area and other receiving parishes and (3) from residences but within the same parish. The 18 parishes were Ascension, Calcasieu, Cameron, East Baton Rouge, Iberia, Jefferson, Lafourche, Livingston, Orleans, Plaquemines, St. Bernard, St. Charles, St. Helena, St. Tammany, Tangipahoa, Terrebonne, Vermilion and Washington.

The U.S. Census Bureau, the most common source of population and demographic data, publishes annual estimates for all counties in the United States. For Louisiana's parishes, the easiest way to calculate net effects of the hurricanes would be to subtract the 2005 figure from the 2006 estimates to obtain a net migration number for each parish. Net migration estimates, however, are insufficient for several reasons.

- Net migration does not show how many people moved out of and how many moved into any given parish.
- The net migration does not provide any information on movement within parishes.
- Census data could not be used to distinguish between displacement due to the hurricanes versus nonstorm-related migration, including in-migration to support recovery efforts.
- Census estimates are generally reliable under normal circumstances, whether a particular parish has been witnessing population growth, stagnation or decline. Their reliability, however, is questionable in unusual circumstances such as the 2005 hurricanes, which resulted in catastrophic migration patterns. For example, the census incorporated the effect of 2005 hurricanes into 2006 annual population estimates by using data from the U.S. Postal Service's National Change of Address (NCOA) file.

> Almost 85,000 people left Jefferson Parish in the year after the storm, and another 22,000 relocated within the parish. Similarly, St. Tammany's net gain of 9,500 belies the fact that more than double that number left the parish.

The Louisiana Health and Population Survey provided better estimates of overall displacement dynamics to augment census estimates. It does not, however, provide the longitudinal type of data necessary to understand the pace of recovery and repopulation. Still, the LPHS data allow us to move beyond net migration to estimate additional dimensions of displacement dynamics:

- Out-migration from the most severely damaged parishes.
- In-migration to the capital area.
- Broad displacement dynamics for the buffer parishes.

The buffer parishes like Jefferson and St. Tammany had high levels of all three displacement types – out-migration, in-migration and intra-parish movement. Because the census estimates reporting net migration may not show much change from 2005 to 2006, these are the parishes where the true dynamics of population change are most likely to be both understated and misunderstood.

Out-migration from severely damaged parishes

Three parishes in southeastern Louisiana – Plaquemines, Orleans and St. Bernard – were devastated by Hurricane Katrina. Cameron Parish in southwestern Louisiana was severely damaged by Hurricane Rita. Policy makers needed to learn how many people had been displaced from the severely damaged parishes and where they went.

Table 1 shows the estimated number of in-migration, out-migration and net migration (in-migration minus out-migra-

Table 1. Migration estimates for severely damaged parishes.

Parish	All migration In	Out	Net[1]	Percent storm-related
Orleans	20,274	246,389	-226,115	~90%[2]
St. Bernard	No data	>48,905	-48,905	~90%
Plaquemines	2,536	9,002	-6,466	94%
Cameron	1,191	3,004	-1,813	86%

[1]*Calculated using 2005 and 2006 Annual Population Estimates from U.S. Census.*
[2]*Insufficient data to calculate precise estimates.*
Source: Louisiana Recovery Authority, Migration Report

Mark J. Schafer, Assistant Professor, Department of Agricultural Economics & Agribusiness, LSU AgCenter, Baton Rouge, La.; and Makiko Hori, Ph.D. Candidate, Department of Sociology, LSU.

Table 2. Where Orleans Parish evacuees migrated.

Migrated to	Estimate	Percent	Percent storm-related
Jefferson Parish	45,323	18%	98%
Capital area	23,158	9%	85%
North Shore	9,269	4%	98%
Other surveyed parishes	5,275	2%	86%
Other	163,365	66%	
Total	246,390	100%	

Table 3. Estimated migration to capital area.

Migration from	Number	Percent	Percent storm-related
Southeast Region[1]	32,790	44	89
New Orleans Only	23,150	31	85
North Shore[2]	2,467	3	No data[4]
Other La. Parishes[3]	20,827	28	No data
Out of State	9,983	13	No data
Not Indicated	8,189	11	No data
Total	74,257	100	58

[1]*Southeast Region includes Orleans, Plaquemines and St. Bernard*
[2]*Tangipahoa, St. Tammany and Washington*
[3]*Primarily from Jefferson, but also from St. Charles, St. James and others*
[4]*Sample sizes too small to calculate*

tion) for each parish. The "in" column estimates the number of new residents, primarily working in recovery-related industries like construction and debris removal. All four parishes have negative net migration figures, meaning the out-migration is greater than in-migration. But the table also shows the census figures, which most closely correspond to net migration, understate the number of people displaced from these parishes because the census does not subtract the recovery workers who moved in since the hurricanes.

Out-migration from New Orleans

Table 2 contains even more detailed information about where Orleans Parish migrants went. More than two-thirds of the evacuees went outside the surveyed parishes, either elsewhere in Louisiana or out of state. Jefferson Parish received the largest number of storm-related Orleans Parish out-migrants at 45,000, while another 23,000 relocated to the capital area and 9,000 to the North Shore region.

Even more important, about 54,700 residents moved within the parish. Within-parish movement is another aspect of displacement not picked up by annual census estimates. In comparison to residents from other parishes, Orleans' out-migrants were scattered broadly around the state and to other states.

The capital area includes East Baton Rouge, Ascension, Livingston and St. Helena parishes. The North Shore area includes Tangipahoa, St. Tammany and Washington parishes. The other parishes surveyed were Plaquemines, St. Bernard, Calcasieu, Cameron, Vermilion, Iberia, Lafourche, Terrebonne and St. Charles. "Other" includes outside the surveyed area and out-of-state.

In-migration: Movement to capital area

Only a few residents of East Baton Rouge and surrounding parishes were displaced by Hurricane Katrina, but these parishes received a large number of evacuees from affected parishes. A considerable number remained in the capital area one year later.

Table 3 shows almost 75,000 people migrated into the capital area between July 2005 and July 2006. Surprisingly, only 44 percent of the new residents came from the parishes most affected by the 2005 hurricanes. Baton Rouge was also a popular destination for those from other parts of the state and from out of state, moving for reasons not related to the 2005 hurricanes. Although more than half of all new residents (58%) indicated their move to the capital area was hurricane-related, still a large number of new migrants to the capital area moved for nonhurricane reasons. This survey finding is consistent with longer-term data showing population increase in the Baton Rouge area.

This more detailed analysis of in-migration helps to distinguish between normal migration and hurricane-specific migration, both of which contributed to the growth trend in the capital area from 2005-2006. Unfortunately, because this survey represents a snapshot view at one particular time, it only partially helps predict future population trends in these areas.

Displacement dynamics in 'buffer' parishes

The parishes nearest to New Orleans – Jefferson and St.Tammany in particular – were the ideal place for displaced residents to gain access to their old homes and businesses after the storm. Similarly, Calcasieu Parish was an ideal staging ground for residents of Cameron Parish to relocate after Hurricane Rita. These places were also ideal locations for those who went to assist with recovery of the most damaged regions. These "buffer" parishes also sustained significant hurricane-related damages themselves, causing their own residents to both move to other parishes or to other residences within these parishes.

By simply comparing the post-storm to pre-storm overall population figures, it would appear that Jefferson lost about 22,000 residents while St. Tammany gained about 9,500. The reality, however, is very different. More than five times as many people in both of these parishes were forced out of their homes. Almost 85,000 people left Jefferson Parish in the year after the storm, and another 22,000 relocated within the parish. Similarly, St. Tammany's net gain of 9,500 belies the fact that more than double that number left the parish, and 47,000 were forced to relocate within St. Tammany Parish. Local, state and federal policy makers need to understand the true dynamics of this displacement to adequately assess the impact on Louisiana's population and to provide needed services to those affected. ■

Table 4. Estimates of migration in Jefferson and St. Tammany parishes.

	All migration			Hurricane-related			% Out storm-related	Within parish
Parish	In	Out	Net	In	Out	Net		
Jefferson	63,023	84,697	-21,674	50,692	70,542	-19,850	83%	22,248
St. Tammany	29,041	19,577	9,464	14,852	10,262	4,590	52%	47,469

Post-hurricane research

Health care aftermath

Makiko Hori and Mark Schafer

LSU AgCenter researchers analyzed data from the 2006 Louisiana Health and Population Survey pertaining to age demographics, health insurance coverage and health care access in 18 hurricane-affected parishes in Louisiana. See page 11 for more about the survey.

Table 1. Age structure shifts after 2005 hurricanes in affected parishes.

	0-14	15-24	25-64	65 +	Change
Severely damaged parishes	-6.9%	+.6%	+5.6%	-0.3%	-286,419
Receiving parishes	-3.2%	+2.4%	+0.2%	-1.4%	+89,452
Buffer parishes	-1.6%	+0.1	-2.0%	+1.2%	-21,125

Age demographics

Health care providers need detailed age-based demographic information to adequately supply doctors, nurses, hospital beds and other medical services to a given area. Table 1 shows that in addition to losing nearly 300,000 people, the most severely damaged parishes in Louisiana also saw a change in the age structure of the remaining populations in 2006. The percentage of children under 15 decreased by nearly 7 percent, while the percentage of working age population (age 25-64) increased by almost 6 percent. This indicates that fewer young children who evacuated these areas had returned. These regions saw an increase in the percentage of adults, likely fueled by the labor needs for debris removal and recovery. Somewhat surprisingly, the percentage of older children and elderly remained relatively unchanged.

Also curious is that the percentage of children in the receiving parishes declined significantly. New migrants to those regions had fewer younger children than the pre-storm residents, while the percentage of high school and college age children increased in receiving parishes. This trend may have been fueled by substantial labor opportunities for young adults in and around Baton Rouge and Lake Charles.

The age structure of the population living in the buffer parishes did not change dramatically despite the significant movement of people out of, into and within these parishes.

Severely damaged parishes include Orleans, Plaquemines, St. Bernard and Cameron. Receiving parishes include Ascension, East Baton Rouge, Iberia, Lafourche, Livingston, St. Charles, St. Helena, Tangipahoa, Terrebonne and Washington. Buffer parishes include Calcasieu, Jefferson, St. Tammany and Vermilion.

Health insurance

Insurance is a crucial health care issue. In this survey people were asked if they had some type of health insurance including private, Medicare, Medicaid, Medi-Gap, Louisiana Children's Health Insurance Program, a state-sponsored health plan, military health insurance or other governmental program.

Among the 18 parishes, six parishes had high rates of people with no health insurance: St. Helena (24.1%), St. Bernard (21.4%), Cameron (21.4%), Vermilion (20.6%), Terrebonne (20.4%) and Orleans (20.1%).

Jefferson Parish had the largest uninsured population at 75,256, East Baton Rouge Parish had 63,049 and Orleans Parish had 43,367 uninsured individuals.

Meanwhile, St. Charles Parish had the lowest percentage of uninsured people in the parish population (8.5%), followed by Calcasieu Parish (13.0%), Iberia Parish (13.4%), St. Tammany Parish (13.7%) and Ascension Parish (13.9%). Overall, the estimated number of uninsured people in 18 parishes is 372,153, accounting for 16.4 percent of the population.

Under typical conditions, many factors contribute to lack or loss of insurance such as losing one's job, inability to afford the cost of insurance or death of a spouse or parent. Natural disasters can greatly exacerbate these factors.

Among the 18 parishes, the most severely damaged parishes tended to have higher percentages of people who were uninsured because of the hurricanes: Orleans (28.7%), Plaquemines (24.5%), St. Bernard (32.3%) and Jefferson (20.9%). Surprisingly, the percentage of uninsured because of Hurricane Rita in Cameron Parish was not so high (13.5%).

Tangipahoa Parish had a relatively large percentage (20.1%) of uninsured because of the hurricanes followed by East Baton Rouge Parish at 15.5 percent. These results are a little puzzling because these parishes were not severely affected by the hurricanes. It is likely these parishes had many evacuees from severely damaged parishes who lost their health insurance.

Access to care

Both lack of insurance and displacement may result in difficulties accessing health care. Moreover, the closure of hospitals and doctors' offices in affected parishes posed a challenge to individuals seeking health services there.

In both severely damaged and receiving parishes, there was a substantial decline in the percentages of respondents who typically accessed health care through doctors and HMOs — from 60 percent to 46 percent in severely damaged parishes and from 67 percent to 57 percent in receiving parishes.

In severely damaged parishes, there was a large increase in the percentages of respondents who reported using hospitals or other emergency care as their usual place of accessing health care after the hurricanes (increasing from 18 percent before to 31 percent after). Also, in both severely damaged and receiving parishes, the percentage of people who reported nowhere to go for health care increased after the hurricanes by about 3 percentage points. These results might indicate that people in damaged areas lost access to their family doctors after the storm and that those who relocated to receiving parishes had not yet acquired a new family doctor. ■

Makiko Hori, Ph.D. Candidate, Department of Sociology, LSU; and Mark J. Schafer, Assistant Professor, Department of Agricultural Economics & Agribusiness, LSU AgCenter, Baton Rouge, La.

Post-hurricane research

Social consequences of dislocation on emotional well-being

Joachim Singelmann and Mark Schafer

In late summer of 2005, hurricanes Katrina and Rita hit the Gulf states within a four-week period. Although Katrina wrecked the Gulf Coast from Louisiana to Florida, Louisiana was the only state that fell victim to both hurricanes. While Rita was a less severe hurricane than Katrina, it caused further distress to those evacuees from Katrina who had taken refuge in the areas that were in the path of Rita and now had to find new safe shelters.

The vast destruction brought on by the two hurricanes made rebuilding a daunting task. The failure of government at all levels – from national to local – created a situation where many evacuees remained in FEMA trailer parks 18 months after the disaster. Many of these parks were isolated, without walking access to grocery stores, and often with no ready access to public transportation. Living more than a year in trailer parks, sometimes after having moved from shelter to shelter before the parks, took its toll on the hurricane evacuees, both physical and psychological.

The purpose of this study was to analyze the level and determinants of depressive symptoms and stress experienced by persons who remained in trailer parks and to identify the factors that improve or deteriorate emotional well-being. The objective of the project was to gain knowledge about the incidence of stressors contributing to the prevalence of depression in populations exposed to emergency situations such as hurricanes. Such knowledge could help reduce the incidence of such stressors and thereby improve the emotional well-being of evacuees in future disasters.

Joachim Singelmann, David J. Kriskovich Distinguished Professor, LSU Department of Sociology and the Department of Agricultural Economics & Agribusiness, LSU AgCenter, and Director, Louisiana Population Data Center; and Mark Schafer, Associate Professor, LSU Department of Sociology and the Department of Agricultural Economics & Agribusiness, LSU AgCenter, Baton Rouge La.

Project Design

During February-April 2007, LSU AgCenter researchers conducted a survey among hurricane evacuees who lived in FEMA-managed and commercial trailer parks in four Louisiana communities and their surrounding areas: Lake Charles, Lafayette, Baton Rouge and New Orleans. The researchers conducted 80 interviews in each of the four survey sites. Depending on the size of the trailer parks, the interviews were completed in a single large trailer park, such as in Lake Charles, or in many small parks, such as in Lafayette. Slightly more interviews took place in commercial trailer parks than in FEMA-managed parks. The participation rate for the survey was 67 percent; the refusal rate among those answering the door was 26 percent.

Depressive Symptoms

Studies of depressive symptoms in the United States indicate about 4 percent to 10 percent of adults suffer from major depression in any given year. Data from various surveys for Louisiana also show depressive symptoms to be important. According to a 2002 survey of persons in six metropolitan areas in Louisiana, 16 percent of all respondents reported a level of depressive symptoms that qualify for an onset of clinical depression.

Socioeconomic status has a negative effect on levels of depression; respondents with the lowest incomes have much higher levels of depressive symptoms than the more affluent. Although not all respondents in our 2007 Louisiana FEMA trailer park survey were poor, their average level of depressive symptoms was significantly higher than the depression level of the poor in other LSU AgCenter studies.

Moreover, 58 percent of all FEMA trailer park respondents reported levels of depressive symptoms within the range of clinical depression. Those elevated levels of depression clearly show the toll that the hurricanes and the subsequent displacement have taken on the mental health of hurricane evacuees.

Previous research has identified a number of determinants for depressive symptoms. Key factors include (1) work status, (2) physical health, (3) education and socioeconomic status, (4) marital status and (5) race.

The researchers also explored whether the following hurricane-specific factors affected the emotional well-being of people who lived through the hurricanes and ended up in FEMA trailer parks: (1) years at residence before the hurricanes; (2) number of places lived since the hurricanes; (3) change in health status from before the hurricanes to present; (4) duration of residence in the FEMA trailer park; (5) wanting to return to city of pre-hurricane residence; (6) sense of belonging in the trailer park because of old friends present; (7) involvement in the affairs of the trailer parks; and (8) feeling of trailer park safety.

The results showed that college education, full-time employment, maintaining pre-hurricane physical health and sense of belonging in the trailer park community all tended to reduce the level of depressive symptoms. Perceiving obstacles to getting involved in the trailer park community substantially increased depressive symptoms. The significant hurricane-specific determinants for emotional well-being – safety, sense of belonging, maintaining health and involvement in park activities – are all factors that can be addressed through policy. The findings suggest opportunities exist for special programs to intervene when disasters occur and evacuees must be housed in group settings.

Intervention Needed

The results of this project showed a level of mental distress among evacuees that is significantly higher than typically found among other vulnerable and fragile population groups, such as the poor or persons on public assistance. Almost 60 percent of all respondents reported levels of depressive symptoms that fall within the range of clinical depression.

The findings of this study of hurricane-specific determinants of emotional

well-being have significance for social program intervention. While hurricanes cannot be avoided, and with it the evacuations from such hurricanes, specific programs could alleviate the stressor effects of such dislocation and thereby prevent substantial increases in levels of depressive symptoms.

Available health care is one of the factors that could reduce the deterioration of health during the dislocation, which, in turn, would prevent some increases in depression. Programs aimed at facilitating the evacuees' sense of belonging to the new community as well as their involvement in it would also act as a buffer to the stress of dislocation and feeling of loss and help to prevent depressive symptoms from increasing. ■

Post-hurricane research

Use of remote sensing, GIS techniques helps assess forest damage

Fugui Wang and Yi Jun Xu

Hurricanes frequently cause extensive damage to forests. Such disturbances not only affect the forest industry and wildlife habitats directly, but cause long-term influences on forest succession, site productivity and site drainage.

Hurricane Katrina, the third strongest storm to hit the U.S. coast during the past 100 years, made its landfall on August 29, 2005, near the border of Louisiana and Mississippi. With sustained winds of 121 miles per hour and a storm surge level up to 23 feet, the hurricane caused catastrophic damage in the coastal region of these two states.

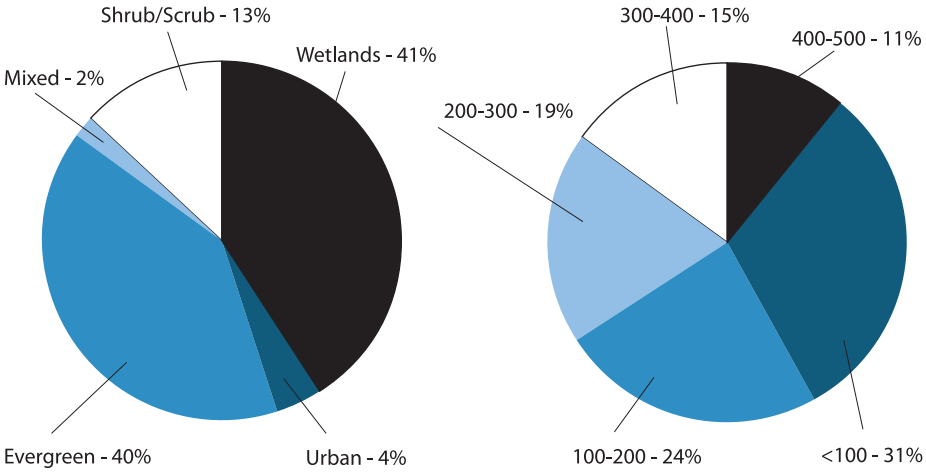
Large areas of the region's forests across the wind swath were severely damaged. It is important to accurately identify the disturbed areas, disturbance severities and the factors that have contributed to the spatial patterns caused by the hurricane. This information can be especially crucial for resources managers and researchers to take short-term actions on salvage harvesting, wood industry and habitat protection and to assess the long-term environmental impacts and forest ecosystem recovery. With much of the Katrina-affected region under permanent or seasonal inundation on the coastal lowlands, however, a full-scale, ground-based assessment was technically difficult and economically challenging.

Using a combination of remote sensing techniques and geographical information system (GIS) applications, LSU AgCenter scientists conducted a comprehensive assessment of Hurricane Katrina damage to forests in the Lower Pearl River Valley – Washington and St. Tammany parishes in Louisiana and Hancock and Pearl River counties in Mississippi. They analyzed the relationships among hurricane disturbance gradient and forest characteristics and site conditions and developed models to predict vulnerabilities of the forests to wind damage. The biotic and environmental factors studied included forest type, forest coverage,

Photo by Sun J. Chang

Hurricane Katrina damage to pine forest.

Figure 1. Forest types, left, and bottomland hardwood distribution in distance (meters), right, to river channel in the Lower Pearl River Basin.



Fugui Wang, Graduate Research Assistant, and Yi Jun Xu, Associate Professor, School of Renewable Natural Resources, LSU AgCenter, Baton Rouge, La.

Figure 2. Forest distribution in the Lower Pearl River Basin before Hurricane Katrina.

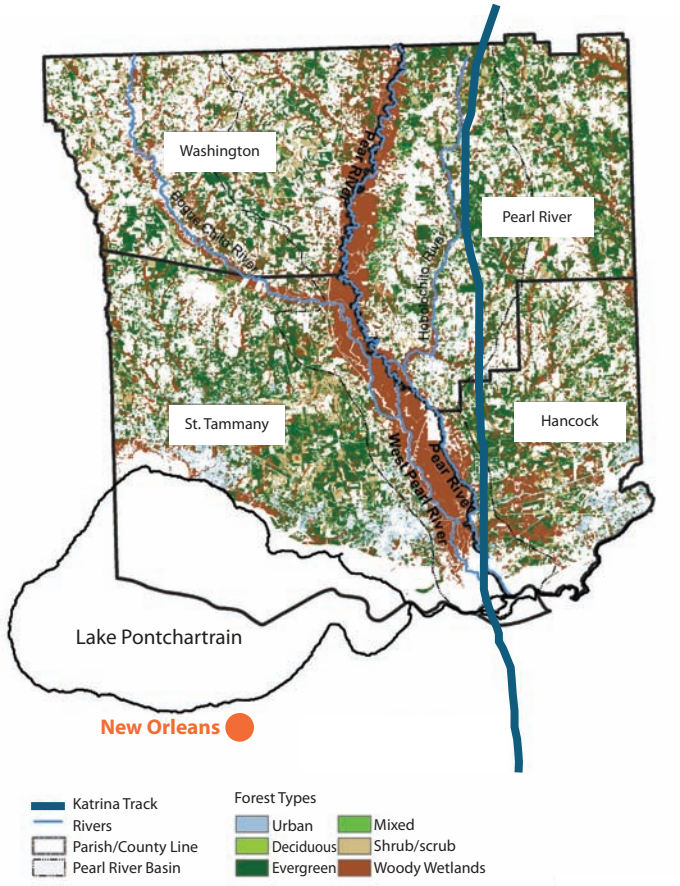
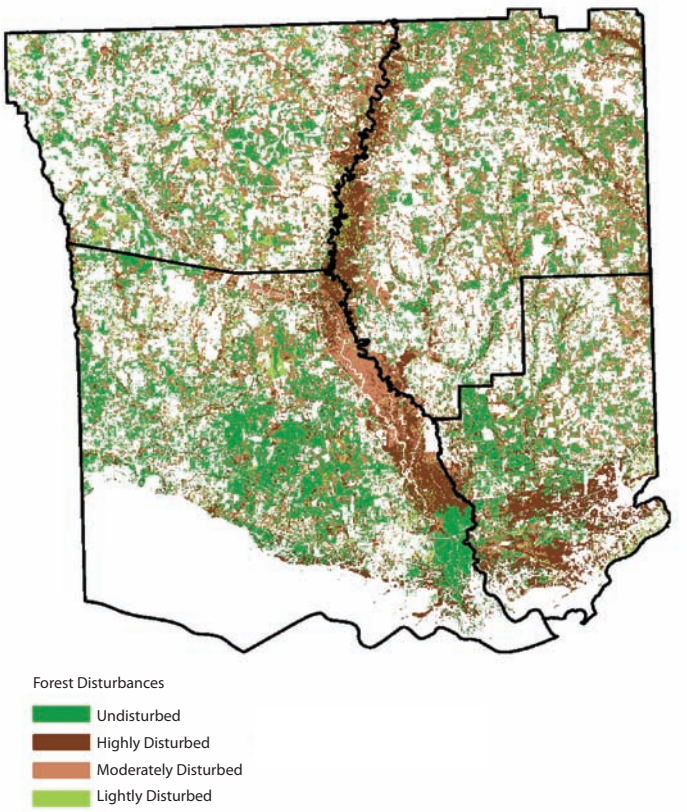


Figure 3. Spatial distribution of Katrina-induced forest disturbance.



stand density, soil great group, elevation, slope, exposure and stream buffer zone.

Katrina damage and spatial distributions

Before Hurricane Katrina, the percentage of coverage and spatial distribution of forests in the Lower Pearl River Valley region varied with forest types (Figure 1). Wetland hardwood forests and upland evergreen forests were two major forest types. The upland forests spread out across the entire region, while the wetland forests concentrated on the Pearl River and Bogue Chitto River floodplains (Figure 2). Urban forests were mainly distributed around towns and cities along the north shore of Lake Pontchartrain and Bay St. Louis. The shrub/scrub land cover appeared in large patches in St. Tammany Parish.

Hurricane Katrina damaged 60 percent of the total forest land in the Lower Pearl River Valley, creating a mosaic of landscape patches including undis-

Figure 4. Wetland forests suffered the greatest damage.

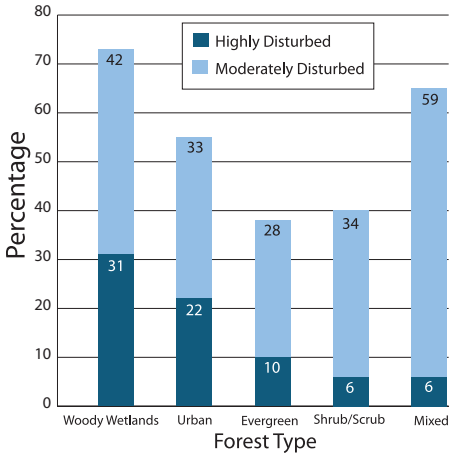


Figure 5. Forest disturbance decreases with increasing elevation.

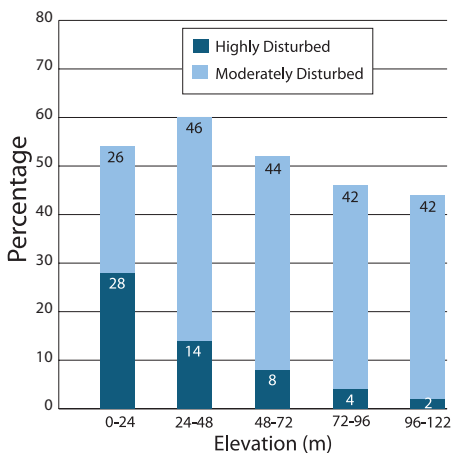
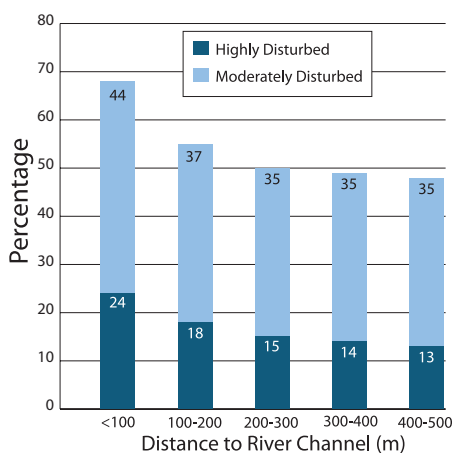


Figure 6. Katrina damage to bottomland wetland forests on the river floodplain.



turbed, moderately disturbed and highly disturbed forests in the region. A large portion of the damaged forests were clustered in the Lower Pearl River Valley and south Hancock County, Miss. (Figure 3). Lightly disturbed forests were randomly scattered as small patches in the region, whereas undisturbed forests clustered in south St. Tammany Parish and northwestern Hancock County.

Forest stand conditions and disturbance intensities

Among five forest types, wetland forests suffered the greatest damage with 73 percent of the area disturbed (Figure 4). The upland evergreen forests and shrub/scrub vegetation showed the lowest area of disturbance (less than 40 percent) with a significantly lower disturbance severity. Urban forest cover in the Lower Pearl River Basin region was small (Figure 1) but suffered great damage under Katrina's wind swath.

In wetland forests, more than half of the stands were composed of water tupelo, swamp tupelo, blackgum, sweetgum, baldcypress and various oaks. Among these species, cypress and tupelo appeared to be more resistant to strong winds because of the presence of buttressed boles. The shallow rooting of oak trees may have contributed to their susceptibility to hurricane wind. In addition to wind damage, Hurricane Katrina pushed Gulf waters up toward the inner Pearl River, causing extensive flooding and saltwater intrusion in the area for several weeks. Unlike the upland forests, the bottomland hardwoods on the floodplains were affected by both the hurricane's wind and the flooding caused by the storm surge.

Site conditions and disturbance intensities

Researchers found a close association between the hurricane disturbance intensities and the local site conditions. Forests growing on moderately developed wet soils were found to be most susceptible to hurricane damage, with a forest damage rate of more than 80 percent. By contrast, forests growing on well-developed wet soils appeared to be most resistant to Katrina's winds, with more than half of the total forests on this soil group undisturbed. It was also found that forests on weakly developed wet soils were susceptible to the hurricane winds, whereas forests on well-developed, low-fertility soils suffered only moderate and light disturbance.

Elevation in the region seemed to have had an effect on hurricane disturbance. Except for the coastal areas at or below 24 meters (79 feet) in elevation, the percentage of disturbance was generally lower at higher elevations (Figure 5). The greatest disturbance occurred at an elevation range between 24-48 meters (79-158 feet). Forests in the areas facing northeast to southwest showed a higher probability of the hurricane disturbance than those in the areas facing west to northwest. Greater exposure to the hurricane winds resulted in higher chances of forest damage.

Forest damage intensity differed among slopes. Forests on 1-degree slopes appeared to be highly susceptible to the hurricane wind. Percentages of highly disturbed forests decreased from 42 percent on flat land to 8.7 percent at a 6-degree slope. At a zero-degree slope, almost the same amount of forest land areas was highly and moderately disturbed. However, as the slope increased, the percentage of the highly disturbed forests was considerably lower than moderately disturbed.

Forests adjacent to the streams and rivers were found more severely damaged by the hurricane (Figure 6), indicating a high susceptibility of bottomland forests to the hurricane damage. Comparing the decreasing trend of percentages of the forests highly disturbed with increasing distance to the river channels, percentages of the forests moderately and lightly disturbed displayed slightly escalating trends.

Beyond assessment on Katrina's damage, this study elucidates the usefulness of remote sensing and GIS technique combined with statistics modeling in assessing the large-scale risks of hurricanes to coastal forests. The model developed in the study can ultimately be used to predict potential wind damage to forests in South Louisiana. ■

Photo by Sun J. Chang

Hurricane Katrina damage to loblolly pine.

Soil carbon stock and sequestration potential across Louisiana's watersheds

Yi Jun Xu and Biao Zhong

Soil carbon storage and dynamics represent an important component in the global carbon cycle. LSU AgCenter scientists are conducting a study to quantify soil carbon storage and investigate its spatial distribution and relationships with land use types across the state of Louisiana. The Soil Geographic Database (STATSGO) and land cover data were used to aggregate total soil carbon and estimate average soil carbon density by soil organic carbon (SOC) analysis and GIS spatial analysis. The study found an average soil carbon density of 53 tons per acre in Louisiana, larger than that of the conterminous United States and Alaska (39 tons per acre). The historical and current Mississippi River deltaic lobes in the southeastern tip of Louisiana have the highest soil carbon density. The study reveals that soils under emergent herbaceous wetlands, evergreen forests and row crops are among the largest carbon sinks and that land use types exert significant impacts on soil carbon storage. ■

Yi Jun Xu, Associate Professor, and Biao Zhong, Graduate Student, School of Renewable Natural Resources, LSU AgCenter, Baton Rouge, La.

Forestry value decreases in 2007

The projected Louisiana gross farm value of forest products decreased significantly Oct. 1, 2006, through Sept. 30, 2007, according to the LSU AgCenter's 2007 AgSummary. This followed an increase in 2006. The 2007 total sawlog harvest decreased by 50 million board feet (4%) to a cut of 1.3 billion board feet. The pine sawtimber harvest decreased by 3%, to a total statewide harvest of 1.1 billion board feet. The hardwood sawtimber harvest fell to 170 million board feet (9% decrease) in 2007. Pine chip-n-saw harvested in 2007 totaled 878,019 cords, a decrease of 19% from 2006 totals. Over the past three years, chip-n-saw harvests have declined more than half.

The 2007 Louisiana pulpwood harvest was 5,966,475 cords, down 160,935 cords (3%) from the 2006 harvest. Pine pulpwood harvest increased 6%, from 4.5 million cords in 2006 to 4.8 million cords in 2007. ■

Post-hurricane research

STORM SURGE

affects sugarcane borer pest management

T. Eugene Reagan, Julien M. Beuzelin, Waseem Akbar, Howard Cormier and Jimmy W. Flanagan

Between 30,000 and 40,000 acres of sugarcane production in St. Mary, Iberia and Vermilion parishes were substantially affected by storm surge from Hurricane Rita that came on shore in southwestern Louisiana on September 24, 2005. LSU AgCenter scientists documented soil salt residual averaging five times greater than normal in many areas inundated by the storm surge, with standing saltwater lasting up to eight days. By the spring of 2006, farmers and consultants observed many effects from the hurricane including reduced plant stand potentially affecting crop yield. The surge also affected the integrated pest management system by reducing well-established biological control agents such as fire ants and spiders.

To evaluate the storm surge effect in the integrated pest management system, LSU AgCenter scientists designed a study during the summer and fall of 2006 involving 48 sugarcane fields. The fields were divided into four groups, which included two sugarcane fields flooded by the storm surge and two nearby fields that had not been flooded. Within each of these groups, there was one field planted within six weeks before the hurricane and one field not planted that year. Sugarcane is normally planted only once every three or four years.

Figure 1. Red imported fire ant abundance affected by Hurricane Rita storm surge.

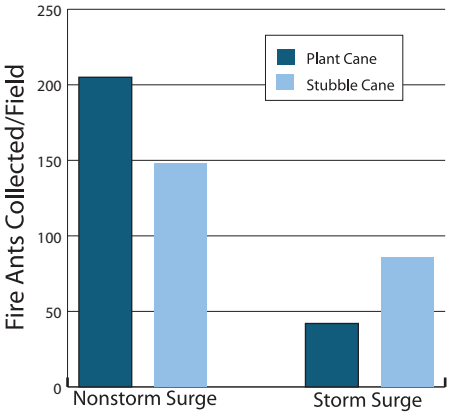


Photo by T. Eugene Reagan

A deadheart in sugarcane is a dead shoot that results when the internal growing point has been killed, often by the feeding of stem borers. Deadheart counts assist in determining sugarcane borer abundance during the spring.

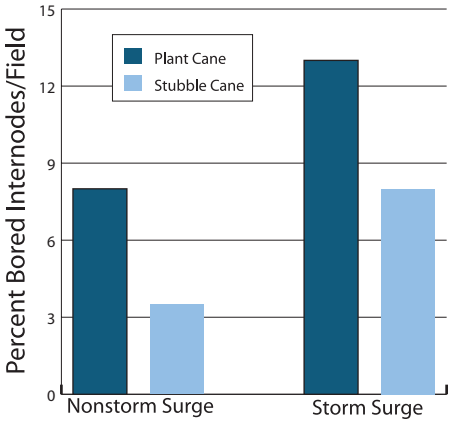
Sampling included soil analyses of cane fields in the top 3 inches and 4-6 inches (five probes per field). In addition, two traps were placed in each field for six weeks to assess soil surface arthropods (insects and spiders, primarily). Each farmer was contacted to determine the amount and frequency of insecticides used in the sampled fields for sugarcane borer control during the 2006 crop season. Season-long damage from the sugarcane borer was determined by counting bored internodes from 25 randomly sampled sugarcane stalks on the two rows adjacent to and between the traps.

Soil sampling during the summer following Hurricane Rita (2006) indicated significantly increased salt concentrations averaging 806 ppm in storm surge fields versus only 162 ppm in nonstorm surge fields. Figure 1 shows a 42 percent (stubble cane) to 80 percent (plant cane) reduction in fire ants collected in traps in storm surge fields during the sampling period, July 22 to September 9, 2006. There was a strong trend that spiders were reduced in storm surge areas, also nearly a full year after the hurricane. However, no adverse effects were detected on predatory beetles and earwigs or nonpredatory arthropods.

Many of the producers and consultants working in these areas had to make earlier and more frequent insecticide applications to suppress increasing sugarcane borer infestations in storm surge fields. Insecticide applications averaged two per field in storm surge fields compared to only 0.8 per field in non-storm surge fields, a 2.4-fold increase in insecticide use associated with the storm surge. Even with increased insecticide applications, the percent bored internodes caused by higher sugarcane borer infestations was 10.7 percent in storm surge fields versus 5.9 percent in nonstorm surge fields (Figure 2).

Our studies also showed a greater diversity among various groups of ar-

Figure 2. Sugarcane borer injury to sugarcane affected by Hurricane Rita storm surge.



T. Eugene Reagan, Austin C. Thompson Endowed Professor of Entomology; Julien M. Beuzelin and Waseem Akbar, both Graduate Research Assistants, Department of Entomology, LSU AgCenter, Baton Rouge, La.; Howard Cormier, County Agent, Vermilion Parish; and Jimmy W. Flanagan, County Agent, St. Mary Parish

thropods (species diversity) in the storm surge habitats compared to the nonstorm surge areas, which were more strongly dominated by the red imported fire ants. Additional sampling during April and May of 2007 for sugarcane borer-caused deadhearts showed a continued significant impact from Hurricane Rita storm surge – 390 deadhearts per acre versus 240 per acre in nonstorm surge fields in Vermilion Parish. Therefore, a full 20 months after Hurricane Rita came on shore with a major storm surge into south Louisiana, the integrated pest management system in sugarcane was still being negatively affected.

Importance of beneficial arthropods in sugarcane

The red imported fire ant is so helpful to sugarcane growers that the predation it provides is equal to two insecticide applications to control the sugarcane borer. Spiders are the primary borer egg predators, and predaceous beetles and earwigs also are important beneficial arthropods. Though crickets are neutral insects in sugarcane fields (neither pests nor beneficials), they are food for predaceous ants. Storm surge mortality to ants and the resulting decreased predation enhanced sugarcane borer pest problems and allowed for a greater diversity among both beneficial and neutral arthropods. Though Hurricane Rita enhanced a greater balance among various arthropods, this new balance interfered with the natural sugarcane borer control provided by fire ants and spiders.

Deadhearts

Deadhearts in sugarcane result when sugarcane borer larvae kill the growing point of the plant, causing the center leaves to turn brown. Deadheart abundance is related to borer infestations during the spring. Surveys conducted during the spring of 2007 showed there were greater than 150 percent more deadhearts in fields flooded by the Hurricane Rita storm surge. ■

LSU AgCenter employee knowledge of genetically modified (GM) products

(Continued from page 2)

had completed graduate school (70%). The highest response rate was from those that identified themselves as field agents (25%).

According to the results, LSU AgCenter employees were aware of biotechnology. For example, there was a 70 percent affirmative response to the statement, "Genetic modification involves recombinant DNA technology." More men knew this than women, and more men than women were familiar with biotechnology.

The respondents were aware that genetically modified crops have already been released in the United States (94.4%); older people were more aware of the prevalence of genetically modified crops than younger people.

The respondents were aware that biotechnology was used for producing insulin (78.6%); women were more aware of this than men.

The respondents felt positive about biotechnology with 68.7% indicating that it was very important. The respondents also felt that GM products can reduce soil erosion (68.3% positive response), water use (78.1% positive response) and clean pollutants (78.1% positive response).

However, the respondents also had some concerns. The majority felt that there are significant environmental issues involved with GM (89%) products, with women and younger people being more concerned about the risks.

About half expressed concern about moving genes from modified organisms to the environment (48.2%). Older individual and men were less concerned about moving genes to the environment than women and younger individuals. There was also concern about the creation of "superweeds" (56.2%), or creation of insects that develop resistance to pesticides (59.8%).

This study found that, overall, LSU AgCenter employees were aware of biotechnology and were in favor for the use of biotechnology in food crops. They also felt that the use of GM products did not harm the environment, although there were concerns about moving genes from one organism to another. Previous studies have found ambivalence and reservations among the public regarding the use of biotechnology within agriculture and food production. The study population consisted of the employees of the LSU AgCenter who may be more knowledgeable about biotechnology than the general public. According to the survey, the respondents were aware that genetically modified food products were available, that medications were being produced using biotechnology and that GM involves recombinant DNA technology.

Based on this study, an educational program on biotechnology in agriculture and food production should address concerns about the environment, such as creation of resistant weeds and insects and the influence on water use and pesticides. It should also address the production of pharmaceuticals in food crops, and should encompass legislation and consumer acceptance of GM products around the world.

An educational program including a PowerPoint presentation, fact sheets and a display will be ready for training LSU AgCenter employees beginning in August 2008. The program will be used to educate the public about genetic engineering of plants and animals beginning October 2008. ■

Acknowledgment
LSU AgCenter Institutional Biosafety Committee for help in preparing the survey and James Geaghan, Professor, Department of Experimental Statistics, LSU AgCenter, Baton Rouge, La.

MANAGING sweetpotato weevils in South Louisiana

Tara P. Smith and Abner M. Hammond

Photo by Gerald Lenhard

Sweetpotato weevil

Sweet potatoes are an important agricultural commodity in Louisiana. More than 14,000 acres of sweet potatoes were planted in Louisiana in 2007 with a farm gate value of $65 million. The total value of the crop after packing and processing exceeded $112 million. Sweet potato producers face many obstacles each year in crop production. Insect pests are often cited by growers as their primary concern.

The sweetpotato weevil is the most damaging insect pest of sweet potatoes in both tropical and subtropical areas of the world. Sweetpotato weevils can attack sweet potatoes in the field and in storage, and larvae feeding on sweet potato roots can cause major economic damage and yield loss. Reported yield losses due to sweetpotato weevil damage range from 5 percent to 80 percent. Feeding larvae tunneling through the roots induce chemical changes, and these infested roots reportedly taste bitter, rendering them unsuitable for human consumption.

An effective integrated pest management program is multidisciplinary and includes numerous management options. Several tactics employed to manage the sweetpotato weevil in Louisiana include cultural practices, monitoring with pheromone traps and routine application of insecticides. Insecticides traditionally have been the primary defense against root damage by these insects, and they are a valuable tool in pest management systems. However, they must be used judiciously to reduce the development of insect resistance.

Currently, sweetpotato weevils are established primarily in southern regions of Louisiana, and a quarantine exists to minimize the spread of weevils into northern areas of the state. All commercial sweet potato fields and seedbeds in the state are monitored with pheromone traps for the presence of sweetpotato weevils.

> All commercial sweet potato fields and seedbeds in the state are monitored with pheromone traps.

Sweet potatoes are produced in two primary production areas in Louisiana. Approximately 80 percent of Louisiana sweet potato production is concentrated in the northeast parishes of West Carroll, Franklin, Morehouse and Richland. The remainder of the acreage is in South Louisiana, primarily in Avoyelles, Acadia, St. Landry, Evangeline and Rapides parishes.

The northeastern part of the state is defined as a "green tag" area. Sweet potatoes grown in green tag areas are monitored for the presence of sweetpotato weevils, but distribution is not restricted by quarantine regulations. South Louisiana is referred to as a "pink tag" area, and movement of sweet potatoes and any plant material originating from this area is restricted to areas where sweetpotato weevils are established or where quarantine restrictions are not imposed on pink tag material.

In addition, a mandatory insecticide use program has been outlined by the Louisiana Department of Agriculture and Forestry and is required for all sweet potato production fields and seedbeds in pink tag areas. The statewide monitoring program and the mandatory spray program have been successful in two ways. First, sweetpotato weevil numbers in South Louisiana have been below average in recent years, and second, sweetpotato weevils have been contained within the pink tag production areas.

The mandatory spray program was established in 2001. Since its inception, sweet potato production fields and seedbeds have been treated with labeled, recommended insecticides on a 10-to-14-day spray schedule. A study initiated in 2004 compared the response of two populations of sweetpotato weevils to selected insecticides used in the required spray program.

The Louisiana population of sweetpotato weevils used in these bioassays was obtained from a laboratory colony established in 2002 from field-collected sweet potato roots taken from Avoyelles Parish. Sweet potatoes grown at this location received numerous applications of one or more of the insecticides evaluated in this study, indicating that weevils collected from this location had experienced multiple insecticide exposures. A Texas colony was collected from pheromone traps placed near wild sweetpotato weevil host plants in Frio County, Texas, and this population had limited or no previous exposure to insecticides.

A glass vial technique was used to determine the susceptibility of the two populations of sweetpotato weevils to the insecticides. Technical-grade insecticides were dissolved in acetone to yield the desired concentrations. Insecti-

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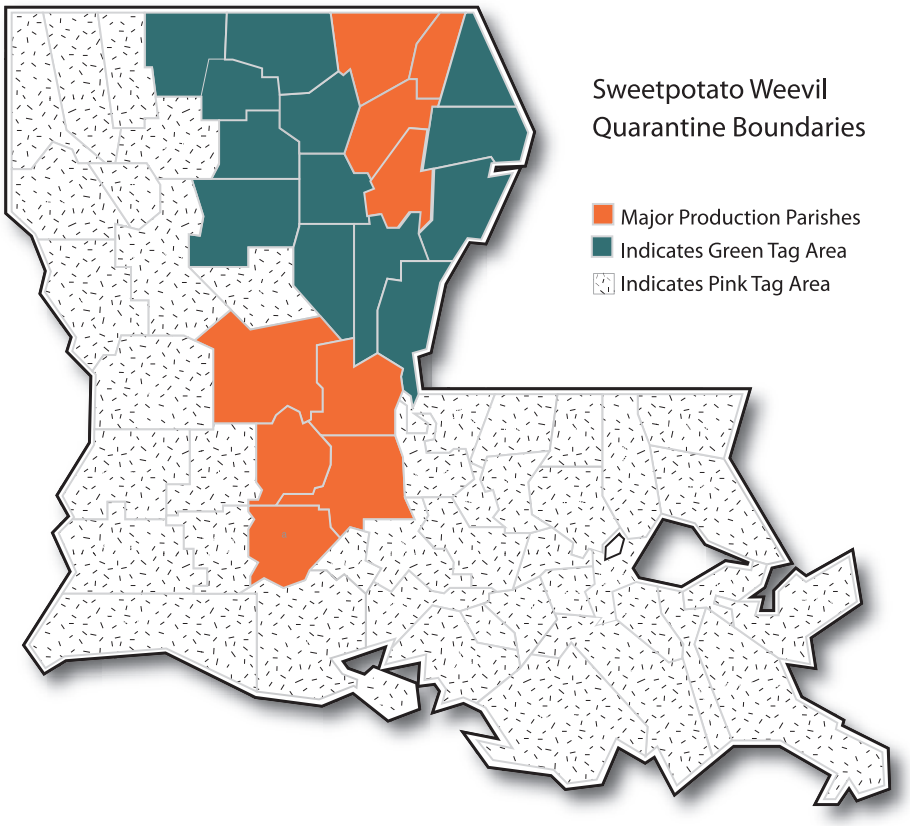
cides evaluated included methyl parathion, bifenthrin, cyfluthrin, carbaryl and phosmet. All chemicals evaluated are recommended for control of the sweetpotato weevil and are labeled for use on sweet potatoes in Louisiana. The interior surface of each vial was coated with the appropriate insecticide solution. Control vials were treated with acetone only. Vials were then rotated until all the acetone had evaporated and a residue of insecticide was deposited on the interior surface of the vials.

One adult sweetpotato weevil was placed in each of the vials. A minimum of 10 insects were used for each concentration. Three trials (with a minimum of 20 insects per concentration) were conducted with Louisiana weevils for each insecticide tested and two trials (with a minimum of 10 insects per concentration) were conducted with Texas weevils for each insecticide. No food was provided to insects during testing, and all assays were conducted at about 75 degrees. Mortality was determined 24 hours after exposure for all insecticides tested. Weevils were considered dead when they were unable to maintain an upright posture and perform coordinated movement after being dislodged from the vials.

More sweetpotato weevils died with each increase in concentration of all insecticides tested, and the results indicated Louisiana weevils were less susceptible than Texas weevils. Methyl parathion was the most toxic of the chemicals evaluated, followed by bifenthrin and cyfluthrin.

The Louisiana population's lower susceptibility than the Texas population's is cause for concern because weevils in South Louisiana are repeatedly exposed to the insecticides evaluated in this study. Surveying insect populations for changes in susceptibility is an integral part of insecticide resistance management, and determining the range of initial resistance frequencies among insect populations can allow for early detection of changes in susceptibility to insecticides.

Continued monitoring of the Louisiana sweetpotato weevil population's susceptibility to currently labeled insecticides is necessary to ensure that controls don't fail in the field. The mandatory weevil quarantine program initiated by the Department of Agriculture and Forestry has been a valuable asset to overall sweet potato production in the state. We will continue to monitor sweetpotato weevil populations for resistance development and modify the management programs when appropriate. ■



Louisiana sweet potato industry continues to prosper

Louisiana sweet potato producers harvested an average to slightly above average crop in 2007, although acreage was slightly down from that of 2006 with 14,254 harvested acres for 2007. Total production in 2007 was 5.5 million bushels compared to 4.5 million the previous year. The average price received for the 2007 crop was $15.50-16.50 for a 40-pound box. Total gross farm value for sweet potatoes was $65 million with $50.9 million from fresh sales and $14.1 million from canning sweet potatoes.

The production year started off on a positive note. Soil moisture and temperatures were ideal for planting in May and June, and, as a result, the majority of the crop was planted by mid-June. Producers experienced an unusually wet July across the state, with most production areas receiving 10-12 inches of rainfall. Some producers in northern production areas received in excess of 20 inches of rainfall in July. The excess moisture contributed to delayed maturity, and harvest operations began a couple of weeks later than expected because early plantings were slower to size than normal.

Despite the initial delay, the 2007 crop was harvested under good conditions, unlike 2006, when a large percentage of the crop was not harvested because of adverse weather conditions in October and November. Acreage in 2007 was down compared to 2006, but yield and quality of the crop were above-average and partially offset the reduction in acreage. Initial movement and price of the 2007 crop were strong.

The number of sweet potato producers has declined significantly in recent years. There were 159 producers in 2003, compared to 104 in 2007. Sweet potato acreage is expected to remain at current levels with the potential for a slight increase in 2008. The demand for sweet potatoes is increasing in domestic and foreign markets. Long-term expectations are for Louisiana producers to increase their acreage to satisfy the increasing demands of more health-conscious consumers and to take advantage of niche markets to increase profitability. ■

Source: LSU AgCenter's AgSummary 2007

Photo by Padma Latha Bommireddy

Southern green stink bug affects cotton fiber quality

Padma Latha Bommireddy
and B. Rogers Leonard

Cotton bolls within specific age classes were caged with southern green stink bugs.

Stink bugs were first recorded as pests of cotton during the early 1900s. The most common species of stink bug found in cotton fields across the southern United States are the southern green stink bug, green stink bug and brown stink bug. The general reduction in the frequency of broad-spectrum insecticides for cotton pest management has increased the incidence of this pest complex. Stink bug infestations in Louisiana cotton fields increased from 8 percent to 69 percent of total cotton acreage from 1999 to 2006. This same group of stink bugs also can be found as pests of other Louisiana row crops including field corn, soybean, wheat and grain sorghum.

Numerous factors have been associated with an increase in insects with sucking mouthparts, such as stink bugs, during the past decade. The most important factor has been a reduction in the use of broad-spectrum insecticides, which target one pest but inadvertently control everything in the field. The frequency of use of these products against boll weevils and the target pests of Bt cotton have decreased. The void created by the absence of these pests allowed others such as the stink bug complex to become more important.

In cotton fields, stink bugs primarily damage immature bolls by piercing the fruit wall and feeding near or on immature seeds. Small bolls may fall from the plant, but larger, more mature bolls that are injured will form a rough, warty growth on the inner carpel wall at the site of injury and remain attached to the plant. These insects significantly reduce yield by affecting cotton weight and reducing seed quality. Both adult and late-instar stages of stink bugs can injure cotton bolls and reduce seedcotton yields.

Limited information is available on the effects of stink bug adult and nymph stages on cotton lint quality. The evolving change in the pest status of stink bugs and an emphasis on improving the value of cotton fiber properties has prompted LSU AgCenter researchers to examine the influence of southern green stink bug adults and fourth-fifth instar nymphs on cotton bolls and physical fiber quality.

These studies were performed at the LSU AgCenter's Macon Ridge Research Station near Winnsboro in Franklin Parish during 2005 and 2006. Southern green stink bug adults and nymphs were collected from nontreated fields of corn and

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Photo by Melissa Siebert

Southern green stink bug has become a common late-season pest in Louisiana cotton fields.

Photo by Padma Latha Bommireddy

Mesh cages were used to confine southern green stink bugs on cotton bolls.

soybeans during both seasons. Insects were maintained in the laboratory on green beans for 24 hours to eliminate any insects in poor physical health. Cotton bolls were caged either with a stink bug adult or fourth-fifth instar nymph. Control noninfested bolls were caged but with no insects.

After 72 hours, all cages and insects were removed. All bolls were marked with a tag that included treatment information. Harvest aids were applied to the entire test area at crop maturity, and all tagged bolls were manually harvested 10 to 14 days after defoliation. Cotton was separated into lint and seed fractions with a tabletop gin in the laboratory.

Physical fiber properties were measured by processing lint samples through the high-volume instrumentation system in the LSU AgCenter's Cotton Fiber Laboratory in Baton Rouge. The cotton fiber properties examined in this study included length, micronaire (measure of fiber fineness or maturity), strength, uniformity and discoloration or brightness (determined by reflectance and referred to as yellowness).

Stink bugs, regardless of life stage, significantly affected fiber quality. Fiber length was significantly shorter, and micronaire was significantly lower in stink bug-infested bolls compared to noninfested bolls. Both life stages significantly reduced fiber strength. Fiber uniformity was lower in stink bug-infested bolls compared to that in non-infested bolls. Fiber discoloration was significantly higher in stink bug-infested bolls compared to that in non-infested bolls.

The value of cotton is influenced by fiber quality in addition to lint yield. The significant differences in fiber quality associated with stink bug-infested bolls will affect crop value. Fiber micronaire, strength, uniformity and length were significantly lower, whereas fiber discoloration was higher in bolls infested with southern green stink bugs compared to fiber harvested from noninfested bolls.

There were no significant differences in cotton fiber quality among southern green stink bug life stages. These results are important in developing and validating sampling protocols for action threshholds to initiate insecticide treatments for stink bug management. The lack of differences among life stages allows a cumulative number of southern green stink bugs to be considered rather than develop individual threshholds for different life stages.

These results indicate that the relationship of stink bug injury and cotton fiber quality must be considered in the development of action threshholds. Future studies should consider not only yield losses but also effects on fiber properties and harvested seed viability when estimating economic injury and developing action levels for insect pests that attack cotton bolls. ■

Photo by Padma Latha Bommireddy

Mature cotton bolls were hand-harvested to determine cotton weights and for fiber analyses.

Photo by Melissa Siebert

Stink bug feeding not only reduces cotton weight but can also affect fiber quality.

Photo by Mark Claesgens

Wheat response to simulated glyphosate drift

Christopher A. Roider, James L. Griffin, Stephen A. Harrison, Billy J. Williams and Roy P. Vidrine

Glyphosate (sold under numerous formulations including Roundup, Touchdown and others) is a nonselective, postemergence herbicide used to control weeds in reduced tillage systems and in glyphosate-resistant soybeans, cotton and corn marketed in the southern United States. The increased use of glyphosate has increased the incidence of off-target movement to sensitive crops. Herbicide drift is most often the result of improper application. In most cases the herbicide rate in drift situations would be somewhere between 1/10th and 1/100th of the applied rate and would be considered sub-lethal. If a crop is very sensitive to the herbicide, however, the effect on growth and yield could be significant.

In the South, glyphosate is applied before planting from February through April to kill vegetation in fields intended for corn, cotton and soybeans. At that time of the year the growth stage of wheat could range from late tillering to flowering. Wheat would be especially sensitive to glyphosate at jointing when tillering is complete and the first node is visible on the stem because this is when the seedhead is formed. In addition, when wheat is exposed to glyphosate at flowering, a reduction in both the number of spiklets produced per seed head and seed weight could affect yield. This research evaluated how simulated drift of glyphosate from first node through early flowering would affect crop growth, yield and yield components of six wheat varieties.

The wheat variety USG 3209 was planted in early December at the Central Research Station near Baton Rouge; at the Dean Lee Research Station near Alexandria; and at the Northeast Research Station at St. Joseph. Glyphosate was applied to wheat at first node, boot stage or early flowering at rates to simulate drift representing 1/8th (four ounces per acre), 1/16th (two ounces per acre) and 1/64th (0.5 ounces per acre) of the use rate of 32 ounces of Roundup Ultra (one pound active ingredient per acre). Injury from glyphosate appeared within three to five days after application as bleaching of leaf foliage followed by some

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growth inhibition beginning seven to 10 days after application. At 14 days after treatment, wheat injury was 40 percent to 55 percent for the 2-ounce-per-acre rate applied at first node and the 4-ounce-per-acre rate applied at all growth stages (Table 1).

Wheat height 28 days after treatment was reduced 47 percent when glyphosate was applied at 4 ounces per acre at first node and was reduced around 26 percent when glyphosate was applied at 2 ounces per acre at first node and at 4 ounces per acre at boot stage (Table 1). Wheat height was not reduced with glyphosate at 0.5 ounces per acre applied at first node or boot stage. Wheat height was not reduced for any rate of glyphosate applied at early flowering.

For glyphosate at 4 ounces per acre, wheat yield was reduced 72 percent applied at first node, 45 percent applied at boot stage and 54 percent applied at early flowering (Table 1). At 2 ounces per acre, wheat yield was reduced 25 percent to 30 percent for the three application timings. Wheat yield was not reduced when glyphosate was applied at 0.5 ounce per acre at any growth stage. The reduction in yield was reflected in spike density (number of seedheads per unit area), spikelet number per spike (number of seeds per seedhead) and seed weight (data not shown).

Data clearly show that yield reduction from glyphosate applied at 4 ounces per acre is associated with reduced number of spikes, spikelets per spike and seed weight. Yield reduction associated with the 2-ounce per acre rate, however, could not be explained based on individual yield components but is probably due to the additive effects of all the components.

An additional study was conducted at Baton Rouge in 2001 and 2002 to evaluate wheat variety response to simulated glyphosate drift. Wheat varieties included Coker 9663, Mason, LA 422, AGS 2000, Pioneer/26R61 and USG 3209. This study further defined the response of USG 3209 and included other varieties currently grown in the South. Wheat was planted at the Central Research Station near Baton Rouge in early December of 2000 and 2001 and was harvested in May. The six wheat varieties responded the same to glyphosate applied at four ounces per acre and two ounces per acre.

Wheat height 28 days after treatment was reduced an average of 34 percent for 4 ounces per acre and 17 percent for 2 ounces per acre of glyphosate applied at first node, but height was not reduced when glyphosate was applied at early flowering (data not shown). Yield was reduced an average of 58 percent for 4 ounces per acre and 43 percent for 2 ounces per acre applied at first node and 38 percent for 4 ounces per acre and 19 percent for 2 ounces per acre applied at early flowering. In both studies yield reductions in most cases were reflected in reduced spike density, spikelets per spike and seed weight.

* * *

Wheat is more sensitive to glyphosate applied at first node compared with boot stage or early flowering. In previous research conducted in Louisiana, early application of glyphosate to two- to three-leaf rice and six-leaf corn reduced yield more than the later applications at panicle differentiation in rice and at one week before tasseling in corn. At the highest rate evaluated for glyphosate (4 ounces per acre or 1/8th of the labeled use rate), which is typical of what could be expected from herbicide drift, rice yield was reduced in two of three years by 99 percent and 67 percent when glyphosate was applied early. Corn yield at the same rate was reduced an average of 78 percent over three years when glyphosate was applied early.

Wheat is more sensitive to glyphosate applied at first node compared with boot stage or early flowering.

Yield reduction for wheat from first-node application at four ounces per acre reduced yield 72 percent for the variety USG 3209 and 58 percent when averaged across six varieties in the second study. The yield reductions are comparable to what has been reported for rice and corn and clearly show the negative effect of off-target drift of glyphosate on grass crops.

Glyphosate is effective in controlling grasses, which explains the greater sensitivity of wheat. Even though wheat yield reduction from sub-lethal rates of glyphosate was similar to that reported for rice and corn when applied early at the same rate, visual injury alone was not a good indicator of rice or corn yield loss. This research, however, shows that visible injury would be an accurate indicator of wheat yield reduction. Bleaching of wheat foliage was clearly evident within seven to 10 days after application, but it was not observed as a common injury response to sub-lethal rates of glyphosate applied to rice and corn. ■

Table 1. Wheat injury 14 days after treatment (DAT), plant height 28 DAT, and yield as influenced by glyphosate application timing and simulated drift rates.[a]

Application timing[b]	Rate[c]	Injury 14 DAT	Height 28 DAT[d]	Yield[d]
	oz/A	%	% reduction	
First node	4	55	47	72
	2	40	26	29
	0.5	16	3	8
Boot stage	4	42	27	45
	2	30	14	30
	0.5	18	4	13
Early flowering	4	43	3	54
	2	27	3	25
	0.5	15	1	2

[a]Data averaged across six experiments for USG 3209 wheat.
[b]Application timings correspond to first node in late February/late March, boot stage in late March/early April and at early flowering in early to mid-April.
[c]Glyphosate rates represent 1/8th, 1/16th and 1/64th of the labeled rate of 1.0 lb ai/A or 32 oz/A (4, 2, and 0.5 oz/A) of Roundup Ultra.
[d]Data expressed as percent reduction compared with the nontreated control. For the nontreated control for the first node, boot stage and early heading treatments yield was 53.1, 49.7 and 51.9 bu/A, respectively.

Harvest aids in indeterminate

Joseph M. Boudreaux and James L. Griffin

Photo by Joseph M. Boudreaux

Soybeans in the foreground and background are the same variety planted at the same time. Soybeans in the foreground received a Gramoxone Inteon harvest aid application at R6.5 (50 percent seed moisture) and are ready to harvest.

Farmers have traditionally used harvest aids to desiccate weeds and improve crop quality and harvest efficiency. In recent years, harvest aids have become especially important in producing early-maturing soybeans in Louisiana. Excessive foreign material and moisture associated with green plants at harvest can reduce the price producers receive. Additionally, as soybean plants remain in the field drying down, adverse weather conditions can reduce both yield and seed quality – and income to the grower.

Maturity Group IV (indeterminate) and Group V (determinate) soybean varieties are widely grown in Louisiana. These varieties differ in physiology and vegetative growth that occurs after the plants begin to flower.

Indeterminate soybeans begin flowering at the lower nodes of the plant, and flowering continues upward toward the top. The plants continue to grow for several weeks after flowering begins. Seeds on the bottom of the plant will mature first, and the most immature seeds will be in top of the plant.

Determinate soybeans, by contrast, begin flowering in middle of the plant, and flowering proceeds both upward and downward. For the most part, these plants quit growing when flowering begins. The most immature seeds will be on both the top and bottom of the plant, but most seeds mature at the same time.

Because indeterminate varieties continue to grow taller after flowering begins, plants tend to retain leaves longer. For this reason, a desiccant may be of greater value with these varieties.

Gramoxone Inteon and sodium chlorate are labeled as harvest aids/desiccants for soybeans. The label for Gramoxone Inteon states that for indeterminate varieties it should be applied when at least 65 percent of the seed pods have reached a mature brown color or when seed moisture is 30 percent or less. For determinate varieties, Gramoxone Inteon should be applied when plants are mature – when beans are fully developed, half of the leaves have dropped and remaining leaves are yellowing. The timing of application based on the label is unclear and may be difficult for a grower or consultant to interpret.

Research conducted in 2006 and 2007 evaluated timing the application of the harvest aids Gramoxone Inteon at 1 pint per acre, Gramoxone Inteon at 1 pint plus Aim at 1.4 ounces per acre, and sodium chlorate at 4 quarts per acre. Aim was applied with Gramoxone Inteon to represent situations when broadleaf weeds were present. Soybeans were treated when average seed moisture was at 60, 50, 40, 30 or 20 percent, which was determined by collecting seeds from the top four nodes of plants where seeds would be the least mature. Seeds were weighed, dried and re-weighed to calculate moisture. In general, seeds lost 10 percent moisture in seven to 14 days, depending on the year.

Experiments were conducted using a maturity Group IV indeterminate variety and a Group V determinate variety. Soybeans were harvested and yield was determined when seed moisture was around 13 percent. The number of days soybeans were harvested before the nontreated control was recorded to further quantify the value of the harvest aid treatments. Harvested soybean samples were not graded at the elevator, and economics of the treatments were not determined. Further research, however, is under way to determine if improvement in grade and seed quality justify harvest aid use.

All harvest aid treatments were equally effective in desiccating soybean foliage for both varieties, but application timing had a significant effect. The Group IV indeterminate variety showed no statistically significant difference in yield among the harvest aid application timings in 2006, but differences were observed in 2007 (Table 1). Yields were reduced by an average of 10.3 bushels per acre (17 percent) when the harvest aid treatments of Gramoxone Inteon and sodium chlorate were applied at 60 percent

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and determinate soybeans – application timing and value

average seed moisture compared with the application at 50 percent moisture. The yield at 50 percent seed moisture, however, was equal to the other treatments. When harvest aid was applied at 40 percent and 50 percent moisture, soybeans were harvested nine and 14 days earlier than the nontreated soybeans in 2006 and five and 10 days earlier in 2007.

For the Group V determinate variety when harvest aid was applied at 40 percent average seed moisture, yield was equal to the nontreated control in both years (Table 2). In 2006, yield was reduced by 6.2 bushels per acre (12.1%) with application at 60 percent moisture compared with 40 percent moisture. Yield was equal when harvest aid was applied at 40 percent and 50 percent seed moisture. In 2007, yield was reduced by 17.7 bushels per acre (27.7%) with application at 60 percent moisture and reduced by 13 bushels per acre (20.3%) at 50 percent moisture when compared with 40 percent seed moisture. Yield reductions were attributed to reduced seed weight, which would be expected when soybean leaves are removed before seed fill is complete. When harvest aid was applied at 40 percent moisture, soybeans were harvested seven days earlier than the nontreated soybeans in 2006 and 15 days earlier in 2007.

Application timing was more flexible with the indeterminate variety because the most immature seeds are present only in the top of the plant instead of in both the top and bottom of the plant as with the determinate variety. Research results show that harvest aid – either Gramoxone Inteon or sodium chlorate – can be of value by desiccating leaves and stems and speeding up harvest of both indeterminate and determinate soybeans. A harvest aid may be especially valuable for indeterminate soybeans because terminal buds continue to grow several weeks after flowering and plants retain leaves longer. For soybean varieties grown in Louisiana, harvest aids can be applied when seeds from the uppermost four nodes of the plants are around 50 percent moisture (at R6.5) without negatively affecting yield. ■

Table 1. Asgrow 4403RR Group IV indeterminate soybean variety response to application timing of harvest aid versus a nontreated control (NTC) in 2006 and 2007.

Application timing (Avg. seed moisture)	Yield Bu/A		Moisture at harvest (Percent)		Days harvested before NTC	
percent	2006	2007	2006	2007	2006	2007
60	55.1	49.2	12.7	11.4	14	10
50	59.9	59.5	13.2	11.7	14	10
40	59.8	62.0	13.0	13.2	9	5
30	59.3	60.3	11.4	13.5	3	0
20	61.0	63.6	12.4	13.8	0	0
NTC	60.7	62.9	12.3	15.1	0	0

Table 2. Asgrow 5903RR Group V determinate soybean variety response to application timing of harvest aid versus a nontreated control (NTC) in 2006 and 2007.

Application timing (Avg. seed moisture)	Yield Bu/A		Moisture at harvest (Percent)		Days harvested before NTC	
percent	2006	2007	2006	2007	2006	2007
60	45.1	46.3	13.7	15.4	18	21
50	47.6	51.0	13.7	15.6	13	21
40	51.3	64.0	11.6	13.7	7	15
30	52.4	67.5	13.6	13.8	7	7
20	57.1	65.8	12.4	14.7	0	7
NTC	52.9	65.4	13.8	15.1	0	0

Procedure to determine when to apply a harvest aid to indeterminate and determinate soybeans

- **Collect pods from the uppermost four nodes of plants at random across the field.**
- **Open pods and look for separation of beans from the white membrane inside the pod.**

Beans should be easy to shell from the pods. If this is observed for all pods collected, then seed are at physiological maturity (around 50 percent moisture) and have reached maximum dry weight. Many leaves on plants have dropped by this time, and the remaining leaves are yellow. It is safe now to remove the remaining leaves chemically without affecting seed weight. Another sure-fire way to know that it is safe to apply a harvest aid is when one normal pod on a main stem has reached mature color. This growth stage is R7, and harvest should occur in about three weeks.

If after opening the pods not all beans easily separate from the pod wall, application of harvest aid will result in some yield loss because of lower seed weight, and the effect will be greater for determinate varieties. Growers will need to decide if the yield loss can be offset by earlier harvest or improvement in grade. A reduction in price received per bushel because of dockage associated with foreign material may more than offset the cost of a harvest aid application.

Evaluating very early maturing SOYBEANS in Louisiana

The movement toward early season soybean production in the southern United States began around 1990. Now, Maturity Group IV varieties are a mainstay throughout Louisiana and the Midsouth.

Steven H. Moore and Donald J. Boquet

The success of early season production coupled with the increasing late-season occurrence of Cercospora leaf blight, Asian rust and stink bugs has led Louisiana soybean producers to consider even earlier maturing varieties to maintain profitable soybean production. The purpose of this research was to determine how well-adapted the very early maturing Group III soybeans are in Louisiana.

Flowering in soybeans is most often influenced by the length of nighttime. Early maturing soybean varieties generally require a shorter nighttime period to trigger flowering than later maturing ones. For this reason, early maturing soybeans planted at recommended dates in Louisiana will usually flower and subsequently fill their seeds earlier than later maturing ones

Field tests were conducted in 2005 and 2006 with Group III through Group VI soybeans at the Dean Lee Research Station in the Red River Valley of central Louisiana and the Macon Ridge Research Station in northeast Louisiana to determine yield and agronomic performance. Sixteen Group III varieties in 2005 and 19 Group III varieties in 2006 were planted at relatively early (March) and late (April/May) dates. In addition, the Group III variety Dyna-Gro DG3392 was planted weekly from March 31 through May 12, 2006, at Dean Lee to gain a better idea of when Group III varieties should be planted for best results.

The yield of Group III varieties was significantly affected by planting date. When planted in late March, Group III soybeans yielded an average of 28 bushels per acre, which was lower than other maturity groups (Table 1). When planted after mid-April, Group III soybeans yielded an average of 43 bushels per acre, which was less than the Group IV soybeans, which averaged 49 bushels per acre, but was about the same as Group V varieties, which averaged 42 bushels per acre. With yields similar to Group V, Group III soybeans would likely be more profitable because of lower costs for insect and disease control because of a shorter growing season.

Yield of late-planted Group III soybean varieties averaged about 10 bushels more per acre than Group VI soybeans, which averaged 33 bushels per acre. The difference would have been even greater if the Group VI test at Macon Ridge was not discarded in 2006 because of extreme disease that caused very low yield and seed quality. The relatively large difference in yield between late-planted Group III and Group VI soybeans in 2006 at the Dean Lee Research Station was attributed to late-season Cercospora leaf blight infection and underscores the advantage of producing early-season soybeans.

The Group III varieties averaged 6 inches taller at the later planting dates than at the early planting dates. Plant height of Group III varieties, especially those that were planted early, was shorter than Group IV, Group V and Group VI varieties. Late-planted Group III varieties, however, averaged only 2 inches to 3 inches shorter than the later maturity groups. Plant height in Group III varieties significantly correlated with yield in six of the eight field tests, indicating that most of the yield increase attributed to later planting was the result of increased plant size. Lodging (the propensity of plants to fall over) was

Table 1. Average yield (Bu/A) of soybean varieties in commercial performance trials at two locations over a two-year period.

Year	Station	Group III Early	Group III Late	Group IV	Group V	Group VI
2005	Dean Lee	22	38	45	36	35
2006	Dean Lee	27	43	60	47	23
2005	Macon Ridge	35	46	41	46	42
2006	Macon Ridge	27	47	52	39	—*

**Yield of less than 10 bu/acre was the result of infestations of insects and diseases in the late-maturing varieties and was not representative of relative variety performance.*

Steven H. Moore, Professor, Dean Lee Research Station, Alexandria, La., and Donald J. Boquet, Jack and Henrietta Jones Endowed Professor, Macon Ridge Research Station, Winnsboro, La.

fairly moderate in Group III varieties, probably due to their growth habit and relative shortness.

Group III and Group IV soybean varieties usually have indeterminate stem termination, and later-maturing varieties have determinate stem termination. Indeterminate soybeans continue to grow and put on new leaves most of the summer. Determinate soybeans, on the other hand, flower in a short period and do not put on a lot of new growth after pods begin to fill. Early-season indeterminate varieties in the Midsouth often retain green leaves, so harvest aids are frequently used to help dry the crop. Group III soybeans frequently display this behavior, and only a few varieties dried in a normal manner at Dean Lee in 2005 (Figure 1). At Macon Ridge, green leaf retention was noted in the March plantings but not in the April plantings.

The difference in maturity date between early-planted and late-planted Group III varieties was 11 days in both years at Macon Ridge, even though planting dates differed by 20 days to 30 days. It is likely that the colder temperatures associated with March plantings slowed early plant growth and development. Because the time from planting to harvest maturity was reduced for the later plantings, producers should be aware that the earlier harvest they seek by planting at the earlier date may not be realized entirely.

One concern with Group III varieties is the seed quality when maturation occurs during high temperatures in July and August. Seed quality of early-planted Group III soybeans was lower than other maturity groups (Table 2); however, late-planted Group III soybeans had the highest seed quality of all maturity groups in both years. Seed quality was very low for Group V and Group VI varieties in 2006. The results showed that seed quality was lower when Group III soybeans were planted in March, but when planting was delayed until after mid-April, the seed quality of Group III soybeans was not lower than other maturity groups.

In the two-location study with two planting dates about a month apart, yield and seed quality were higher in late-planted Group III soybeans than in early-planted Group III soybeans (Table 1). In the planting date experiment at Dean Lee with a single Group III variety and seven weekly plantings from March to June, yields were lowest for the March 31 planting, increased with each planting until May 5, and then decreased for later plantings. The optimum planting date was determined to be April 16. Although these results are only for one variety produced in one environment, these data support the results of the other studies that show the optimum planting date for Group III soybean varieties is mid to late April.

Group III soybeans have potential for profitable production in Louisiana. Yields averaged as high as 47 bushels per acre when Group III soybeans were planted after mid-April.

Photo by Steven H. Moore

Figure 1. Maturity Group III soybeans often retained green leaves after seed formation at the Dean Lee Research Station location in 2005.

Table 2. Seed quality of soybeans at the Macon Ridge Research Station.

Year	Group III Early	Group III Late	Group IV	Group V	Group VI
2005	3.1	1.5	2.0	1.8	3.0
2006	2.8	2.1	2.4	—	5.0

Scale of 1-5, where 1 = excellent quality and 5 = very poor quality.

March-planted Group III soybeans produced lower yield than those planted after mid-April. The yield of Group III varieties was highly correlated with plant height. It is likely that plant height and yield of Group III soybeans would increase in closer row spacing. Seed quality was lower for early-planted Group III soybeans; however, the seed quality of Group III soybeans planted after mid-April was as good as or better than later-maturing soybeans. Crop desiccants may be needed to help dry down Group III soybean varieties for harvest. Group III soybeans can produce good yields and may be one solution for escaping late-season disease and insect pressure; however, adapted Group IV varieties have yielded 5 to 10 bushels per acre higher when planted on the same dates as Group III soybeans. ■

Acknowledgment
Early season soybean production research programs in the LSU AgCenter were partially funded by the Louisiana Soybean and Grain Research and Promotion Board.

Effect of late nitrogen applications

on corn yield on a Mississippi River alluvial soil

Henry J. "Rick" Mascagni Jr., Gary Breitenbeck and Bubba Bell

Nitrogen fertilization is a critical component of cultural practices required for producing maximum corn yield. Many factors including climatic conditions, soil type and tillage systems determine optimum nitrogen rates. Nitrogen is typically knifed-in soon after the crop has emerged and an adequate stand is established. After fertilizer application, uncontrollable factors such as excessive or lack of rainfall may produce soil conditions conducive to nitrogen fertilizer loss through denitrification and inefficient plant nitrogen uptake.

Sometimes nitrogen applications are delayed or omitted because of inclement weather. At other times, growers apply the recommended nitrogen rate for an expected yield potential. As the crop develops, however, yield potential may be higher than expected and additional nitrogen may be required. In each of these situations, the question arises: Can nitrogen applications as late as reproductive growth stages be effective? Trials to evaluate late nitrogen applications on a Mississippi River alluvial soil attempted to answer this question.

Field experiments on Sharkey silty clay at the Northeast Research Station near St. Joseph were conducted in 2006 and 2007 to evaluate the influence on corn yield of early-season and late-season nitrogen applied at different rates. Early-season nitrogen was injected at about the two-leaf growth stage as 32 percent urea ammonium nitrate solution at nitrogen rates of 150, 180, 210, 240 and 270 pounds per acre. Late-season nitrogen was broadcast at the early-tassel stage as ammonium nitrate at rates of zero or 60 pounds of nitrogen per acre. Treatments were evaluated with and without irrigation.

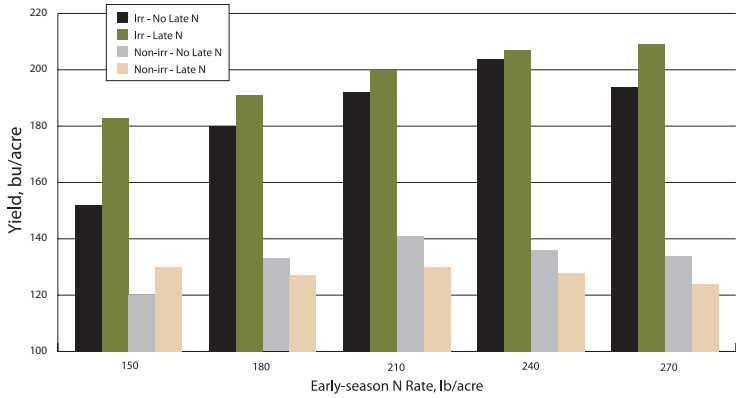
Furrow irrigations were scheduled based on a 1.5-inch soil moisture deficit. Late nitrogen was watered-in soon after application in the nonirrigated trial in 2007 and was in the irrigated trials both years. Late nitrogen received rain soon after application in the non-irrigated trial in 2007 and was watered-in in irrigated trials both years. Rainfall, which was needed to activate the late-season treatments in the non-irrigated trial in 2006, did not occur for three to four weeks after the applications. Yields are presented as two-year averages, since yield responses to both the early- and late-season nitrogen treatments were similar each year.

When irrigated, average yields ranged from 152.2 to 204.5 bushels per acre for the no-late-nitrogen treatment and 183.6 to 209.7 bushels per acre for the late nitrogen (Figure 1). The optimum early-season nitrogen rate was about 210 pounds of nitrogen per acre. The late applications of 60 pounds of nitrogen per acre consistently increased yields for the lower early-season nitrogen rates, with the largest response occurring for the 150-pounds-per-acre early-season nitrogen rate. Yields were increased by 20.7 percent – ranging from 152.2 to 183.6 bushels per acre. Yields for total nitrogen applied (early season plus tassel emergence) were similar regardless of whether applied in single application at early season or split between early season and tassel emergence. For example, yields for the 210-pounds-per-acre rate applied either once at early season or split between early season and tassel were 192.4 bushels per acre for early season and 183.6 bushels per acre for the split application.

Under dryland conditions, yields were much lower than the irrigated yields, ranging from 120.7 to 141.9 bushels per acre for the no-late-nitrogen treatment and 127.4 to 130.2 bushels per acre for the late nitrogen treatments (Figure 1). The optimum early-season nitrogen rate was about 180 pounds per acre. Late nitrogen applications at tassel emergence did not increase corn yield. The low yields in the nonirrigated trials were primarily because of little May and June rainfall. If applying nitrogen as late as tassel emergence, it is important that the fertilizer be activated either by rainfall or irrigation as soon as possible for maximizing plant availability of the nitrogen fertilizer and minimizing any yield loss associated with late-season nitrogen deficiency.

These findings indicate that nitrogen fertilizer applications as late as tassel emergence may increase corn yield if the plant is nitrogen deficient. The efficacy of split nitrogen applications depends on many factors; however, climatic conditions are probably the most influential because they affect both soil nitrogen availability and plant nitrogen demand. Plant monitoring using remote sensing techniques is being evaluated for monitoring the plant nitrogen status late in the season. More extensive research is needed to determine if late-season plant monitoring can be used to determine if late nitrogen applications are warranted. ■

Figure 1. Influence of late-season and early season nitrogen rates on corn yield on Sharkey silty clay at the Northeast Research Station, averaged across 2006 and 2007.



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Teaching youth entrepreneurship
in rural Louisiana

James N. Barnes and R.L. Frazier

New business formation has always been important for economic growth. Self-employed individuals who have no paid employees operate 75 percent of U.S. businesses. Spurring entrepreneurship activity is an economic development strategy for rural Louisiana. As part of the entrepreneurship initiative at the LSU AgCenter's Delta Rural Development Center in Oak Grove, faculty have identified youth in Northeast Louisiana as a target group for entrepreneurship education.

Why youth?

A 2005 survey by Junior Achievement, a successful youth entrepreneurship program in the United States, concluded that nearly 70 percent of teenagers wanted to become entrepreneurs, despite knowing this path wouldn't be easy.

Research shows teaching entrepreneurship skills to youth can have several positive effects. These include:

- Acquisition of time management and interpersonal skills.
- Increased problem solving and decision making skills.
- Improved academic performance, school attendance and overall educational attainment.
- Increased interest in attending college and occupational aspirations.
- Increased independent reading and leadership behavior.

Developing a pilot program

LSU AgCenter faculty developed a pilot program for a group of six 4-H Junior Leaders in West Carroll Parish. The goal was to introduce the students to business on the Internet and challenge them to learn about buying and selling on eBay, but mostly selling. AgCenter faculty met bi-monthly with these students for entrepreneurship training sessions. The program involved three phases.

Phase 1 was to study eBay. The students were to bring a product from home, write a product description and then upload their product onto eBay for sale via an auction. Some students struggled with product descriptions. The students who struggled the most had brought products such as antique lamps and old record albums. The students quickly learned that standardized products such as movies and games already had descriptions either on the box itself, or consumers could recognize movies and games by their titles. The students learned an important lesson. Helping buyers understand what the product looks like and how it performs increases the probability of selling products.

Phase 2 began by using case studies about running a business. Students played an online game called Hot Shot Business. The case studies combined with the game made the principles of running a business more realistic. The students had to make decisions about pricing, marketing, sales and ethics.

In Phase 3, the group returned to eBay activity to practice marketing, sales and finance skills with a real project. The product to sell was a youth-sized four-wheeler. The students did the research on pricing and product description for the four-wheeler by examining auctions for similar vehicles. They also had to calculate shipping charges. Armed with their business model, they visited the actual storefront in Oak Grove to negotiate for their commission. After settling on a 10 percent commission, the students listed the product and watched the number of buyers and bids for the next week.

During the last of the 10 sessions, the students presented what they learned to the Oak Grove Chamber of Commerce. The chamber provided students with cash prizes totaling $100 dollars for the top three participants for their efforts to learn entrepreneurship skills and apply them in the Oak Grove community.

Lessons learned

Here are the lessons learned from the pilot program:

- Start with a small, dedicated group of students. The tasks are difficult, and the students need much individual attention.
- Don't plan to make money. Tell the students a business usually takes four years to make a profit.
- Use defined rewards. The students were motivated to do the lessons with the promise of a cash prize at the end.
- Keep it fun. Playing the game, Hot Shot Business, was a way for the students to learn from mistakes safely. Teaching negotiation skills helped students work with each other and provided some free time to learn how to buy and sell effectively.

In December 2007, AgCenter faculty invited six 4-H Junior Leaders from Caldwell Parish to participate in this program. Two students from the West Carroll pilot program participated in the training. Faculty taught marketing strategies for selling online based on the case study readings assigned. Students were also required to bring items from home, write product descriptions and upload their products onto eBay. One week later, faculty and the two students from West Carroll taught students how to play the Hot Shot Business game and then explained how students could package and ship products. As the auctions ended, students had sold two of the five products. Based on evaluations, the program was highly successful at teaching the entrepreneurial skills of managing an online business on eBay.

LSU AgCenter faculty will continue to offer the abbreviated program. By the summer of 2008, an in-service training for other 4-H agents in Northeast Louisiana will be provided to share all the teaching materials developed. These materials will be available at the LSU AgCenter's Delta Rural Development Center at www.lsuagcenter.com/drdc. ■

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Photo by John Wozniak

What do Louisiana nonindustrial, private forest landowners think about FOREST CERTIFICATION?

Richard P. Vlosky
Priyan Perera
Michael A. Dunn
Glenn Hughes

According to the U.S. Forest Service, timberland nationwide totals 504 million acres with the South accounting for approximately 40 percent, or 203 million acres. Forests cover 14 million acres, about 50 percent of Louisiana's land area, making it the state's greatest single land use. Twenty-three percent of U.S. softwood timber and 44 percent of hardwood timber are grown in the South, accounting for about 55 percent of the total U.S. annual roundwood harvest. As such, southern forests are often referred to as the "wood basket" of the nation.

The forest sector plays a key role in Louisiana's economy. For example, the forest sector generated more than $4.5 billion in value (farm gate plus value-added) in 2005 and has more than 28,000 employees. In addition, forests provide Louisiana landowners and the public many amenities, including recreational value, aesthetic enjoyment, wildlife habitat and water quality.

Southern forests are predominantly owned by non-industrial private forest (NIPF) landowners – defined as private forest owners who do not own or operate wood processing facilities – which include farmers, miscellaneous individuals and non-forest-industry operations. Of the 203 million acres of timberlands in the South, approximately 90 percent (181 million acres) are privately owned either by forest industry or NIPF landowners. The remaining 10 percent is collectively owned by federal, state and local public entities. NIPF landowners account for the greatest share of timberlands with 4.9 million landowners owning 71 percent of the forestland in the South. An estimated 144,000 Louisiana NIPF landowners own about 62 percent of the state's timberlands.

Forest management certification is an assessment of the effect of forest activities against standards agreed to as significant and acceptable to stakeholders. Certification can be an internal assessment by an organization of its own systems and practices (first-party), an assessment by an association or trade group (second-party) or by a neutral entity (third-party). Third-party organizations pass judgment on the environmental performance of products rather than leave assertions to product manufacturers themselves. Presently, forest certification is being provided by third-party organizations that claim to have no self interest in a specific forest activity, are not stakeholders in the forest being certified and can assure the public of independent and professional judgment.

Table 1. General attitudes on certification (percent of respondents) (n=271).

	Strongly Disagree	Somewhat Disagree	Neither Disagree Nor Agree	Somewhat Agree	Strongly Agree
Certification programs can provide a vehicle for the forest industry to communicate positive accomplishments to the public.	6%	6%	48%	27%	13%
Certification is a potentially viable mechanism to aid in promoting sustainable forestry in the U.S.	9%	7%	43%	25%	16%
Certification could reduce the need for additional forest management regulation.	12%	9%	49%	21%	9%
The U.S. forestry community should be involved in the certification issue.	9%	3%	35%	29%	25%
The U.S. forestry community has been adequately involved in the certification discussion.	6%	9%	66%	13%	7%
Landowners have been adequately involved in the certification discussion.	26%	23%	44%	5%	2%
Consumers are confused by the number of certification organizations that exist.	3%	4%	44%	18%	31%
I question the willingness of the public to support certification.	3%	5%	40%	29%	24%

This study, conducted in 2005-2006, reveals how well NIPF landowners in Louisiana understand forest certification, their willingness to pay to become certified and their general perceptions about the certification process and implementation requirements. We surveyed 1,200 randomly selected Louisiana NIPF landowners who owned 10 acres or more of timberland in 2005. A total of 306 usable surveys resulted in an adjusted response rate of 29 percent (after accounting for undeliverable questionnaires).

More than 74 percent of respondents owned 200 acres or less of timberland in 2004; only 3 percent owned 5,000 acres or more. Over the previous 10 years, respondents acquired 142,370 acres of forestland and sold 385,187 acres. This corresponds to an average acquisition of 514 acres and average sales of 1,381 acres. Thirty-two percent of respondents ranked timber production as the most significant reason to own timberland. The second most important reason was to pass on the property to their heirs. This was followed by recreational purposes, as a land investment and to enjoy the privacy that the forest offers.

Eighty-one percent of respondents harvested timber products during the time they owned forestland. Sawlogs was the main product harvested (59 percent of respondents), followed by pulpwood (53%), chip-n-saw (15%) and posts/poles (10%).

Respondents were asked about their perceptions of the need for forestland certification by U.S. owners. Respondents gave top priority to national and state forests followed by tropical forests. Non-industrial private forestland was ranked last. Respondents were also asked to rank their level of agreement regarding the impetus for certification in the United States. Highest ranked were environmental organizations followed by forestry organizations, certifiers and certification consultants. Consumer demand ranked last.

Landowners were asked questions to reveal their knowledge of certifica-

NIPF landowners account for the greatest share of timberlands with 4.9 million landowners owning 71 percent of the forestland in the South. An estimated 144,000 Louisiana NIPF landowners own about 62 percent of the state's timberlands.

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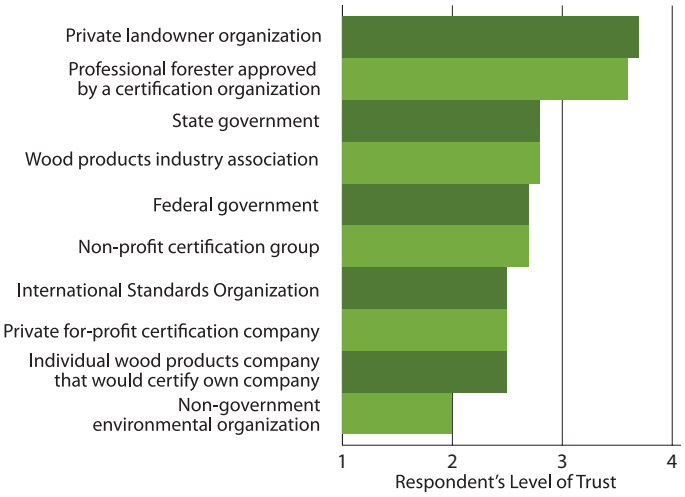
Figure 1. Level of trust to administer forest certification (scale of 1-5 where 1=trust least; 5=trust most) (n=267).



tion. Forty-six percent said they understand the concept of forest certification well or to some degree, and 52 percent felt certification can improve the forestry profession in United States. In addition, results suggest that respondents were not sure how wood products manufacturers or consumers would react given the choice between certified and non-certified products.

Forty-eight percent of respondents believed certification would add an unnecessary level of regulation on private lands, and 20 percent felt federal or state laws make certification unnecessary.

Table 1 summarizes additional responses regarding attitudes about certification. Forty-one percent had a positive perception of forest certification and believed that it can promote sustainable forestry. However, 53 percent of respondents said they were skeptical of public willingness to support certification and further elaborated that they believed consumers are confused by the proliferation of certification schemes.

Figure 1 indicates respondents' level of trust of various entities to implement and monitor certification in the United States. Private landowner organizations and professional foresters approved by certification organizations were the most trusted. Environmental organizations, identified by respondents as the main driving force for certification, were the least trusted.

Cost of certification was a concern for both NIPF and industrial forest landowners. Although certification programs are voluntary, landowners often have to incur costs associated with modifying and implementing programs in order to become certified. Results indicate that a majority of respondents (78 percent) were not willing to bear any of the cost of certification.

Certification can be an opportunity for NIPF landowners, but landowners must plan and act years in advance to capture this potential opportunity. If certification continues to gain momentum in the marketplace, the pressure of participating in certification may reach NIPF landowners.

Although many respondents said they understood the concept, many seemed to know relatively little about the nuances of forest certification. Many were not averse to having certifiers monitor their forest management activities, and they appear more likely to support certification if there are no conflicts between landowner objectives and certification procedures and if the cost to certify can be justified.

Private landowner organizations and approved professional foresters were seen as the most trustworthy to administer certification. Therefore, these groups could be a conduit of information to NIPF landowners to introduce them to certification concepts and programs. This approach would also mitigate respondents' concerns that the forestry community was not adequately involved in the certification discussion. ■

SPATIAL ANALYSIS
identifies Louisiana's forest products manufacturing clusters

Richard P. Vlosky and Francisco X. Aguilar

According to the theory of clusters in the business world, companies tend to spatially concentrate in places where they experience unusual competitive success. Clusters are generally geographically concentrated and are composed of a group of companies encompassing related industries in an industry supply chain. They may include suppliers, ancillary service providers or providers of specialized infrastructure. The study and identification of clusters can contribute to a better understanding of forest products industry competitiveness and regional development.

Spatial analysis can be applied to forest products manufacturing sectors to identify clusters. Spatial analysis is the process of extracting or creating new information about a set of geographic features. Spatial data consist of measurements taken at specific locations or within a specified area. Spatial analysis

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often requires the use of Geographic Information System (GIS) combined with statistical tools.

The forest products industry is considered to have cluster characteristics. The industry ranks among the top 25 largest clusters in the United States based on the number of people employed and spatial concentrations. Various factors affect industry concentration in certain regions. For example, transportation costs and associated proximity to resources and markets contribute to the concentration in the forest products industry. Sawmills benefit from economies of scale and the spatial aggregation of manufacturers can result in gains in efficiencies and cost reductions. Hence, there seems to be a spatial tendency for primary and secondary manufacturers to conglomerate in clusters. This classification is not always clear, but most industry observers agree on general definitions of the groups:

- Primary products are those produced directly from raw timber input. Examples include pulp, chips, lumber, veneer, plywood and their by-products.
- Secondary manufacturers use primary products as input for remanufacturing. Examples include various types of paper, paperboard, panels, engineered composites or dimension stock. Secondary products can also include final consumer products such as furniture.

The forest sector is by far Louisiana's most important agricultural sector. According to the LSU AgCenter's AgSummary for 2006, the forest sector contributed more than $4.8 billion to the state's economy. The forest products sector accounts for about 11 percent of total manufacturing jobs in Louisiana employing nearly 28,000 people.

To conduct a spatial analysis of primary and secondary forest products manufacturers in Louisiana, spatial point patterns and spatial correlations of 78 primary producers and 176 secondary producers in Louisiana were calculated. Using a map projection for Louisiana, socio-economic data from the 2000 U.S. Census were merged with the zip code map projections and geo-spatial industry clusters for primary and secondary forest product manufacturers were identified and mapped.

In Figure 1 a lighter color indicates a higher incidence of primary forest product manufacturers. Note that there are several clusters of primary companies throughout the state. Primary forest product manufacturers are forest resource dependent and are located primarily close to the forest and raw materials (logs). In the northwestern part of the state, the predominant forest type is loblolly/shortleaf pine. In the southwest it is longleaf/slash pine, and in the southeastern part of the state it is a mix of loblolly/shortleaf pine, longleaf/pine, and gum/oak/cypress. The dominant species in these areas may be a factor affecting this spatial pattern.

In Figure 2 the frequency for the secondary forest products industry is less dispersed. The largest incidence is located in the southeast part of the state, suggesting that the two largest incidences of secondary manufacturers are located close to the largest urban areas in the state, New Orleans and Baton Rouge. Compared to the primary forest products industry, the secondary manufacturers are typically situated near final consumers for their products in more populated areas. This pattern is in part motivated by easier access to consumer information and potential benefits derived from scale economies as a cluster grows larger. Secondary forest products manufacturers can source input materials from other areas (regions or even countries) and are not spatially tied to the source of input materials.

Some of the elements that encourage companies to be a part of a cluster include proximity to markets, access to plentiful supply of raw materials and potential customers, and skilled labor. The clusters identified in this study embody commonalities that can facilitate economic development efforts in this sector. Working with clusters enables policy makers to identify the most promising opportunities to encourage further innovation, develop worker skills and address issues that affect industry productivity. Primary forest products' manufacturers are found in Louisiana near raw materials supplies, while secondary forest products' manufacturers are concentrated near major populated areas. A cluster approach can also help firms achieve a competitive advantage by promoting common interests and can also help the public sector be more effective in supporting the cluster industry.

Future research will build on this analysis to identify geo-spatial locations of supply chain members in the wood-producing sector, model more complex business relations, and ultimately identify additional socio-economic factors that contribute to or hinder supply chain success. ■

Figure 1. Where Louisiana primary forest products manufacturers are clustered.

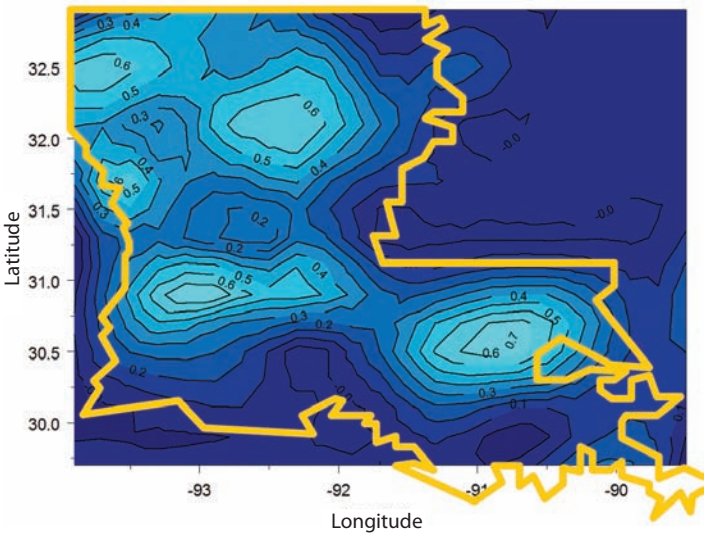
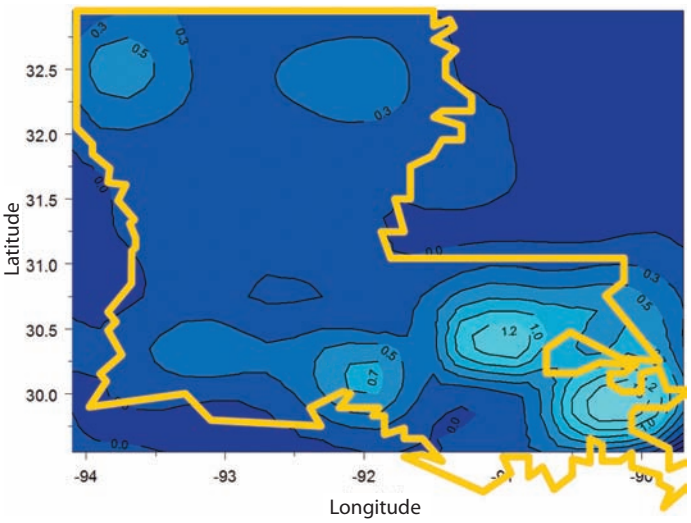


Figure 2. Where Louisiana secondary forest products manufacturers are clustered.



Coastal plants team wins Tipton Award

Photo by Mark Claesgens

The coastal plants study team won the LSU AgCenter's top research team award for 2007. Called the Tipton Team Award, it is named for Kenneth W. Tipton, the former vice chancellor for research. The 10 members represent three units within the AgCenter: the School of Plant, Environmental & Soil Sciences, the Department of Plant Pathology & Crop Physiology and the Rice Research Station. From left to right are: Ida Wenefrida, Herry Utomo, Carrie Knott, Marc Cohn, Mike Materne, Niranjan Baisakh and Prasanta Subudhi. Not pictured are Gary Breitenbeck, Steve Harrison and Ray Schneider.

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