

LOUISIANA Agriculture

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ENSURING OUR FUTURE THROUGH SCIENTIFIC
RESEARCH AND EDUCATION

THROUGH FIRE,
DROUGHT AND FLOOD,
The LSU AgCenter Is There
for Louisiana

ABUNDANT RAIN AND A LONG GROWING SEASON: HOW THE LOUISIANA CLIMATE AFFECTS AGRICULTURE

■ JAY GRYMES

The Louisiana climate is heavily influenced by the Gulf of Mexico and the subtropical climate that we share with the four other Gulf Coast states. Of those Gulf Coast states, we are on average the wettest. That rain is a big component of why we call Louisiana Sportsman's Paradise, and the abundance of water that creates a green environment is a monster contributor to Louisiana agriculture.

Given that it's a subtropical climate, Louisiana has a very long growing season compared to other parts of the country. That extended growing season coupled with abundant moisture is one of the reasons why forestry is our biggest agricultural sector. It's a wonderful environment for growing trees throughout the year.

In a normal year, we get a surplus amount of rain in the winter and spring. If it's not too excessive, that's a good thing. It sets up a good reservoir of summer-time moisture. However, that surplus can also lead to significant flooding during the winter and spring seasons, and that can be devastating for agriculture, particularly in the northern half of the state.

In the summer months, the northern half of the state only averages about half as much rain as the southern part of the state. That explains the need for irrigation for the central and northern parishes. Under a normal annual pattern, this is a manageable and productive rainfall climatology for agriculture. Problems arise, however, when rainfall runs below normal for extended periods of time. Then, even "wet" Louisiana can slip into drought. Most recently, drought condi-

tions developed two years ago, reaching critical levels by summer 2023. Not only was that devastating for a good bit of the state's agriculture, but it also generated one of the worst wildfire seasons that the state has suffered in decades.

The moral of the story is that when we look at averages, Louisiana looks like a great agricultural state from a weather perspective. Typically, it is, but in recent years we have seen a higher-than-normal degree of year-to-year and intra-year rainfall variability — wet years followed by very dry years — and those flip-flops are unpredictable. More importantly, that variability can be a constraining and inhibiting factor for Louisiana agriculture.

Then there is the issue of tropical weather. While the focus of tropical storm and hurricane impacts tends to be on the coastal parishes, we can't ignore the potential effects of tropical systems throughout the state. Tropical winds and rains of 10 to 20 inches can extend from the coast all the way through the northern parishes. What is a bit troubling is that the 21st century has seen the greatest frequency of tropical landfalls that Louisiana has ever experienced based on records back to the 1850s. That uptick in landfall activity has the state averaging more than one named-storm landfall every year since 2001.

In summary, Louisiana's normal weather and climate patterns do a great job of supporting and sustaining the state's wide variety of agriculture, forestry and aquaculture. However, producers need to be flexible with their management practices and adapt to future variability in rainfall, our key

climatic driver. In addition, where possible, producers need to look at schemes that may reduce the impacts of increased tropical activity.

Whether you want to attribute recent climatic trends across the Bayou State to anthropogenic causes or not, it's clear that the state has experienced an increase in climate variability, if not climate change, over recent decades. Louisiana agriculture, and the state as a whole, must prepare for the possibility that this kind of variability may continue for at least the foreseeable future.

Jay Grymes is the interim state climatologist and chief meteorologist for WAFB-TV in Baton Rouge. As state climatologist, Grymes is partnering with the LSU AgCenter to provide information, education and outreach.



Jay Grymes was named the interim Louisiana state climatologist in February. Grymes, the chief meteorologist for WAFB in Baton Rouge, previously served as the state climatologist from 1991 to 2003. Photo by Olivia McClure

LOUISIANA Agriculture

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Adam Gordon, a private landowner managing property in Allen and Beauregard parishes, burns pine straw during an LSU AgCenter prescribed burning certification workshop in Florien in western Louisiana in March. Photo by Olivia McClure

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DIAZ NAMED DIRECTOR OF INVASIVE SPECIES RESEARCH CENTER

LSU AgCenter entomologist Rodrigo Diaz has been named director of the AgCenter's Center for Research Excellence for the Study of Invasive Species. The center is working to advance the understanding of destructive non-native insects, weeds, wildlife and disease-causing microorganisms.

With more than 40% of invasive species found in the United States being present in Louisiana, the center is a necessity to better understand and control them, said Matt Lee, LSU vice president for agriculture.

Diaz, whose research has focused on the study of invasive species' impact on managed and natural ecosystems, will facilitate the direction and management of the center; develop research goals and objectives; and coordinate research, education and outreach activities.

Currently, the center has collaborators at Southern University, LSU and the U.S. Army Corps of Engineers. ■ **TOBIE BLANCHARD**



Rodrigo Diaz, LSU AgCenter entomologist, samples roseau cane scales in March 2021 in Plaquemines Parish. Diaz has been named the director of the AgCenter's Center for Research Excellence for the Study of Invasive Species. Photo provided by Rodrigo Diaz



Rubayet Bin Mostafiz. Provided photo

MOSTAFIZ TO OVERSEE RESEARCH AT LAHOUSE

Rubayet Bin Mostafiz has been appointed assistant director of research at the LSU AgCenter LaHouse Research and Education Center.

Mostafiz has served as an assistant professor of research at LaHouse since July 2023. He previously worked as a postdoctoral researcher at LaHouse. He earned his doctorate in oceanography and coastal sciences from LSU in 2022.

In 2020, Mostafiz was named a Louisiana Sea Grant Graduate Research Scholar. He earned the Outstanding Performance Recognition Award from the Governor's Office of Homeland Security and Emergency Preparedness in 2019 for contributing to an update of the Louisiana State Hazard Mitigation Plan.

His research expertise includes spatial analysis, hazard risk assessment, climate hazard variability, impacts on the landscape and human communities, and risk estimation due to extreme weather events.

LaHouse is a display home located on LSU's Baton Rouge campus that focuses on promoting resilient, sustainable and healthy homes and communities through research and extension. Researchers at LaHouse work on identifying the best strategies to mitigate the damage done by high-speed winds and floods. ■ **SHELLY KLEINPETER**

FRST FERTILIZER RECOMMENDATION SUPPORT TOOL LAUNCHES NATIONWIDE TO DIGITIZE CROP NUTRIENT MANAGEMENT

A national group of scientists — including two from the LSU AgCenter — has released the Fertilizer Recommendation Support Tool, or FRST, a decision aid providing an unbiased, science-based interpretation of soil test phosphorus and potassium values for crop fertilization.

The FRST project is a collaboration of more than 100 soil science and agronomic professionals representing nearly 50 universities, four divisions of the U.S. Department of Agriculture, several nonprofit organizations and one private sector partner. This diverse partnership underscores the collective effort and expertise invested in the development of FRST.

The LSU AgCenter is represented on the project by Jim Wang and Muhammad Rasel Parvej. Wang and Parvej expressed excitement about the launch of the decision support tool. FRST was developed in response to the pressing need to harmonize soil testing across state boundaries, improving the evaluation of soil test correlation.

The new web-based tool, available at soiltestfrst.org, represents a significant advancement in soil testing for phosphorus and potassium and nutrient management. It uses data from across the U.S. with the potential to save farmers millions of dollars annually while reducing excess nutrient losses to the environment. ■ **V. TODD MILLER**

From Our SOCIAL MEDIA

Join the LSU AgCenter on social media. AgCenter researchers and extension agents reach out via the web with videos, articles and helpful hints on Facebook, YouTube, Instagram, LinkedIn and X, which was formerly known as Twitter.

Join the conversation by following the LSU AgCenter.



FACEBOOK

FOLLOW THE AGCENTER AT

FACEBOOK.COM/LSUAGCENTER

FEB. 12 | If you're interested in starting a little free food pantry in your community, the LSU AgCenter Healthy Communities initiative can help plan, install and promote it!



INSTAGRAM

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INSTAGRAM.COM/LSUAGCENTER

JAN. 24 | Louisiana's 2024 crawfish season is facing a tough start. Mark Shirley, LSU AgCenter crawfish specialist, and Jacob Landry, owner of Hole 'N Da Wall Seafood and basin fisherman, discuss what they're seeing.

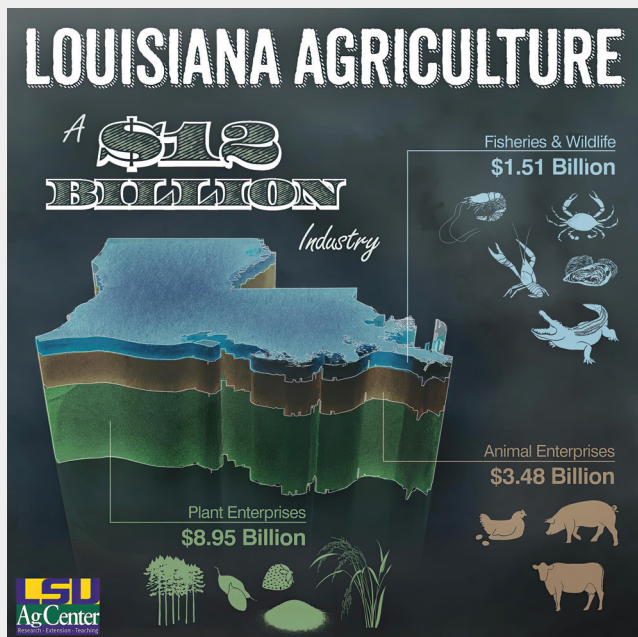


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MARCH 19 | Celebrating #NationalAgDay in Louisiana! Louisiana agriculture is a \$12 billion industry!



FEB. 27 | Today is National Strawberry Day! The Louisiana strawberry industry has a gross farm value of \$10.2 million! Production is primarily concentrated in Tangipahoa and Livingston parishes. Find LA strawberries at your local farmers markets and grocery stores!



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JAN. 18 | The LSU AgCenter has named Adam Famoso resident director and research coordinator of its H. Rouse Caffey Rice Research Station near Crowley. **#RESEARCH #LEADERSHIP #LSUAGCENTER**



USDA DEPUTY SECRETARY VISITS LSU, TOUTS AGRICULTURAL EDUCATION

Xochitl Torres Small, deputy secretary of the U.S. Department of Agriculture, visited the LSU campus April 1. Torres Small, who assumed the position less than a year ago, has been touring land-grant universities to learn about how they are addressing key agricultural issues through research and education programs.

“Something I think we’re all focused on is what the future of agriculture looks like,” Torres Small said during a meeting with university leaders, representatives of governmental agencies and others at the LSU Foundation Building. “And as I think about that future and some of the pivots that farmers — who are some of the most important businessmen and women we know — have to make in recognizing some of the challenges they’re facing right now, our land-grant institutions are fundamental in supporting them.”

Universities not only train the next generation of agriculturalists, she said. They also help keep farms — especially small- and mid-sized operations — profitable through research in emerging areas such as drought-resilient crops, specialty crops and value-added agriculture.

Torres Small said more people must be recruited to carry on land-grant institutions’ research and extension missions and to work in other aspects of agriculture — including at the USDA, where she oversees more than 100,000 employees.

The average age of the American farmer is 58, and the workforce at her agency and many other agricultural entities is aging too, she said.

“We depend on this relationship with you,” she told the LSU administrators, to recruit new hires. ■ **OLIVIA MCCLURE**

XOCHITL TORRES SMALL, DEPUTY SECRETARY OF THE U.S. DEPARTMENT OF AGRICULTURE, SPEAKS TO STUDENTS DURING A VISIT TO THE LSU CAMPUS APRIL 1.

Photo by Olivia McClure



LSU PH.D. CANDIDATE EXPLORES ENVIRONMENTAL POLICY ON A NATIONAL SCALE

LSU doctoral candidate Ashley Booth, who grew up in the mountains of South Carolina and Georgia, says her grandmother often spoke fondly of her experiences living near the Mississippi River and Louisiana swamps.

When Booth felt the urge to study and work in the environmental space, she was naturally drawn to the Bayou State, where she eventually landed a doctoral assistantship studying coastal wetlands at LSU's School of Renewable Natural Resources in the College of Agriculture.

This past year, Booth's academic journey took her to the highest levels of the federal government, where she recently completed a National Oceanic Atmospheric Administration Sea Grant Knauss Marine Policy Fellowship working in the office of U.S. Sen. Brian Schatz of Hawaii.

"This experience provided an unparalleled opportunity to expand my expertise in communicating science to inform action on individual, state, federal and international scales," she said.

As a legislative fellow, Booth supported the senator in his legislative and policy efforts related to oceans, water, coastal resilience and the environment.

"This work involved writing legislation, providing edits and amendments to existing bills, briefing the senator on environmental issues, staffing the senator at hearings and meetings and forming collaborative partnerships with congressional offices, federal agencies and community stakeholders to address emerging issues," she said.

Booth worked with Hawaii-based organizations to develop more than \$150 million in appropriations requests for the 2024 federal budget. She also worked with federal agencies to develop the Hawaii congressional delegation's requests for the 2024 Water Resources Development Act and helped craft legislation related to weather modeling, carbon storage and sustainable aquaculture. ■ **STAFF REPORT**



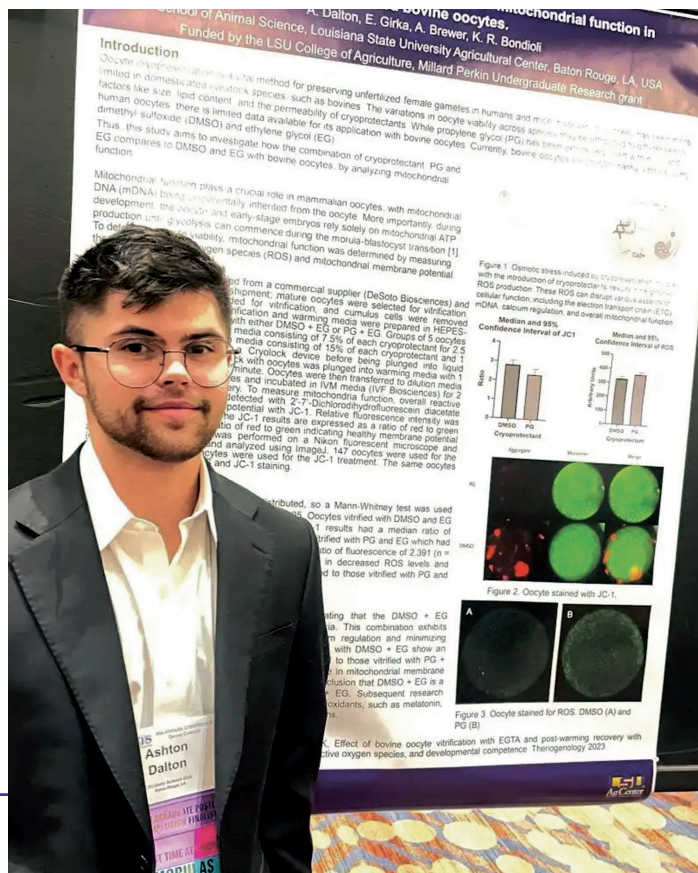
Ashley Booth with U.S. Sen. Brian Schatz. Photo provided by Ashley Booth

UNDERGRADUATE RESEARCHER REPRESENTS LSU AT INTERNATIONAL CONFERENCE

Ashton Dalton, an LSU senior double majoring in animal sciences and religious studies, was given the opportunity to represent LSU undergraduate research at the International Embryo Technology Society annual conference in Denver, Colorado.

Dalton, who also took part in LSU Discover Day 2024, was included for his involvement in a research project, "The influence of different cryoprotectants on mitochondrial function in vitrified bovine oocytes." ■ **MADDISON JARVEAUX**

Ashton Dalton had the opportunity to represent LSU undergraduate research at the International Embryo Technology Society annual conference. Provided photo



A man, M.P. Hayes, stands in a shallow, muddy wetland or bayou. He is wearing a white Nike baseball cap, a white polo shirt with blue horizontal stripes across the chest, dark blue trousers, and a purple LSU belt. He is holding a blue and black hydroacoustic transmitter in his right hand. The background is a dense thicket of green trees and vegetation.

BORN ON THE WATER, M.P. HAYES

WORKS TO PROTECT THE RIVERS, BAYOUS, LAKES AND COAST

■ KYLE PEVETO

**M.P. HAYES, LSU AGCENTER
ASSISTANT PROFESSOR
OF AGRICULTURAL AND
INDUSTRIAL WATER QUALITY,
POSES AT A POND ON THE LSU
CAMPUS IN BATON ROUGE.**

Photo by Olivia McClure

From his office on the LSU campus in Baton Rouge, the path from Michael Patrick Hayes' childhood in Fairhope, Alabama, to his career as a water quality specialist looks clear.

He grew up in the water on Weeks Bay in coastal Alabama, spending his days hunting, fishing and learning to gig fish, spearing them in shallow water.

"Both my granddads had me fishing and hunting from a really young age, catching soft shell and flounder," said Hayes, who goes by his initials, M.P. "And I always tell people over here (in Louisiana) I gig flounder — not frogs. You know, a little different side of things."

Even as a child, Hayes' scientific mind recognized the estuary as part of a larger system of interconnected rivers, bayous and lakes.

"It all ties in to growing up down there in south Alabama, being so integrated with the outdoors and asking, 'How does that work?'"

Hayes, who joined the LSU AgCenter and Louisiana Sea Grant in 2023, directs the Water Quality Extension Lab, a service that helps agricultural producers throughout the state learn to improve their operations and use water more efficiently. The lab also provides water-quality assessments to promote water conservation and waterway protection.

He credits his grandfathers — one an electrician and the other a building contractor — with teaching him to analyze both the natural world and the built environment. Their family practiced a conservation mindset when harvesting deer or other game, an approach that advocates for the preservation of the environment and wildlife through herd and natural resource management.

In school Hayes was also drawn to science, and he considered going to an engineering-focused university for undergraduate work.

Reflecting on the advice of some old-timers he drank coffee with at a diner

in Fairhope, he chose to attend Spring Hill College, a small liberal arts institution in Mobile, Alabama, and majored in chemistry. The Jesuit-founded Catholic school encouraged community service, and he wanted to give back.

"I could be a scientist anywhere," Hayes said. "I could be an engineer anywhere. But what's going to help me give back to this community?"

At Spring Hill, Hayes met his wife, Chandler. They both moved on to graduate school at LSU and married in 2020.

Hayes pursued his doctorate in chemistry and researched wetland and river nutrient cycling. His dissertation was accepted in February 2020, and most job opportunities he anticipated dried up when the COVID-19 pandemic began. He accepted a job testing agricultural commodities at the port of New Orleans for pesticides, heavy metals and other substances.

Yet Hayes wished to return to the university setting. He wanted to mentor students and conduct research.

“**I COULD BE
A SCIENTIST
ANYWHERE.**

**I COULD BE
AN ENGINEER
ANYWHERE.**

**BUT WHAT'S
GOING TO
HELP ME GIVE
BACK TO THIS
COMMUNITY?**

”

"But another reason was the ability to disseminate the science," he said. "In the industry, a lot of it is trade secrets, and science is something that should be shared with all audiences."

Hayes moved to the LSU Industrial Assessment Center and conducted sustainability assessments for industrial manufacturers.

Two years ago, M.P. and Chandler welcomed their son, whom they named Caspian after the inland sea that borders Europe and Asia.

In March 2023, Hayes joined the AgCenter and Sea Grant to build the Water Quality Extension Lab.

Through the lab, Hayes connects agricultural producers and manufacturers with research-based recommendations to help improve their processes. He can analyze their water quality and help them apply for grants to build projects that save money or improve water usage.

Hayes has helped a koi fish farm evaluate whether its wastewater could make a decent fertilizer, and he has assisted shrimp processors, plant nurseries and sugar mills. Recently he has also researched the use of floating solar panels on agricultural ponds for electricity generation and community resiliency.

"It's an opportunity to put a value on currently, unutilized space," he said. "Instead of taking up agricultural land with solar, they can use water space."

Working to improve water quality and help agricultural producers throughout Louisiana, Hayes feels like he has begun to fulfill the goal he set years ago of giving back to his community.

"I'm not quite back in Fairhope with my extension," he said, "but I still feel like when I work with a lot of our rural manufacturers and agricultural communities here, I feel like I'm giving back to my roots."

Kyle Peveto is the editor of Louisiana Agriculture.

‘IN TOUCH BUT NOT IN THE WAY,’

*JUSTIN DUFOUR IS A RESOURCE FOR
CENTRAL LOUISIANA FARMERS*

■ OLIVIA MCCLURE

*AVOYELLES PARISH
FARMER FRED
COLLINS, LEFT, AND
LSU AGCENTER AGENT
JUSTIN DUFOUR LOOK
FOR HESSIAN FLY
PUPAE IN WHEAT.*

Photo by Olivia McClure



When he first enrolled in college, Justin Dufour thought he wanted to become an athletic trainer. But a few classes into his coursework at LSU Alexandria, he realized that career path wouldn't suit his interests very well.

Ultimately, it was Dufour's part-time job at the neighboring LSU AgCenter research station that helped him settle on a degree in biology and led him to a career in agriculture. Working under scientists at the Dean Lee Research and Extension Center, Dufour learned the ins and outs of conducting agricultural research and sharing information with farmers.

Dufour grew up in what he calls "sweet potato country" in the Avoyelles Parish village of Hessmer.

"But I didn't come from a family farm or anything like that," he said. "My experience at Dean Lee really opened my eyes to what agriculture was and the fundamentals of research and how important it was."

After graduating from LSUA, Dufour worked as a research associate at Dean Lee for a few months before becoming an AgCenter agriculture and natural resources agent based in his home parish of Avoyelles in 2014 — a role he still holds today, and one in which coworkers say he has excelled.

Dufour recently received the County Agent Award from the Louisiana Agricultural Consultants Association. It was presented during the organization's annual Louisiana Agricultural Technology and Management Conference held Feb. 7 to 9 in Marksville.

"I would characterize Justin as a hard worker with a servant's heart," said Boyd Padgett, an AgCenter plant pathologist who nominated Dufour for the award and mentored him early in his career. "His focus is on improving Louisiana agriculture and the lives of our stakeholders."

What does it take to be a good extension agent? Being knowledgeable of the eight different crops along with the cattle, crawfish and honey that are produced in his three-parish area is part of the equation. So is adapting to changes, such as a decline in sweet potato and cotton acres and growers shifting to other commodities.

At the end of the day, the job is all about communication, Dufour said.

"Relationships are everything in this industry," he said.

He has a motto for his approach: "in touch but not in the way."

"You don't want to bother them because they have a lot going on, but you also want to let them know that you're there to help," he said.

In addition to Avoyelles Parish, Dufour also is the ANR agent for Grant and Rapides parishes.

"We have a lot going on," Dufour said. "Whenever I make a presentation about myself, I always call this area a playground for me because there's any and everything you want to see."

It takes effort to build connections with so many different groups — and Dufour has demonstrated "110% buy-in," said Tara Smith, director of the Louisiana Cooperative Extension Service.

"Extension is grounded in relationships, and successful relationships are grounded in trust," said Smith, who first got to know Dufour in her previous positions as a sweet potato specialist and regional director. "An agent being able to earn the trust of the clientele that they're serving helps us effectively disseminate information and execute our mission to help producers be sustainable and profitable."

When farmers, consultants and others call for advice, Dufour usually has the information they need. It's his job to be a resource for constituents, pointing them to growing practices backed by AgCenter research and handling inquiries about issues being encountered in the field.

Being an agent in a region with such a diverse mix of crops and cultures, however, requires a touch of humility.

"You're not going to know everything," Dufour said. "But you need to know the resources to find out the answer."

It helps to be a fast learner — another quality Dufour's colleagues admire in him.

"If he calls you with a question, he doesn't have to ask that question again," said Daniel Stephenson, director of the AgCenter Central Region and a weed scientist at the Dean Lee Research and Extension Center.

Stephenson hired Dufour as a student worker in 2009.

"I recognized pretty quickly that Justin had a good head on him," Stephenson said. "If my research associate was out, I could rely on Justin to get things done, and that is uber rare. A person with that attention to detail and desire to learn is exceptional — and it's one of the reasons we encouraged him to get his master's."

Dufour earned a master's degree in agronomy and crop science from LSU in 2019.

He said it was an honor to receive the County Agent Award.

"Working with commercial producers and knowing that's their livelihood and how dependent they are on information from the AgCenter, I take pride in being able to do anything I can to help them," he said.

Olivia McClure is a writer, photographer and editor for AgCenter Communications.

**SHROUDED IN SMOKE,
PARTICIPANTS OF A MARCH
12 PRESCRIBED BURN
TRAINING AT THE LOUISIANA
ECOLOGICAL FORESTRY
CENTER USE FLAPS TO PUT
OUT FIRES.**

Photo by Olivia McClure





WORKSHOP TEACHES PROPER **PRESCRIBED BURNING METHODS**

■ OLIVIA MCCLURE

RODNEY MCKAY KNOWS A LOT ABOUT STARTING FIRES.

Between 15 and 25 times a year, McKay heads into the woods with a drip torch, rakes and an array of other tools used to light fires, monitor their spread and manage the smoke they produce. As the land manager of the Louisiana Ecological Forestry Center in Sabine Parish, McKay employs a practice called prescribed burning to ensure the health of the thousands of acres of longleaf pines he oversees.

Burning fallen trees and excess brush helps limit fuel for wildfires — a problem that is fresh on the minds of many in western and central Louisiana, where drought and extreme heat led to blazes in numerous forests this past summer. Prescribed burns also benefit wildlife, letting in sunlight that encourages the growth of forages. And they can improve the aesthetics of the forest.

Fire, of course, has inherent risks. Teaching others about the value of prescribed burning and how to do it safely is important to McKay and the foundation in charge of the forestry center, which is located near Florien on the site of the former Hodges Gardens State Park. For the past several years, McKay has joined the LSU AgCenter in leading prescribed burning certification workshops, including one held March 11 to 13.

About a dozen people — from private landowners to rookie firefighters with the state Office of Forestry — participated in the training, which included a burn exercise as well as classroom lessons on weather considerations, regulations, fire behavior and wildlife impacts. Those who passed an exam on the final day of the workshop were certified as prescribed burn managers.

Wearing a yellow, flame-resistant shirt on the morning of the burn exercise, McKay filled out a burn plan form, checked the weather forecast and called state officials to alert them he was planning to conduct a prescribed burn.

“There’s a lot of little things to pay attention to,” he told the group.

With help from the forestry center crew along with AgCenter agents Keith Hawkins and Valerie West, McKay guided the students as they used a drip torch filled with a mixture of diesel and gasoline to start a line of fire in the pine straw circling a tract of trees due for a prescribed burn.

As the fire grew, smoke shrouded the forest. It was time for other equipment to come into play, like flaps, which smother fire, and a few different types of rakes, which help move leaves and other material out of the way to create a fire line that limits the spread of flames.

Adam Gordon, a private landowner managing property in Allen and Beauregard parishes, was among those in the class. He already had experience with prescribed fires but wanted to learn more and acquire the burn manager certification.

“We’re learning how to fill out a proper burn plan, how to assess a situation, when it’s a good day and bad day and how we can work within those parameters,” he said.

He was motivated to enroll in the class after the 2023 wildfires in his area.

“We had some horrible experiences this summer with wildfires that kind of opened a light to a lot of us to what we didn’t understand could be possible,” Gordon said. “We were doing some of these burnings to work with wildlife but also to help the timber. But now we do it as a precautionary measure where we can look at not getting ourselves in that same situation — setting up more fire lines, better maintaining those and also having the equipment available on hand to handle what could come up in the future.”

While it’s legal to burn without the certification in Louisiana, completing a course can be beneficial.

“There’s a certain way to do it right and there’s a certain way to do it wrong, and we’re trying to help with the right part,” said Hawkins, an agriculture and natural resources agent based in Beauregard Parish.

One of the most critical aspects of planning and managing a prescribed fire is keeping smoke from getting out of control. Burners must take precautions to ensure smoke stays away from places like residential areas, schools, nursing homes, hospitals, roads and airports.



Rodney McKay, left, land manager of the Louisiana Ecological Forestry Center, and LSU AgCenter agent Keith Hawkins, right, review their plans before starting a prescribed burn March 12. Photo by Olivia McClure



**FLAMES CONSUME PINE STRAW
AND CONES DURING A PRESCRIBED
BURN TRAINING AT THE LOUISIANA
ECOLOGICAL FORESTRY CENTER
NEAR FLORIEN.**

Photo by Olivia McClure

When used properly, fire can be a useful management tool for foresters and landowners.

“It is the least expensive tool to use — much less expensive than using herbicides or doing heavy mechanical site prep, for example,” Hawkins said.

For McKay, prescribed burning is helping him maintain a longleaf pine forest — an important but disappearing habitat in his part of Louisiana. About 5 million acres of longleaf can be found across the southeastern United States.

“The longleaf pine ecosystem can support a lot of different wildlife, including threatened and endangered species,” McKay said, adding that he has noticed more and higher-quality wild turkeys, quail and deer following burns.



LSU AgCenter agent Keith Hawkins, right, guides a participant as he uses a drip torch to lay flame for the back fire during a prescribed burn training March 12 at the Louisiana Ecological Forestry Center near Florien. Photo by Olivia McClure

Olivia McClure is a writer, editor and photographer for AgCenter Communications.

SAMMY KING:

STUDYING WETLANDS AND RESTORING THE WHOOPING CRANE IN LOUISIANA

■ OLIVIA MCCLURE

Sammy King is an expert on wetlands and the many species of waterbirds and other wildlife that call these habitats home. He leads the U.S. Geological Survey's Louisiana Cooperative Fish and Wildlife Research Unit and is an adjunct professor teaching courses in the LSU School of Renewable Resources. He has helped with efforts to reintroduce the whooping crane in Louisiana, and today, there are dozens of the birds living in the state.

How did you first become interested in wetlands?

I grew up in Watson in Livingston Parish in Louisiana and fished a lot with my dad throughout south Louisiana, and a friend of mine had property on the Amite River. We would run up and down the river in a little jon boat and set up trotlines. I learned a lot about the river, but I just loved being outdoors. And so I went off to college and first started out in prephysical therapy and went to do my volunteer hours. And after about 15 minutes, I was like, "This is not what I'm going to be doing."

I had a cousin who was working for the Louisiana Department of Wildlife and Fisheries, and he talked to me about

getting a master's in wildlife. And so I went to Auburn University and worked with prescribed fire and cottontail rabbits — and I also knew that that was not the direction I was going to go either. But my last year there, I took a 20-day field trip with Dr. George Folkerts, who was the greatest teacher that I've ever been around, the greatest naturalist. We slept on the ground in September in Florida. We didn't have tents or anything like that. We were up at 5 in the morning, and we'd go to 1 or 2 in the morning wading around the wetlands, catching all kinds of critters and learning about them. And I was hooked at that point.



**SAMMY KING,
AN EXPERT ON
WETLANDS AND
AN ADJUNCT
PROFESSOR IN
THE LSU SCHOOL
OF RENEWABLE
NATURAL
RESOURCES,
POSES AT CRATER
LAKE IN OREGON.**

Provided photo

SAMMY KING HAS HELPED REINTRODUCE THE WHOOPING CRANE TO LOUISIANA. THERE ARE NOW DOZENS OF THE BIRDS LIVING IN THE STATE.

Photo provided by Louisiana Department of Wildlife and Fisheries



Whooping cranes vanished from Louisiana in the mid-20th century. What led to their demise, and why was it important to bring them back?

Historically, we had more whooping cranes than anywhere in North America. We had both the migratory population that bred in the Midwest and would come down to the coastal prairie region of southwest Louisiana, which now has been converted mostly to rice. And then we had a resident population that was centered at White Lake Wetlands Conservation Area. Primarily because of draining of wetlands for agriculture in Illinois and Iowa, we lost that population of whooping cranes around 1918.

We continued to have the resident flock up until 1950. Eventually the numbers got so low, they were down to one bird. A guy by the name of John Lynch, a U.S. Fish and Wildlife Service biologist, went up in a helicopter and pinned the bird down. He literally put the whooping crane in a station wagon and drove it over to Aransas National Wildlife Refuge, which is where the wild migratory flock would come to, and released it. Unfortunately, it died a short time later, and with the death of a Louisiana bird in captivity, we lost the genetic stock for the Louisiana population.

As part of the recovery of the species, the idea was we didn't want just one migratory population to be everything for whooping cranes. With endangered species, you want to have multiple populations to increase the resiliency of the species. If something were to happen with that migratory flock, would we have other birds that would be established in the landscape that could save the species? Also, Louisiana has the most intact habitat anywhere in the country in terms of whooping cranes. And so, in 2011, Louisiana Department of Wildlife and Fisheries began to release birds in southwest Louisiana to try to rebuild that nonmigratory population here in the state.

How do environmental factors affect cranes and other species?

What I tend to think of is that the birds — or a product or a pattern — that emerge in nature is just like if you're baking a cake. The cake is the product, but there's all these processes that go into making that cake.

We study a lot of hydrology, looking at flooding patterns. We look at soils. We try to understand what dictates when plants germinate and what plants germinate under various conditions because those are the things that are going to be driving foraging habitat and nesting habitat for these birds. We go into a wetland and assess what the problems are. Why are we not getting the vegetation that we thought we would, or why is there such low productivity in this system? We focus on the processes that are leading to the production of the birds because it's so important to be able to produce them.

You have spent a lot of time working in the field and taking your students on expeditions. How do hands-on experiences in other locations improve one's understanding of wetlands?

If you grow up in Louisiana, you see so many wetlands, and the climate is one climate. And as you move west and you get less rainfall, you get more drought. You just move into different kinds of climatic patterns. The wetlands look very different, and so it forces them to think about what are those driving processes that make wetlands function. It gets students super excited. There's no way that you can't get excited when you're standing on a mountaintop looking at Great Salt Lake or some of the other places that we go.

Olivia McClure is a photographer, writer and editor for AgCenter Communications.

AGCENTER BREEDERS WORK TO EXTEND THE RANGE OF SUGARCANE NORTHWARD

■ KYLE PEVETO

In northern Pointe Coupee Parish, Gertrude Hawkins and her brother, George LaCour, have farmed for more than three decades, growing the region's traditional row crops — cotton, corn, soybeans and wheat.

In 1998, they started growing sugarcane, and by 2005, the crop became an integral part of their business as they grew it on 4,000 of their acres.

"We are fortunate to have very good soil," Hawkins said. "We can farm just about any row crop. Sugarcane fits into the practice."

Pointe Coupee Parish and Hawkins' farmland lie north of the traditional core range for growing the crop, but over the past 20 years, the parish has become the state's sugarcane leader. Between 2004 and 2022, Pointe Coupee farmers increased their sugarcane acreage from 32,000 acres to 72,681, according to AgCenter statistics, overtaking Louisiana's longtime leader in the crop, Iberia Parish.

New sugarcane varieties developed by crop breeders have helped expand the crop's range, and LSU AgCenter researchers are working to develop new varieties that will help the farmers of central Louisiana produce even more cane.

EXPANDING THE CROP RANGE

Sugarcane is a tall, perennial grass that originated in the tropics. It has been a mainstay of Louisiana agriculture since Catholic priests first planted sugarcane in present-day New Orleans in 1751. The crop has been bred over two centuries to thrive in Louisiana's subtropical climate. Today it is a \$1.5 billion piece

of the Louisiana economy grown in 24 parishes.

When sugarcane became a more viable crop for central Louisiana growers, it provided additional diversity to the Hawkins and LaCour farm business.

"The sugarcane varieties were also a contributing factor to our decision to grow sugarcane," Hawkins said. "The varieties then and today have higher sugar and tonnage possibilities compared to varieties in the mid-1980s and earlier."

Hawkins learned a great deal about sugarcane working at the sucrose lab at the AgCenter Sugar Research Station in St. Gabriel. In 2020, the recently refurbished lab was named after her following her retirement in 2019. She and her brother grow six different varieties of sugarcane to spread their risk if disease, insect pests or other problems affect a particular variety. They consistently rely on one variety, L01-299, which has been called a workhorse for Louisiana producers since its release in 2009.

AgCenter sugarcane breeders developed the variety over 12 years and found that it had good sucrose content and an erect growth habit, and it contains a gene that protects it from brown rust disease, according to Kenneth Gravois, the state sugarcane specialist and one of the breeders who developed the variety along with breeder Keith Bischoff.

L01-299 also tolerates the cold well, an important trait for a tropical plant grown in Louisiana's subtropical environment. Louisiana sugarcane breeders have long focused on developing more cold-tolerant plants, said AgCenter sugarcane breeder Collins Kimbeng.

"We're always fearful of a freeze," Kimbeng said. "That happens sometimes in November. The cane cracks, and there's bacteria that can get into the cane and start metabolizing the sucrose and converting it to reducing sugars, so the quality of the cane that gets delivered to the mill is poor."

Because sugarcane is a perennial grass, a plant can produce for more than one growing season. After harvest, underground buds survive, and in the spring, they grow shoots that become the next crop. One plant can be harvested multiple times, and newer varieties can be harvested four to five times — or to the fourth or fifth "stubble."

"You can keep them beyond third stubble," Hawkins said of the new varieties. "That's a big thing."

Breeding cane that returns in the spring after a hard winter is important to Kimbeng.

"Planting is the most expensive operation," Kimbeng said. "So we try to breed for ratoon-ability so they have the ability to come back even if there is a freeze."

DEVELOPING BETTER SUGARCANE

As the sugarcane growing belt stretches farther north, AgCenter researchers are testing the best ways to develop sugarcane for the region. While most plant breeding is done at the Sugar Research Station in St. Gabriel, researchers have begun testing an early generation of plant crosses farther north in Pointe Coupee Parish.

"The most variability in the breeding program is in the seedling generation," Kimbeng said. "So we're trying to see

if we can capture that variability very early.”

If they find that planting early generations in a slightly colder environment leads to different selections in the breeding process, Kimbeng said, they may commit to more research farther north.

To increase the resilience of sugarcane, researchers have long used clones of wild species of sugarcane to cross with sugarcane developed for high sugar content.

“That allowed us to bring in genes that make our crop more resilient to abiotic stress or environmental stress because those plants grow in far harder conditions than regular sugarcane,” Kimbeng said.

Through traditional breeding techniques, breeders have crossed and backcrossed wild sugarcane and cane bred for higher sugar content over generations, selecting plants for desired traits.

“They have been able to slowly increase the genes for climate resistance while maintaining the genes for sucrose.”

This way of breeding can take more than a decade to create a new variety that will benefit growers. Now, in a lab at the LSU campus in Baton Rouge,

molecular breeding technologies are allowing them to directly analyze the genes of the sugarcane and speed up the process.

“We are able to map these genes and see where they are located on the chromosome,” Kimbeng said. “We’re able to work smarter. We’re able to more intelligently select these genes.”

THE FUTURE OF SUGARCANE DEVELOPMENT

Sugarcane producers like Hawkins await more cold-hardy varieties that can withstand freezes late in their growing season.

“I think we have to keep working hard toward it,” she said.

Breeders from the AgCenter and the U.S. Department of Agriculture Sugarcane Research Unit in Houma are building on hundreds of years of work by growers and researchers to design sugarcane varieties that stand up to the challenges of Louisiana.

“We are standing on the shoulders of giants who came before us who have done some very good work,” Kimbeng said.

Kyle Peveto is the editor of Louisiana Agriculture.

As LSU AgCenter specialists work to expand the range of sugarcane production in Louisiana, they must address new challenges that growers may face.

Sugarcane growers that have previously produced cotton and grain in central Louisiana may be faced with weed issues less common with growers south of the Interstate 10 corridor, said Matt Foster, who became the AgCenter sugarcane weed specialist in 2023.



LEARN MORE AT

www.lsuagcenter.com/agmagspring24



Sugarcane is harvested at the Pointe Coupee Parish farm owned by George LaCour and Gertrude Hawkins. The parish lies north of the traditional growing area for sugarcane, but it has become the top-producing parish in the state. Photo provided by Gertrude Hawkins

A COMMUNITY-ENGAGEMENT APPROACH TO MANAGING DROUGHT: THE DROUGHT IRRIGATION RESPONSE TOOL (DIRT)

■ MEGGAN FRANKS, STACIA L. DAVIS CONGER, CAROL FRIEDLAND, ROBERT ROHLI, APRIL DIVINE, ANDREW GARCIA, SHIFAT MITHILA AND MD ADILUR RAHIM

Louisiana is one of the most vulnerable U.S. states to extreme weather events due to its high frequency of natural disasters. Of these disasters, drought is the most expensive risk to Louisiana agriculture, accounting for 95% of projected crop losses by 2050.

Shifts toward more frequent and intense drought would increase the need for supplemental irrigation when aquifer withdrawals, the primary water source for agriculture, already exceed recharge rates. Further, unsustainable pumping rates can cause wells to run dry. It can also lead to higher pumping costs, soil subsidence and higher salt content that can impact crop yields.

The Mississippi River Valley Alluvial Aquifer (MRVAA) supports agricultural irrigation in the Lower Mississippi River Basin, which includes the Louisiana Delta and ranks second among aquifers for water use in the country with an average of 12,100 MGD (million gallons per day). Combined with the onset of drought conditions in 2022, Louisiana is an excellent location to develop and launch a drought-focused hazard mitigation tool for scheduling irrigation.

With concerns about the sustainability of water supplies in mind, LSU AgCenter researchers actively worked to secure critical funding to develop an irrigation decision-making app and outreach campaign aimed at helping farmers mitigate drought risks in an environmentally and economically responsible way.

Through a specialized U.S. Department of Agriculture National Institute of Food and Agriculture (USDA NIFA) grant program dedicated to rapidly responding to extreme weather events, funding was obtained to convert an already developed and tested irrigation scheduling spreadsheet into a convenient web tool accessible on any internet-enabled device. Thus, DIRT, the Drought Irrigation Response Tool, was created.

The envisioned outcomes of DIRT are ambitious yet essential: widespread adoption of more efficient irrigation techniques, which will lead to a reduction in the utilization of finite water resources and contribute to a more



**FURROW IRRIGATION IS A COMMON
FORM OF CROP IRRIGATION IN
MUCH OF LOUISIANA.**

AgCenter file photo



PROJECT IMPACTS OF AND ESSENTIAL INSIGHTS INTO THE DIRT MODEL

A path toward environmental change

DIRT usability: Farmers spoke positively of the tool’s responsive design (i.e., adapt to the screen size of the electronic device), simple look and feel and multiple data viewing options.

DIRT worthiness: Farmers unanimously deemed the project as “very worthwhile.” They appreciated the AgCenter’s investment in irrigation research, recognizing its potential to enhance agriculture statewide.

Support for DIRT: Farmers expressed enthusiasm for the DIRT application, emphasizing its role in “improving irrigation efficiency.” They affirmed that they would “absolutely use” the web tool, recognizing it as a valuable resource. Further, they advocated for marketing efforts, and some committed to piloting the application with partnering farmers.

Adoption and impact of DIRT: Farmers are committed to adopting, utilizing and testing the DIRT application in the upcoming growing season. They also anticipate resource savings, such as water, money and time; reduced fuel and electricity consumption; a reduction in overpumping wells; labor efficiency gains; and a positive return on investment (see Table 1).

TABLE 1.
ANTICIPATED BENEFITS OF USING THE DIRT WEB TOOL
TO ASSIST WITH IRRIGATION DECISIONS
(ACCORDING TO PILOT USERS)



sustainable water supply and a decrease in future drought risks. Combined with an aggressive outreach campaign, the long-term goal of this project is to inspire behavioral change in overall water consumption across increasing drought risk scenarios to enhance regional environmental sustainability.

As droughts become more frequent and severe, our collective actions matter. Developing, strengthening and sustaining relationships within the agricultural community is vital to achieving lasting community impact.

COMMUNITY-ENGAGED PROGRAM DEVELOPMENT: A COLLABORATIVE APPROACH

The traditional model of extension often emphasizes outreach between an educational institution and the public. However, a more dynamic and effective approach emerges when we shift from outreach to community engagement. This collaborative method involves partnering with key stakeholders, including farmers, to address societal needs comprehensively. The essence of community engagement lies in reciprocity. It allows stakeholders — farmers, researchers and/or educators — to become co-creators of knowledge, programs, research and scholarship. By actively involving key stakeholders, such as farmers, we can tailor our efforts to better meet the diverse needs of communities worldwide.

Recognizing the significance of community engagement, the Carnegie Foundation introduced a classification and partnership framework. Designed to deepen service practices and strengthen bonds between universities and their surrounding communities, this framework serves as the future of university-community engagement.

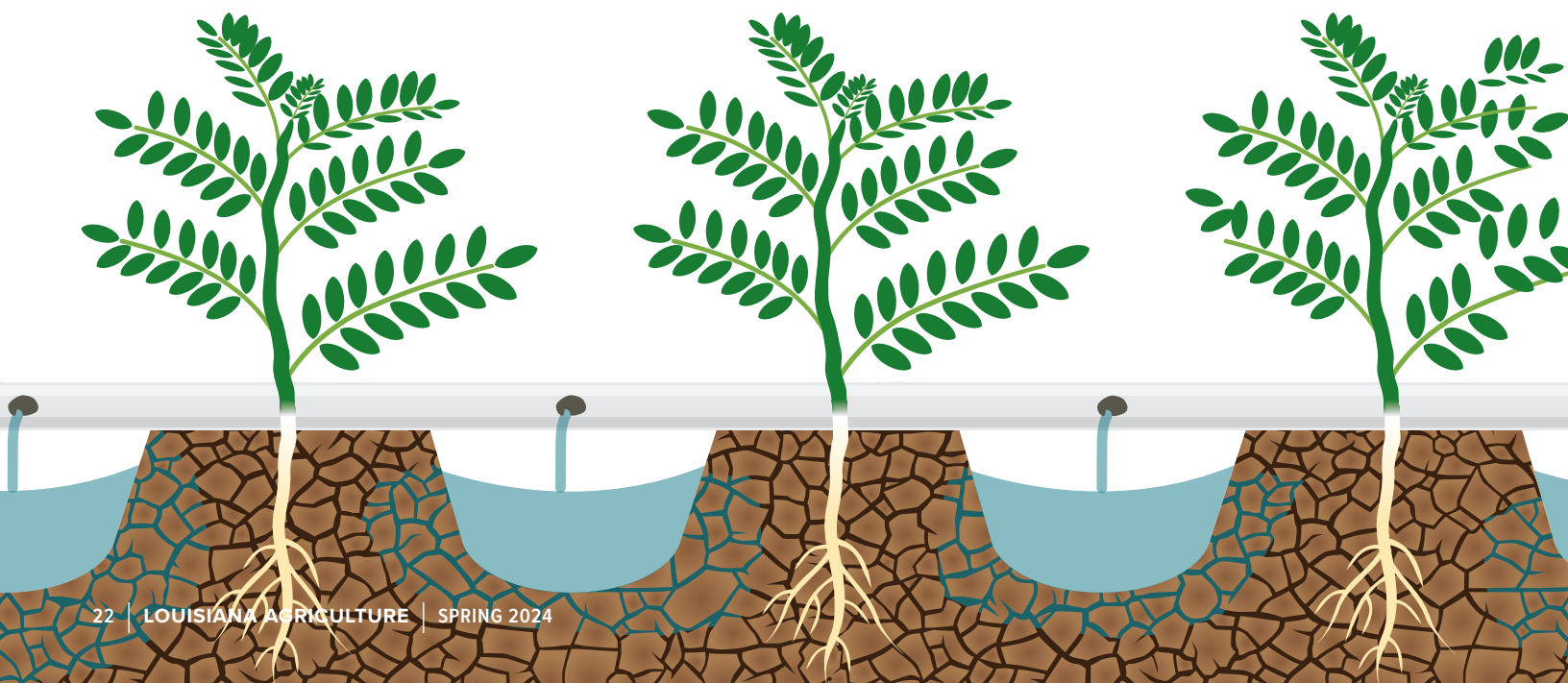
The DIRT project team embraced this framework wholeheartedly. Throughout the project's development, they actively

sought feedback from stakeholders, including farmers and producers, whose voices became integral to the team's decision-making process.

The community-engaged approach involved ongoing focus groups and virtual and in-person interviews throughout the project's development. These gatherings spanned various locations, capturing input from farmers and end-users. During each session, AgCenter researchers outlined the project's goals and continued progress, setting the context for fruitful discussions. Project team members diligently recorded and transcribed each session and synthesized responses to comprehensively summarize farmer and producer feedback. Within its pages lay actionable requests directed toward the development team. These requests would shape the project's implementation. Further, farmers completed pre- and post-meeting reflections that captured additional insights and assessed the integration of community voice, collaboration and reciprocity.

In agricultural research and extension, community engagement is pivotal in shaping effective programs and fostering collaborative relationships. By actively involving farmers and key stakeholders in project development, we aimed to create a program that addresses community needs and fosters stronger partnerships. In closing, this initiative exemplifies how technology and strategic partnerships can address critical challenges, ensuring a sustainable future for Louisiana's agricultural community.

Meggan Franks is the manager of reporting and program impact for the LSU AgCenter. Stacia L. Davis Conger is an assistant professor at the AgCenter Red River Research Station. Carol Friedland is the director of LaHouse Resource Center. Robert Rohli is a professor in the LSU Department of Oceanography and Coastal Sciences. April Divine is an extension associate at LaHouse. Andrew Garcia is the assistant director of application development for the AgCenter. Shifat Mithila is a postdoctoral researcher at LaHouse. Md Adilur Rahim is an assistant professor of research at LaHouse.



STRENGTHENING RELATIONSHIPS BETWEEN THE AGCENTER AND COMMUNITY

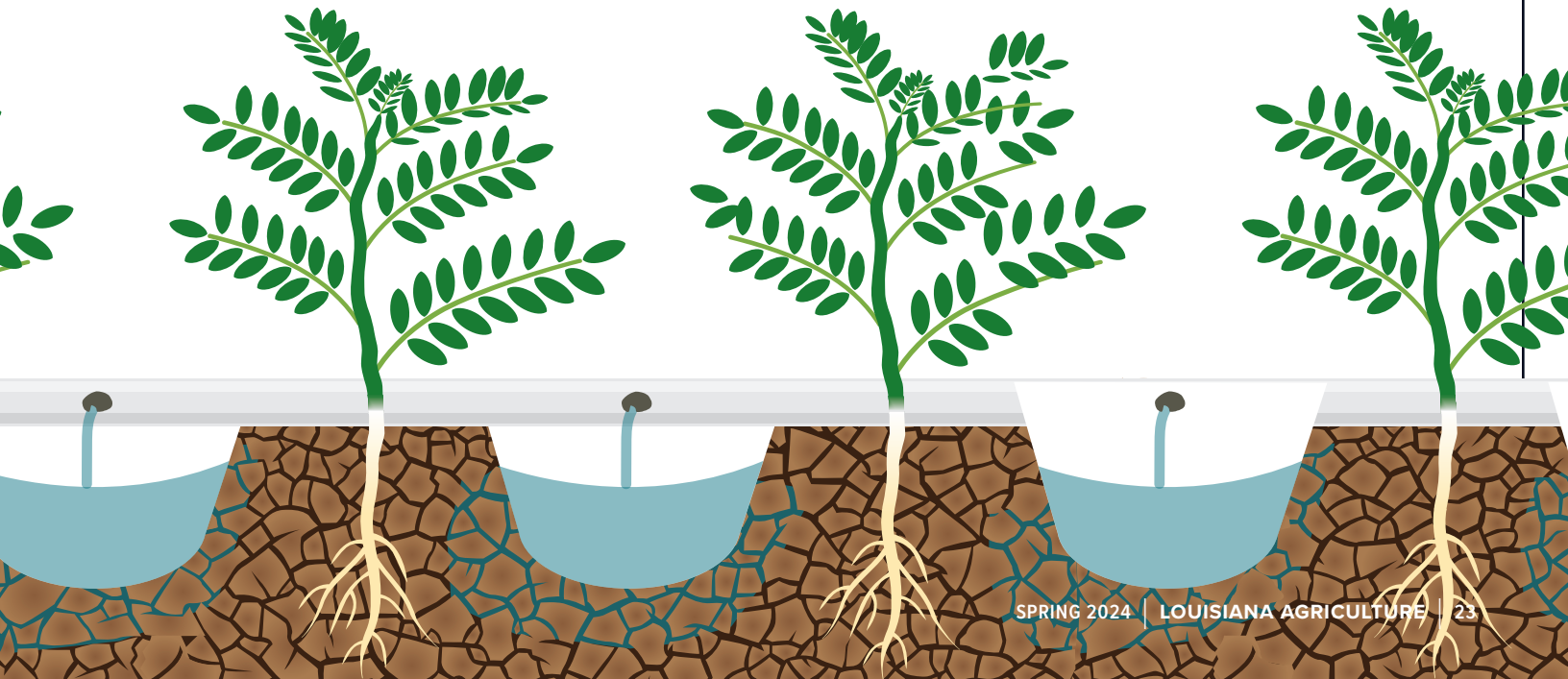
The evaluation findings also demonstrate the significance of this community-driven approach and stakeholder-AgCenter relationships (see Table 2). Findings include:

Enhanced stakeholder awareness: Through the community-engaged process, farmers significantly improved their understanding of available irrigation resources and technologies provided by the LSU AgCenter and expressed a commitment to utilizing AgCenter resources and personnel for informed decision-making. As a result, the AgCenter emerged as a credible and reliable source of irrigation information.

Positive stakeholder perception: Farmers viewed the AgCenter more favorably as a collaborative partner and felt included in decisions that directly impacted their community. Further, they felt their expertise was valued.

Strengthening community partnerships: Farmers who engaged in multiple sessions continued to perceive the AgCenter as a credible resource and collaborative partner. They also felt increasingly valued as community experts.

TABLE 2. COMMUNITY ENGAGEMENT PARTNERSHIP SCALE QUESTIONS.	PREFOCUS SESSION SCORE	POSTFOCUS SESSION SCORE
The AgCenter is a credible resource for irrigation information.	87%	96%
I will use AgCenter resources when making irrigation decisions.	76%	100%
I will connect with the AgCenter when making irrigation decisions.	76%	92%
The AgCenter values me as a collaborative partner.	80%	100%
The AgCenter values my expertise.	80%	100%
The AgCenter has had a positive impact on me.	86%	96%
The AgCenter involves me in decisions that impact my community.	73%	96%
I am aware of irrigation training/resources provided by the AgCenter.	60%	100%
I am aware of irrigation technologies developed by the AgCenter.	58%	96%



MOSQUITOES *AND* CLIMATE CHANGE

■ KRISTEN HEALY

While there are more than 60 species of mosquitoes in Louisiana, temperature and precipitation are most often the primary drivers of annual changes in presence and abundance. On the cold extreme of temperature, the entering and exiting of winter hibernation, called diapause, can be fatal to a mosquito if it's not prepared. In cold environments in the United States, most adult mosquitoes prepare for winter by increasing sugar reserves and finding a sheltered environment. Other species of mosquitoes will survive by spending the winter in the egg stage of development.

In 2023, researchers in the Healy lab published a study that compared the impact of high temperatures on mosquito survival, biology and behavior. It was found that mosquitoes that typically spend the winter as adults freeze at colder temperatures than mosquitoes that spend the winter as eggs. Even when trying to trick mosquitoes into thinking they were engorging on sugars by feeding them artificial sweeteners instead, researchers did not see a drastic reduction in populations in freezing temperatures. While these data are not surprising, it is an excellent example of how different mosquitoes adapt to cold environments.

On the other extreme, high summer temperatures can also limit a mosquito's ability to survive unless it has already adapted to this type of environment. While we think of Louisiana summer temperatures as being ideal for mosquitoes, very high temperatures can greatly affect the simple biological systems that are occurring within a mosquito, such

as digestion and metabolism. Unless a mosquito has been well adapted to these changes, it is unlikely it can survive those extremes.

Not only does temperature affect mosquito survival, but it also affects other aspects of mosquito biology and behavior. In general, there is a relationship between temperature and how fast a mosquito develops from egg to adult. The interesting thing about this relationship is that it is so consistent that we can use it to predict when and where we might see mosquito activity. In 2019, researchers in the Healy lab published a paper comparing different populations of Asian tiger mosquitoes from New Jersey to Louisiana. Researchers evaluated how quickly mosquitoes developed from egg to adult at different temperatures. Regardless of population, it was observed that mosquitoes consistently develop at certain rates depending on temperature. This information helped to establish a "seven-day rule" for mosquito development, since at most temperatures, it takes about seven days to go from egg to adult mosquito. This allowed the AgCenter to encourage residents to check their yards for standing water once a week to help adequately reduce Asian tiger mosquitoes near their homes.

By further looking at temperature-based development rates, it was also possible to predict when mosquitoes were likely to exit winter diapause. These dates were predicted using simple formulas that took into account the environmental temperature in relation to lab-based results. Because of

this, it is consistently expected that the first Asian tiger mosquitoes will emerge in the spring around February or March. Interestingly enough, these dates are similar whether you are in the cooler, northern limit of the mosquito in New Jersey or if you are in its range in Louisiana.

Recently, an AgCenter study evaluated 10 years of Baton Rouge temperature data to see if there is a trend in the emergence rates in early spring. As shown by the data, there continues to be annual fluctuations of when these mosquitoes emerge in the spring. These fluctuations in emergence and abundance will likely vary every year, depending on temperature and rainfall.

In addition to presence, researchers also evaluated if early emergence of this mosquito predicted a higher-than-normal level of activity in West Nile virus. While this mosquito is not the primary driver of West Nile virus in Louisiana, it can be used as a proxy for temperature-based development rates. It is important to recognize that temperature impacts a mosquito's ability to transmit pathogens by modifying how quickly a virus can replicate within the body of a mosquito. There is likely complex physiology within a mosquito that balances temperature, biology and viral infection. Interestingly enough, the research did not show a direct correlation between the week in the spring in which these mosquitoes first appeared and the number of West Nile virus human neuroinvasive cases. It was noted, however, that high case numbers do seem to occur in years where mosquitoes emerge in February

as opposed to March, but understanding if this relationship is real or an artifact of the methodology is still yet to be understood.

Temperature also plays many other unique roles in a mosquito's biology and behavior. It also can affect how quickly the small, standing bodies of water that mosquitoes sometimes use as habitats dry up in an environment. In 2011, LSU researchers modeled rates in which an Asian tiger mosquito habitat would evaporate in certain temperatures as it relates to how quickly the mosquito develops. At higher temperatures, it is a challenge for mosquitoes to develop in small container habitats before the water dries up. This is interesting, because in 2023, Louisiana experienced an unusual drought. As a result, there were in fact fewer mosquitoes in collections overall. Therefore, it is important to note

that too high of a temperature isn't always going to improve a mosquito's ability to develop quickly enough. In 2018, AgCenter research showed that a mosquito's metabolism does decrease tremendously under higher temperature extremes. While some mosquito species might be adapted to this type of temperature and environment, it can present a challenge for others to survive.

Because immature mosquitoes, called larvae, require water to survive, adult mosquitoes lay eggs in areas that are either flooded with water or will eventually become flooded. Mosquito larval habitats range from small, standing water habitats, such as cups, tree holes or rock pools, to much larger permanent habitats, such as swamps and swimming pools. Preference for the type of habitat will be different depending on which mosquito species is present. For

example, the Asian tiger mosquito loves backyard habitats near people's homes. While we find larvae in abundance in backyard tires and buckets, we would not expect to see this species laying eggs in swamps. As a result, precipitation is more likely to affect this species, as it depends on those small containers to get flooded during rain events.

While these are only a handful of the many ways that temperature affects mosquitoes, these relationships become more complex as we also understand the role precipitation plays in their presence as well.

Kristen Healy is an associate professor of medical entomology and public health entomology. Healy leads the AgCenter's research into mosquito biology, behavior, surveillance and control through her own studies and as director of the Healy Lab.



ASIAN TIGER MOSQUITO.

Photo by Susan Ellis, Bugwood.org

CLIMATE IMPACTS ON CRAWFISH AQUACULTURE — A YEAR-ROUND CONCERN

■ C. GREG LUTZ

CRAWFISH AQUACULTURE is based on management practices that mimic hydrological and vegetative cycles in natural habitats. Natural reproduction is relied upon as a source of hatchlings each farming season. Rainfall and temperature extremes throughout the year can significantly impact production.

SPRING

Newly established crawfish ponds and many rice fields — some 70% of Louisiana's crawfish aquaculture is conducted in rotation with rice production — are partially flooded and stocked in the spring with mature adult crawfish. Soon after stocking, the crawfish burrow along the levees to reach wet, saturated soil below the surface. Then they plaster and seal their burrows from the inside to trap and conserve water for the months ahead. Burrow openings are typically sealed with plugs of clay soil that soon become very hard. These plugs require significant rainfall to soften them enough for crawfish to leave their burrows. In permanent ponds used only for crawfish production, burrowing is most common in the spring as water temperatures rise. Mild temperatures and frequent rainfall improve burrowing success.

SUMMER

As summer progresses in ponds with rice rotation, rice is harvested for grain and the stubble begins to regrow. Alternately, in crawfish-only management, a forage crop of late-planted rice or natural vegetation is cultivated. In either case, this takes place while the crawfish pass the summer months sealed in their burrows. Very low oxygen is typical in burrows, and high temperatures can worsen these conditions. While still in their burrows, a few female crawfish begin to lay eggs as early as late August. Water must be present in the burrow for successful egg laying, so regular rainfall is important over the summer to maintain some soil moisture and keep the pond banks from cracking. Soil types with limited clay content, or soil with very high clay content that cracks when dry, also may limit crawfish survival while in burrows. AgCenter research published in 2004 confirmed that 71% of the variability in crawfish crops from 1993 to 2002 could be explained by precipitation levels at three locations in Louisiana's crawfish-producing region.

Under drought conditions, if the surrounding soil cracks and allows outside air to enter a crawfish's burrow, the water inside will evaporate and the crawfish will die. In the 1990s,

AgCenter researchers excavated more than 100 crawfish burrows and found dead crawfish only in burrows with no remaining water. They indicated that dry summer conditions can result in a significant reduction in crawfish populations. Permanent ponds (managed solely for crawfish year after year) appear to be more resilient to drought conditions than those in rotation with rice.

FALL

Egg laying reaches a peak in early October. Normally, a female crawfish's eggs hatch while she is still in her burrow and the young remain attached to, or clinging to, her tail until she eventually emerges. Ponds and rice fields are typically flooded from late September through late October to create a suitable environment for newly hatched crawfish. During this period, heavy rainfall events prompt females with eggs or hatchlings to leave their burrows, as their plugs become soft enough to push open. Across the crawfish producing region, folks know "the mama crawfish don't come out until they hear the thunder."

In a study published in 2000, AgCenter researchers observed strong relationships between crawfish emergence (with eggs or young) and rainfall events, even in ponds that were not yet flooded. They concluded that lengthy periods of low (or no) rain in the fall may be problematic because large percentages of crawfish carrying their young emerge only after sufficient rain. On the other hand, from late August through mid-October, heavy rains associated with tropical storms and hurricanes can force females to emerge from their burrows too early, especially if they are temporarily submerged under the storm water. Many crawfish producers have learned over the years that holding stormwater in an attempt to save these animals is usually not a good idea, especially in hot weather. Losing some crawfish that emerge early does not hurt the crop as much as holding deep, rancid water with little or no oxygen.

RICE-CRAWFISH-FALLOW ROTATION

In this production strategy, rice is not cultivated in the same field during consecutive years. This aids in the control of rice diseases and weeds for maximum rice yields. Crawfish are stocked into stands of young, growing rice in the late spring or early summer with the crawfish crop following the rice cultivation period.

Between the end of the crawfish season (typically June) and the planting of the next rice crop (typically the following March or April) the land is fallow. As a result, a field in this rotation strategy requires stocking every other year to reestablish the crawfish population. The most recent survey of Louisiana crawfish producers indicates some 70% of farmed crawfish are produced in rotation with rice crops.

WINTER

After ponds or fields are flooded in the fall, the rice stubble or other vegetation that grew during the summer begins a gradual breakdown process, supporting a natural food web that can typically produce between 350 and 900 pounds of harvestable crawfish per acre over the following seven to eight months. Depending on several factors, mainly temperature and dissolved oxygen levels, hatchlings will grow to marketable size in eight to 16 weeks, with peak harvests from March through May. Freezing temperatures rarely kill crawfish; they simply wait for the water to warm up so they can start moving and growing again. However, harsh winter conditions often eliminate any vegetation remaining above the water surface, significantly reducing food resources for the remainder of the season.

SUMMARY

Weather patterns throughout the year impact crawfish aquaculture in Louisiana. A recent analysis of eight years of harvest data from six ponds at the AgCenter Aquaculture Research Station indicated that, across all years, precipitation levels in October and November had a statistically significant positive effect on monthly crawfish harvests in pounds per trap. Of note is the finding that the number of hours at or below freezing one or two months prior to harvest had a statistically significant negative impact on harvests. Fall precipitation levels impacted harvests throughout the rest of the season. Clearly, Louisiana's crawfish industry is at the mercy of Mother Nature like any other agricultural commodity.

C. Greg Lutz is a professor and specialist in the School of Renewable Natural Resources.



In rice-crawfish rotation, mature crawfish are stocked in the spring to produce the next season's crop. AgCenter file photo

2024 CRAWFISH SEASON UPDATE

Following the prolonged drought conditions experienced in 2023, crawfish harvests had risen to roughly 25% of what could be considered normal as of early April 2024. However, total production prior to March was only 5% to 10% of the typical amount.

As young crawfish that entered ponds after widespread rains in early December finally reached harvestable size, prices had begun to drop. But most producers and industry observers agree that prices were barely enough (and in some cases not quite enough) to cover costs associated with harvesting.

Another problem will be facing many crawfish producers by June. Crawfish populations will have to be reestablished in ponds that were not in production this season due to saltwater intrusion or lack of water altogether. Crawfish will also be needed to stock the roughly 180,000 acres that would normally be in rice-crawfish rotation.

The LSU AgCenter is leading a multidisciplinary research effort to improve the sustainability and profitability of rice farming systems in the southern rice-growing states of the U.S.

LSU AgCenter file photo



CRISP-RICE:

LSU AGCENTER LEADING THE EFFORT TO IMPROVE SUSTAINABILITY AND PROFITABILITY OF RICE FARMING

■ PRASANTA SUBUDHI

Over the past nine decades, the development and implementation of innovative farming technologies have resulted in a 400% increase in agricultural production using 10% less land. As a result, farming has become productive, profitable and adaptive to various environmental and economic fluctuations. However, continuing this progress is at risk due to unexpected climatic variations that reduce farm productivity and environmental quality. The occurrence of

weather disturbances in normal times of the year has become a recurring event. It is affecting rice export and farmers' income along with overall food security on the local, regional and global scales.

The climatic disturbances and human activities have led to a decline in the availability as well as quality of natural resources such as land, water and air that are vital for increased agricultural productivity. It is not just rice growers but the farming communities as a whole

that are struggling to maintain economic viability and sustainability of their farming enterprise. Rice is a major food source for over half of the world population, supplying most of their energy needs. In the state of Louisiana, rice is a dominant crop largely grown for export with over 450,000 acres and contributing \$460 million to the state economy. The United States is the fifth-largest exporting country, and rice plays an important role in providing global food security.

THE CHALLENGES

Rice growers in Louisiana and other adjoining rice-growing states are worried about the viability of rice farming due to climate change. Drought and high nighttime temperature are two major threats affecting both yield and quality of rice. A high nighttime temperature not only leads to earlier flowering and the emergence of new pests, diseases and weeds, but it also increases chalkiness in rice grains. The dwindling freshwater resources call for a new approach to reduce the water requirement of rice crops because on average, 2,500 liters of water are needed to produce 1 kilogram of paddy rice. Similarly, salinity can potentially become a major constraint due to our proximity to the coast. Both the Mississippi River alluvial aquifer and the Chicot aquifer play a significant role in Louisiana agriculture. A study by LSU AgCenter researchers reported that increased salinity levels could reduce rice yield in the Chicot aquifer region by more than 39% within 30 years without implementing any preventive measures. The saltwater creeping inland and saltwater intrusion during hurricanes can make the farmland unsuitable for rice farming. Therefore, development of rice varieties with tolerance to these stresses and new production practices are needed to enhance sustainability and profitability of rice farming system.

Yield enhancement has been the major goal of every rice breeding program. However, new challenges call for a paradigm shift in our approach and innovations. The momentum in yield gain is slowing down, and even maintaining current productivity level in the face of climate change has become an uphill task. The narrow genetic base of American rice cultivars poses further limitation to this effort. Therefore, the transfer of novel climate-resilient traits and genes from exotic germplasms, or genetic material, to high-yielding varieties or breeding lines adapted to southern rice-growing states is an urgent

need to strengthen the rice breeding programs to improve the sustainability of rice farming in the future.

AGCENTER EFFORTS

The Agriculture Innovation Agenda of the U.S. Department of Agriculture aims for enhancing American agricultural production by 40% with a 50% reduction in environmental footprint by 2050. The environmental footprint, also called ecological footprint, is a metric to measure human impact on the environment. Although there has been improvement in land-use efficiency and a decline in water and energy use, greenhouse gas emissions, and soil losses, many current production practices are still resource intensive. In a recent grant titled Climate Resilient Innovations for Sustainable Production of Rice (CRISP-RICE) funded by the National Institute of Food and Agriculture, the LSU AgCenter is leading a multidisciplinary research effort to improve the sustainability and profitability of rice farming systems in the southern rice growing states of the U.S. Seven institutions from five states are involved in research, education and extension activities involving a wide range of disciplines, such as plant breeding, genetics, biotechnology, plant physiology, soil science, plant pathology, entomology, agricultural economics, sociology, artificial intelligence and precision agriculture, to develop novel products and tools and improved management practices to make rice farming sustainable in the long term.

With the projected climate change scenario, the long-term vision of the project is to develop and implement a climate-smart approach that will minimize the use of natural resources, maximize production efficiency, increase land-use efficiency and reduce environmental footprint. This approach encompasses two important components: climate-resilient cultivars and climate-smart production practices. For example, the development of high-yielding rice cultivars with increased climate

resilience, high nutrient-use efficiency, water-use efficiency, and implementation of precision agriculture and improved crop and pest-management strategies has the power to change the future of rice farming. In addition, digital agricultural technologies like remote sensing, drone technology, and crop modeling will be used for forecasting disease and pest outbreaks and timing of irrigation and fertilizer applications, which will reduce production costs. The project will strengthen extension programming by utilizing the latest online and field-based tools to disseminate new climate-smart agriculture technologies, resources and production practices successfully to the current and next generation of rice farmers, consultants and researchers. This multidisciplinary project demonstrates the importance and power of regional research collaborations in providing solutions to pressing problems due to climate change that threaten the farming industry.

Prasanta Subudhi is a professor in the School of Plant, Environmental and Soil Sciences and the project director of the CRISP-RICE project funded by the National Institute of Food and Agriculture.



Photo by Lance Cheung, U.S. Department of Agriculture

CLIMATE-SMART

RICE GROWING STRATEGIES IN LOUISIANA

■ CHANGYOON JEONG, JIM WANG AND XI ZHANG

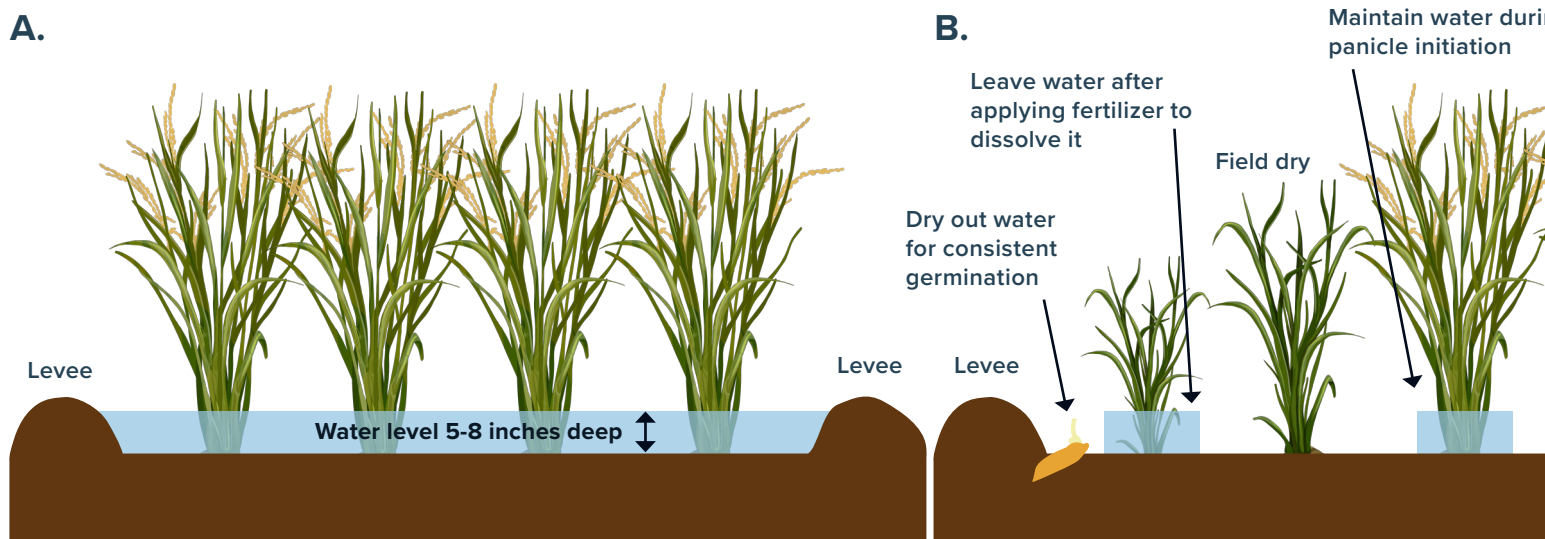
Rice cultivation is critical to global food security, providing a staple food for more than half of the world's population. Most U.S. rice production areas are the Arkansas Grand Prairie, the Mississippi Delta area, the Sacramento Valley of California and the Gulf Coast, including Texas and southwest Louisiana. However, rice cultivation is water-intensive and can be significantly impacted by climate change. Implementing climate-smart practices in rice cultivation is vital for enhancing sustainability, reducing environmental impacts and ensuring food security in changing climatic conditions. Climate-smart rice cultivation aims to increase productivity in an environmentally and socially sustainable way, strengthen farmers' resilience to climate change and reduce greenhouse gas emissions where possible. LSU AgCenter promotes climate-smart rice farming such as efficient water management, soil health practices with nutrient management, integrated pest management, utilizing climate data and modeling to support farmers in planting time and managing risk associated with climate variability, and recommends resilient rice varieties to climate stress.

Greenhouse gas emissions from rice production primarily come from methane (CH_4) released during flooded rice cultivation and nitrous oxide (N_2O) emissions associated with fertilizer application and organic matter decomposition. Mitigating these emissions is crucial for reducing the environmental footprint of rice farming. However, emissions vary, primarily reflecting the impact of management practices. In particular, continuous

flooding of paddies stimulates CH_4 emissions, whereas the fertilizer nitrogen (N) application rate is the most crucial driver of N_2O emissions.

Cover crop cultivation in rice paddies can alter the decomposition dynamics of organic matter, leading to reduced methane emissions. Certain cover crops, such as legumes or grasses, can provide carbon inputs that stimulate microbial communities in the soil, promoting aerobic decomposition and reducing methane-producing anaerobic conditions. In addition, cover crop root exudates — the fluid emitted through the roots — can also influence soil microbial activity, leading to reduced CH_4 production. Cover crop management strategies, such as incorporating cover crop residues into the soil before flooding, can shorten the duration of anaerobic conditions during the rice-growing season, thereby reducing CH_4 emissions. Legume cover crops can fix atmospheric nitrogen, reducing the need for synthetic nitrogen fertilizers and consequently mitigating N_2O emissions associated with fertilizer application. The biomass produced by cover crops adds organic carbon to the soil, improving soil structure while helping decrease N_2O emissions by promoting aerobic conditions.

Water management in rice cultivation is essential for ensuring the sustainability and resilience of this vital crop in the face of global challenges. Through the adoption of improved cultivation techniques, the development of stress-tolerant rice varieties, and the implementation of integrated farming prac-



tices, it is possible to achieve higher productivity, enhanced environmental sustainability and improved livelihoods for rice farmers worldwide.

Traditional rice farming methods, such as continuous flooding, require large quantities of water and contribute to water scarcity in many regions (Figure 1a). Improved water management techniques are essential for making rice cultivation more sustainable and climate-smart. Alternate wetting and drying (AWD) water management is the most popular water-saving technology, which can not only significantly reduce water use by 15%-30% but also AWD decreased N_2O emissions by 12%-70%, which was attributed to optimizing field soil moisture during the application of fertilizer (Figure 1b).

Furrow-irrigated rice production also uses a controlled irrigation method that supplies water directly to the plant roots through furrows (Figure 1c). This method can significantly reduce water usage, making it a more sustainable option in water-scarce regions or under conditions where water conservation is essential. Furrow irrigation minimizes the time for the field to flood and lowers CH_4 emissions compared to flooded rice farming methods. Moreover, by optimizing fertilizer use and reducing runoff, furrow-irrigated rice can minimize nutrient leaching into water bodies, thus protecting aquatic ecosystems. While furrow-irrigated rice offers many advantages, its implementation faces challenges. These include the need for specific infrastructure (like leveled fields and the ability to control water delivery precisely), knowledge and training for farmers to manage the new system effectively, and initial investment costs.

Additional climate-smart practices in rice cultivation may include two more options. The first option is to use enhanced efficiency nitrogen fertilizer (EFNF) to mitigate N_2O emissions and NH_3 volatilization. The typical EFNF is urea or urea ammonium nitrate (UAN) treated with N stabilizers such as urease and

nitrification inhibitors or urea coated with polymer. Researchers have found that applied N stabilizers extended the availability of applied N fertilizer and reduced nitrate production, which is the predominant N_2O precursor under subtropical and tropical regions of the southern U.S. A second option is the application of biochar, a stable form of carbon-derived from biomass conversion under high temperatures with limited oxygen conditions to enhance soil fertility and mitigate greenhouse gas emissions. Biochar amendment was reported to enhance soil physical, chemical and biological properties by improving the soil structure, bulk density, porosity, water and nutrient retention, and hydraulic conductivity. Abundant oxygen- and nitrogen-containing functional groups and aromatic moieties, such as benzene-like properties, on biochar surface could alter the soil's cation- and anion-exchange capacities, improve nutrient retention in the solid phase and increase nutrient availability in the soil solution. Thus, biochar potentially acts as a slow-release fertilizer by infusing it with other nutrients and reducing inorganic N fertilizer, mitigating N_2O gas emission.

Currently, LSU AgCenter soil scientists are researching the optimization and implementation of these different climate-smart strategies and improving soil health parameters to ensure the management of continued and resilient rice production in Louisiana. Implementing these climate-smart strategies requires collaboration among farmers, researchers, policy-makers, extension agents and other stakeholders. Supporting policies, incentives and investments are also necessary to facilitate adoption and scaling up these practices, ultimately contributing to more resilient, sustainable, and productive rice production systems in the face of climate change.

Changyoon Jeong is an associate professor at the LSU AgCenter Red River Research Station. Jim Wang is a professor in the AgCenter School of Plant, Environmental and Soil Sciences, and Xi Zhang is an assistant professor at the Red River Research Station.

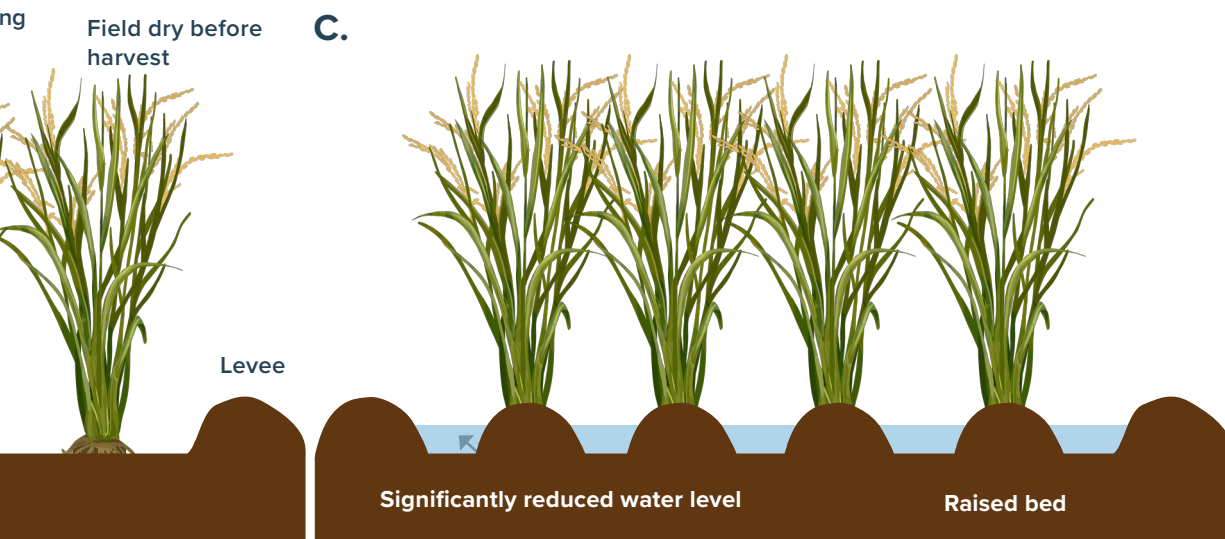


Figure 1. Rice farming methods include several options for irrigation including:

- A.** Conventional flooded rice
- B.** Alternate wetting and drying
- C.** Furrow-irrigated rice. Rice planted in raised beds in furrow-irrigated cultivation reduces labor costs but is also vulnerable to weeds and insects.



Reduced tillage is a form of conservation that entails turning over the soil in an agricultural field less than traditional tillage. It causes less erosion and saves resources. This field is on a model farm that is part of the AgCenter work with the Patrick F. Taylor Foundation to study best management practices.

AgCenter file photo

CONSERVATION ADOPTION TO INCREASE RESILIENCE TO FUTURE CLIMATE VARIABILITY

■ NAVEEN ADUSUMILLI AND LYLA DUPLCHAIN

Drought, extreme temperature and rainfall events can lead to soil erosion, decreased crop yields, water scarcity and overall economic losses for farmers. Farm incomes also have declined in recent years. As a result, there's often a heightened awareness of the need for conservation practices to mitigate the impacts of these events and build resilience in agricultural systems. Thus, demand for conservation activities typically increases significantly following drought and extreme weather events in southern agriculture.

CONSERVATION DYNAMIC

Studies have shown that extreme weather events can cause erosion, soil compaction and loss of soil fertility. Farmers may adopt conservation tillage practices, such as residue management

or no-till or reduced tillage, to minimize soil disturbance and erosion. In recent years, cover crop adoption has seen a substantial increase as the practice has been shown to help improve soil health and structure. Similarly, resource constraints imposed by drought and extreme weather more often than not lead to increased demand for technologies and practices that improve resource efficiency. This includes precision agriculture techniques (e.g., variable rate application of fertilizers and pesticides, pipe-planner based irrigation system and yield monitoring), energy-efficient methods (e.g., annual energy use audits for farm enterprise, reduced tillage or no-till to minimize equipment runs and supplementing traditional energy needs with solar energy) and better nutrient

management practices (e.g., soil testing, use of cover crops, split application of fertilizers and use of animal litter to supplement nutrient needs).

Significant droughts or extreme weather events allow for the government to implement or strengthen conservation programs and policies to support farmers in adopting sustainable practices. These often take the form of financial incentives, technical assistance and regulatory measures aimed at promoting conservation and resilience in agriculture. Participation in two Natural Resources Conservation Service programs that primarily drive conservation efforts in working lands, the Environmental Quality Incentive Program (EQIP) and the Conservation Stewardship Program, have significantly increased

following major weather events. EQIP helps agricultural producers and landowners address natural resource concerns like erosion and water quality, and the Conservation Stewardship Program helps farmers and ranchers adopt additional conservation activities while maintaining existing ones. For example, the 2015-16 jump (see figure below) in conservation dollar obligations could well be the result of increased participation after the 2014 drought as well as initiation of conservation practices implementation for contracts issued in prior years. Moreover, conservation obligations among farmers can vary depending on the specific provisions of the bill, as well as the broader economic and environmental context.

GOVERNMENT PROGRAMS AND POLICIES

It is not uncommon within farm bill programs to modify existing conservation programs, altering eligibility criteria, funding levels or program requirements. As a result, new programs often get introduced aimed at addressing emerging environmental challenges or promoting

specific conservation practices. Farmers are often encouraged through incentives to participate in these programs, which could increase their conservation obligations. New programs within the 2024 farm bill could impose new conservation compliance requirements as a condition for receiving certain benefits or subsidies. Mandates could be related to soil conservation or nutrient management. Farmers may need to adopt or intensify conservation practices to remain eligible for farm bill support.

CONSERVATION ETHOS

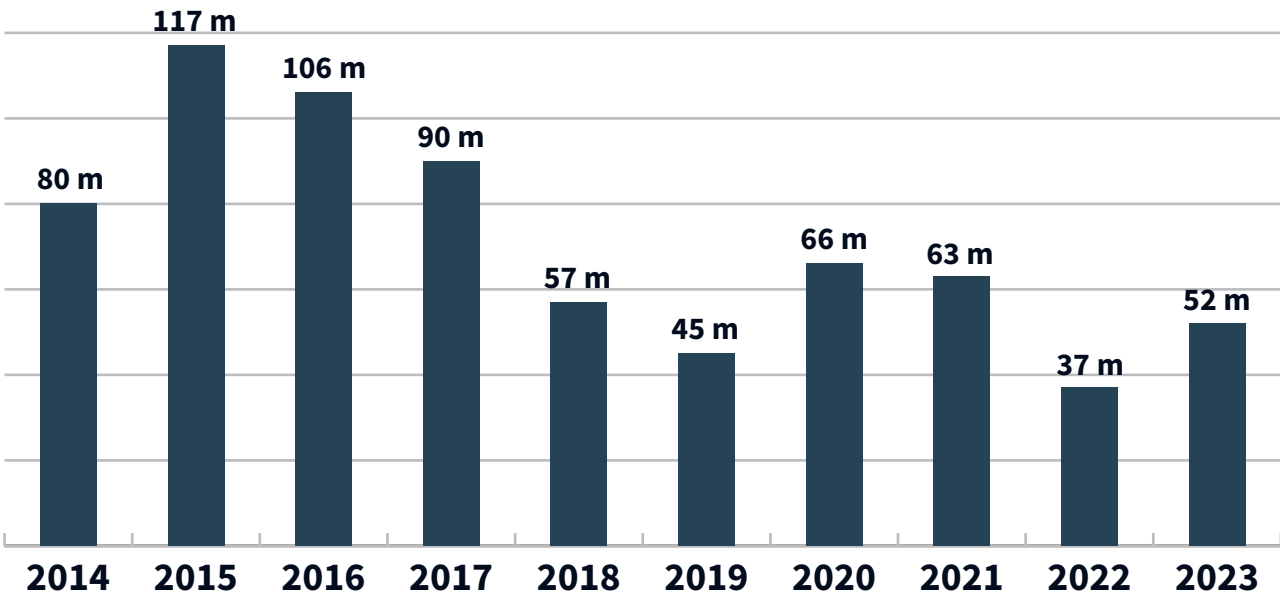
Another crucial component of higher obligations is technical assistance and education, where resources for technical assistance, training and outreach programs are obligated to help farmers implement conservation practices effectively. While these resources can support farmers in meeting their conservation obligations, they may also create expectations or mandates for participation in educational activities. Conservation and stewardship philosophy can influence the broader culture surrounding conservation in agriculture. New farm bill priori-

ties may foster a climate in which farmers feel a greater responsibility to promote sustainability, environmental stewardship, or a conservation-minded approach within their enterprises, thereby increasing their obligations.

Thus, it is important to note that extreme weather events combined with the impact of a new farm bill on conservation obligations among farmers can vary regionally and depending on individual farm circumstances. Although the effectiveness of farm bill conservation programs in achieving environmental outcomes often depends on factors such as funding levels and program design, the willingness of farmers to participate voluntarily provides a strong sense of environmental stewardship among the farmers who need to adapt to changing climate conditions, mitigate risks and ensure the long-term sustainability of agricultural systems.

Naveen Adusumilli is an associate professor in the AgCenter Department of Agricultural Economics and Agribusiness and Lyla Duplechain is an undergraduate student at LSU.

Dollars obligated for Active and Completed Environmental Quality Incentives Plan, Conservation Stewardship Program and Regional Conservation Partnership Program Contracts in Louisiana



Data Source: Natural Resources Conservation Service. Dollars in millions.

WEATHERING EXTREME DROUGHT IN LOUISIANA WITH ALTERNATIVE ROUGHAGE FOR LIVESTOCK

■ KUN JUN HAN AND JEREMY HEBERT

Louisiana experienced extremely dry summer and fall seasons in 2023. According to the National Integrated Drought Information System, the worst drought continued from June to late September in the southern U.S., including Texas, Louisiana and Mississippi. This has put a strain on quality forage production and has impacted the availability of pasture and hay for livestock. In late 2023, LSU AgCenter economist Kurt Guidry confirmed significant economic impacts on the state's livestock industry and hay production due to the weather conditions.

CONVENTIONAL FORAGE VERSUS NON-CONVENTIONAL ALTERNATIVES

Due to mild winter weather, Louisiana livestock producers have historically had the advantage of year-round forage production, beginning with cool-season forage, which includes annual ryegrass, small grain forage and clovers, followed by warm-season forage such as bermudagrass, bahiagrass, forage sorghum and cowpeas. However, the shortage of hay caused by the dry, hot weather in 2023 led farmers and ranchers to seek alternative feeding options.

Table 1 displays the crude protein and total digestible nutrient values obtained from hay samples submitted to the LSU AgCenter Forage Testing Lab in 2023. Agricultural byproducts usable for cattle feeding were categorized as “byproduct or alternative hay” to distinguish them from conventionally produced forage. The lab received five times more alternative hay sample submissions during this time frame than before, reflecting the increase in the use of alternative hay for the year's winter feeding.

Byproducts or alternative hays are recovered from main agricultural commodity productions, usually grains. The nongrain portions of the plant mature and contain low protein and high fiber, resulting in low-quality feeds with various nutrient values. Examples of such byproducts are cottonseed meal (approximately 45% crude protein) and cotton gin trash (approximately 10.5% crude protein). Samples sent to the lab indicate that varieties of alternative hay were utilized for livestock feeding in 2023. Barnyardgrass samples were also submitted as forage despite being known as a fast-maturing annual weed. An analysis of barnyardgrass indicated some potential as an alternative forage when fed prior to seedhead development. An analysis of multiple Johnsongrass samples

indicated potential utilization of this species as well. However, Johnsongrass and sorghum forage must be used with extreme caution as both species can lead to nitrate toxification when produced in drought conditions.

With the exception of barnyardgrass, cotton gin trash and peanut residue, the crude protein and energy (total digestible nutrients) contents of the sampled alternative hays are overall insufficient to meet the nutrient requirements of actively growing cattle. The average nutrient contents in sorghum forage and bermudagrass were above 8% crude protein and 51% total digestible nutrients, which were greater quality hay than medium-quality hay, followed by hays of unidentified grass, bahiagrass, crabgrass and some native grasses (Table 1).

POTENTIAL OF RICE STRAW AS ALTERNATIVE FORAGE

Given that rice straw samples composed the largest group of submissions, it is presumed that rice straw is the alternative hay most readily available to weather the current low hay supply in Louisiana. Unlike countries with relatively low forage production capabilities, rice straw has rarely been considered as forage in the United States. As Table 1 shows, the crude protein and total digestible nutrients of rice straw were equivalent to or even below utility grade. Notable was the ash content in the analyzed Louisiana rice straw, which averaged around 17%, twice the average of bermudagrass hay. The silica content of ash contributed to a large portion of that number. Silica is a main component of glass and sand, and it does not have any nutrient value.

Injections of ammonia gas into plastic wrap-covered rice straw bales have been used in rice-producing countries to improve the nutrient value of rice straw. Table 2 (available at [LSUAgCenter.com](https://www.lsuagcenter.com)) indicates the substantial improvement of crude protein and total digestible nutrients resulting from the gas injection. However, this treatment is not practical in the United States, given the required injection cost, preparation and safety considerations needed.

FEEDING VALUE VARIATION IN RICE STRAWS

Rice straw is an abundant byproduct in Louisiana; therefore, it has value as an emergency feed source. A study was conducted to investigate potential feed value differences in rice straws produced from different backgrounds, such as

variety, parish and nitrogen fertilization. The total digestible nutrient index may differ by rice variety, indicating potential differences in fiber characteristics in rice stems. The most significant difference was found in protein content in rice straw cultivated at the different nitrogen fertilizer application rates. The nutrient values were not influenced by parish, indicating the quality may vary but without consistency in the production regions. Despite the temporary challenges, the increased focus on alternative feed options, particularly rice straw, underscores the resilience and adaptability of Louisiana's livestock industry in the face of adverse weather conditions.

IMPLICATIONS

Due to extreme weather during the growing season of 2023, hay production was at a historic low. Rice straw and other agricultural byproducts are potential alternative feed sources, but the nutrient values do not meet most livestock classes' protein and energy requirements. Although chemical treatments on rice straw have been practiced in some countries to enhance nutrient value and digestibility, the economic gain of those treatments is uncertain in U.S. livestock operations. Additionally, more systematic research is required to confirm the potential variations, as rice straw quality has been found to

be inconsistent with production backgrounds. In the meantime, using rice straw and agricultural byproducts as feed should be considered a temporary solution to be managed carefully with appropriate protein and energy supplements.

Kun Jun Han is an associate professor in the AgCenter School of Plant, Environmental, and Soil Sciences, and Jeremy Hebert is an extension associate based at the AgCenter H. Rouse Caffey Rice Research Station.

SOIL HEALTH CONCERNS

Removing rice straw from a rice field offers a couple of advantages. Notably, it enhances water quality for crawfish production by eliminating decomposing foliage material that consumes oxygen in the water, thereby improving conditions for crawfish. Additionally, employing methods like baling rice straw as baleage or postharvest mowing can lead to a more uniform ratoon crop stand, enhancing overall productivity. However, this practice comes with the drawback of depriving the field of essential nutrient material that would otherwise replenish soil fertility through natural decomposition. Thus, farmers must be vigilant about monitoring soil health and may need to supplement nutrients if a significant amount of rice straw is removed, underscoring the importance of soil sampling to inform management decisions. ■ Jeremy Hebert

Table 1. Average crude protein and total digestible nutrient in byproduct (alternative hay) and conventional hay.

HAY PRODUCT	FEED SOURCE	CRUDE PROTEIN, %	TOTAL DIGESTIBLE NUTRIENT, %
Byproduct or alternative hay	Barnyardgrass	15.2	64.5
	Cotton gin trash	10.5	54.8
	Peanut residue	10.4	53.0
	Johnsongrass	6.8	54.1
	Corn stove	5.6	51.0
	Sorghum straw	4.3	53.4
	Rice straw	3.9	50.6
	Soybean trash	2.6	42.3
Conventional	Sorghum forage	10.0	62.6
	Bermudagrass	9.5	60.8
	Unidentified grass	7.8	56.5
	Bahiagrass	7.4	56.1
	Crabgrass	7.2	55.2
	Native grass	6.8	55.2

View WWW.LSUAGCENTER.COM/AGMAGSPRING24 for more tables.

RESILIENCE:

MINIMIZING IMPACTS OF CLIMATE CHANGE ON LIVESTOCK

■ DR. CHRISTINE NAVARRE, ASHLEY K. EDWARDS AND NEELY HEIDORN

Recent weather extremes, which include record heat and cold as well as drought and flooding, have made it especially difficult to maintain the health and production of livestock in Louisiana. Predicting these weather extremes is nearly impossible at times, but advanced planning can help livestock producers minimize the impacts of these events.

WATER

Flooding from excess rain, storm surges from hurricanes and drought bring issues with water quality and availability. Water pollution and excess water salinity from the first two problems are familiar to Louisiana livestock producers, but the extreme drought of the summer of 2023 brought a new set of troubles. Water quality suffered from increased salinity, increased total solids, such as metals and minerals, and increased bacteria. The specific water quality issues depended on the location of the water source and whether it came from a municipal water supply or a well, pond, canal or other source. Short-term exposure to mild to moderate decreases in water quality likely has few immediate effects if water intake remains normal, but some animals may drink less than their requirements because of taste. Unfortunately, there is a dearth of research into the long-term effects of drinking water of differing quality on livestock production and health.

Because of the volume of water needed for livestock daily, producers need a plan for either transporting large amounts of fresh water or relocating animals. If increased salinity and/or total solids in water is a problem, remove all other sources of mineral supple-

ments. In individual animals, tracking the volume of water intake is important. Adding flavoring to water for horses may increase water consumption. Finding a local water quality expert who can make specific recommendations based on water testing will be helpful.

FEEDSTUFFS

Maintaining livestock in moderate body condition helps protect them against extreme temperatures. Animals with excess body condition according to the body condition score scale or those with fat cover, particularly horses and non-heat-adapted breeds of cattle and sheep, are more likely to suffer from life-threatening heat stress or stroke. Animals with added condition or fat insulating their bodies may be more susceptible to heat stress or stroke than those with proper fat cover. Animals that are too thin will have to burn extra energy to keep warm in extreme cold temperatures, particularly when accompanied by wind and rain. This stress leads to increased risk of illness and death. During drought, available feedstuffs will vary greatly in quality and safety. The quality of local pasture will decrease. Toxic plants may be more abundant, and animals may then be more likely to consume them. Failed crops may be baled and redirected to livestock forage. These feeds should always be tested for quality and any possible toxins (nitrates, mycotoxins, etc.).

Plans should be in place for short-term feeding during flooding and cold spells. Planning for the long-term issue of feed availability and quality during drought is more difficult. The LSU

AgCenter, Natural Resources Conservation Service, the Louisiana Department of Agriculture and Forestry and local feed dealers can help locate feed and hay, develop a supplement plan based on availability and quality of feedstuffs, and test for potential feed toxins. Purchasing feedstuffs in bulk from other parts of the country in cooperation with other producers can help lower costs.

FACILITIES AND EQUIPMENT

Louisiana summers are always tough on livestock, but the extreme, prolonged heat of the summer and fall of 2023 was especially taxing. Exposure to high temperatures day after day leads to decreased production, reproduction and neonatal health. It can also cause death from acute heat stroke. Adequate shade, either natural or artificial, must be provided for the health and welfare of livestock.

Colder-than-normal temperatures, even for short periods of time, are also detrimental to the health and welfare of livestock. Permanent shelter may not always be cost effective, but plans should be made for temporary shelter. Providing dry bedding and setting up temporary wind breaks with round bales of hay can minimize impacts of the cold.

Changes in water temperature, either too hot or too cold, can decrease water intake. Ruminants are more resilient to short-term changes in water intake, but horses are more likely to colic, especially in cold weather. Shade over water troughs and proper flow rates to troughs can help keep water cool in summer. Water intake in horses should be monitored in winter.

A livestock pond on a Louisiana ranch dries up during the drought of 2023. Photo provided by Amelia Kent

Different feedstuffs acquired during drought may make it necessary to have special loading and hauling equipment and feed storage areas. These may also prove helpful during winter supplementation. Natural water sources can either dry up during drought or become frozen during extreme cold. Having water troughs available to provide water can be advantageous during these times.

HEALTH PROGRAM

Extreme weather events are very stressful to livestock. Healthy livestock withstand these stresses better. Veterinarians can develop a preventive health program that will help livestock during normal times and times of more intense stress. They can also help livestock producers develop an emergency health plan should animals get sick or injured during these events.

The LSU AgCenter Master Cattleman, Master Goat and Master Horse programs all incorporate husbandry and animal health information that can prepare livestock producers to be more successful during normal times and during times of extreme weather.

Dr. Christine Navarre is the extension veterinarian for the AgCenter, Ashley K. Edwards is the state livestock specialist for the LSU AgCenter and Neely Heidorn is the state equine specialist.

During the drought of 2023, pastures across the state became nearly bare, and many livestock producers could not grow enough hay for their animals. Many had to find hay from other areas to feed their cattle. Photo provided by Amelia Kent





Hammond, home of the LSU AgCenter Hammond Research Station, increased from 8B to 9A on the U.S. Department of Agriculture Plant Hardiness Zone Map, indicating a warmer lowest average temperature than the previous map, released in 2012. Photo by Ashley Hickman

A WARM WELCOME TO THE NEW USDA HARDINESS ZONE MAP

■ JEB FIELDS AND DAMON ABDI

At the close of 2023, the U.S. Department of Agriculture released an updated Plant Hardiness Zone Map — the first time it has been updated since 2012. This map is based on 30-year averages of the lowest annual winter temperatures in specific locations with data collected from 13,412 weather stations — nearly double as many as the 7,983 used for the last version. The addition of these weather stations provides more robust data, including more information from stations located in remote areas. This assists in providing greater data resolution (i.e., increased data density) across many areas. For example, Alaska received a major increase in resolution as the updated map has a 0.25 square mile resolution compared to the previous 6.25 square miles — a nearly 25-time increase.

As anyone reading this likely already knows, hardiness zones are talked about quite often in horticulture. Hardiness maps are used to determine the suitability of various crops to survive in different regions. The USDA hardiness map indicates the average lowest temperature for an area, as opposed to the Heat Zone Map put out by the American Horticultural Society, which represents the average number of days above

86 degrees Fahrenheit annually. While the zone numbers are indeed very similar, many students mistake the meaning of the two maps. No industry relies on hardiness zone for decision-making more than ornamental horticulture, with literally hundreds to thousands of different taxa in our trade that span a spectrum of different hardiness requirements.

There are 13 hardiness zones (zones 1 through 13, with higher numbers indicating warmer temperatures) represented in the U.S., with each zone split into two sub-zones (i.e., A or B). A hardiness zone represents 10 F, while a half zone represents 5 F. Many of our Louisiana residents may not notice a difference in this new map; however, the gradual shifts are reflected in the half-step increases for north Louisiana, which moves up to 8b, and the southernmost portions of the state, which are moving up to 10a way down by Port Sulphur. Similar shifts were observed for many areas throughout the state, including in Hammond, which increased from 8B to 9A.

This trend is not localized to Louisiana. Approximately half of the U.S. remained in the same hardiness zone while the other half saw an adjustment, typically moving up a half zone

warmer. The map confirmed what many have physically felt with each successive summer, as heat records have been set in several cities throughout Louisiana and the country at large. Armed with the knowledge that our communities are indeed getting warmer, the new hardiness zone map can be used to make more informed decisions in our plant selection.

The importance of understanding what the lowest annual temperature is in a particular area is essential to selecting our perennial plant material. Perennial plants go dormant over winter, where cold temperatures are necessary to spur the flower blooms that are cherished in our landscapes. However, if temperatures get too cold, those plants may not reawaken for the next season (a gentler way to describe their mortality in the landscape). Selecting plants that can reliably be revitalized following winter's chill is necessary to the long-term success of many of our herbaceous perennials, shrubs and trees. On the other end of the spectrum, understanding that our average temperatures are becoming warmer can be a guide to selecting plant material that can handle temperature extremes during summertime.

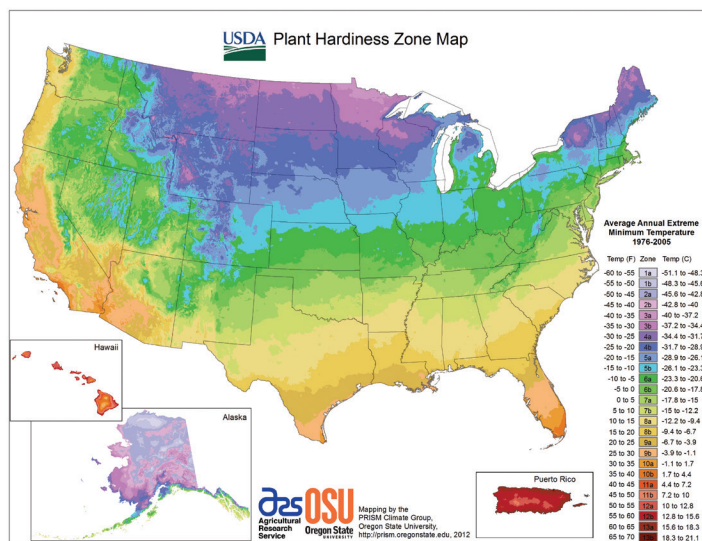
What does this mean for our green industry stakeholders? Landscape contractors and nursery growers can work together to devise a palette of plants that can beat the heat and shoulder the colder temperatures. Many plants that have reliably grown may be less hardy in the not-too-distant future,

as the increasing temperatures may prove too much to take for these selections; conversely, plant taxa from climates warmer than Louisiana (sometimes this is hard to imagine) may become competitive in the market as the increase in average warmer temperatures may signal suitability for these plants here in Louisiana.

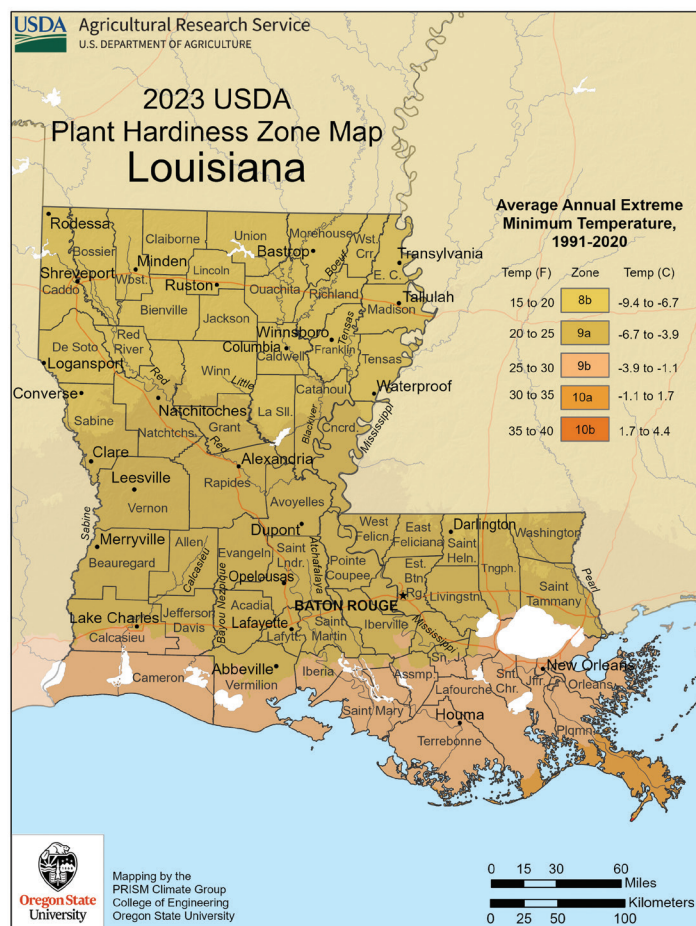
While all feel the heat, feeling the pressure of a warming climate can be avoided by modifying practices. Through selecting plants that are site-appropriate for the current and future climate, this can be used as an opportunity to utilize new plants in the landscapes and shift away from plants that just can't take the heat anymore. As weather patterns will continue to become more erratic, a range of resources, such as the USDA Hardiness Zone Map, can be leveraged to keep Louisiana's green industry blooming.

Maps and map resources are available for download at the USDA Plant Hardiness website: <https://planthardiness.ars.usda.gov/pages/map-downloads>.

Jeb Fields and Damon Abdi are assistant professors at the LSU AgCenter Hammond Research Station. They support the nursery and landscape industry across the state of Louisiana.



At the end of 2023, the U.S. Department of Agriculture released an updated Plant Hardiness Zone Map (right) based on 30-year averages of the lowest annual winter temperatures collected from 13,412 weather stations, an increase from the 2012 map (above). Many areas of Louisiana saw a change in the map, which charts the lowest average temperature of an area. Maps courtesy of the USDA



SEE INSIDE

A part-time job while in school at LSU Alexandria opened Justin Dufour's eyes to agricultural work. His hard work and interpersonal skills led to a successful career as an LSU AgCenter extension agent. Dufour recently received the County Agent Award from the Louisiana Agricultural Consultants Association.

SEE PAGE 10.

AgCenter specialists developed an irrigation decision-making app and outreach campaign aimed at helping farmers mitigate drought risks in an environmentally and economically responsible way. The Drought Irrigation Response Tool (DIRT) was well received by users, according to surveys.

SEE PAGE 20.

Last year, the U.S. Department of Agriculture released an updated Plant Hardiness Zone Map — the first time it has been updated since 2012. This map is based on 30-year averages of the lowest annual winter temperatures in specific locations with data collected from 13,412 weather stations. Several regions saw an adjustment in their growing zones.

SEE PAGE 38.



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