

**FOREST &
WILDLIFE
RESEARCH
CENTER
2015**
ANNUAL REPORT



MISSISSIPPI STATE UNIVERSITY™
FOREST AND WILDLIFE RESEARCH CENTER

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2015 ANNUAL REPORT

The Forest and Wildlife Research Center is a unit in the Division of Agriculture, Forestry and Veterinary Medicine at Mississippi State University.

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The mission of the Forest and Wildlife Research Center is to promote, support and enable the management, conservation, and utilization of forest and other natural resources to benefit the stakeholders of Mississippi, the Nation, and the world.



MISSISSIPPI STATE UNIVERSITY™
FOREST AND WILDLIFE RESEARCH CENTER

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ON THE COVER: *The Andrews Forest and Wildlife Laboratory after a prescribed burn. Located in Oktibbeha county, the Andrews Forest and Wildlife Laboratory is a 550-acre property in the university's Bulldog Forest. (Photo by David Ammon)*

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DIRECTOR



THE FOREST AND WILDLIFE RESEARCH CENTER (FWRC) at Mississippi State University is one of the premier research centers in the country, dedicated to conserving, managing and using the forest, forest products, wildlife and fisheries resources of Mississippi for the betterment of our citizens.

The FWRC provides the research support for the MSU College of Forest Resources. This report highlights a few of the 237 research projects in the FWRC. The FWRC includes the Departments of Forestry; Sustainable Bioproducts; Wildlife, Fisheries and Aquaculture; as well as the Center for Resolving Human-Wildlife Conflicts and the Franklin Furniture Institute.

From black bear restoration to enhancing fisheries production, our faculty, staff, and students in the Department of Wildlife, Fisheries and Aquaculture continue to discover new solutions to complex problems. As the research arm for the Mississippi Department of Wildlife, Fisheries and Parks; the MSU Department of Wildlife, Fisheries and Aquaculture conducts hundreds of projects each year to improve wildlife and fisheries habitat and populations.

The Department of Forestry research projects are diverse and focused on issues facing our state, nation and world. A new tree improvement program will provide strong timber resources for landowners. Additionally, understanding the impacts of the Great Recession on forestry industries, and the influence of the growing China economy on wood exports will help position the U.S. to continue to be a leader in natural resource issues.

Several studies in the Department of Sustainable Bioproducts have been highlighted including restoration of flooded homes, new strength testing in southern yellow pine lumber, and new deck products. All of these projects work to improve our natural resources while increasing the economic impact for both public and private landowners.

Our research centers are also working to grow the Mississippi economy. The Franklin Furniture Institute provides research that aids in the production of high quality products. The Center for Resolving Human-Wildlife Conflicts seeks to find resolutions for conflicts between humans and wildlife. For instance, a new study in the Center is quantifying the economic impact of wild hog damage in agriculture, neighborhoods, and public places. The FWRC is also home to the James C. Kennedy Endowed Chair in Waterfowl and Wetlands Conservation. The Kennedy Chair is evaluating the federally-directed Migratory Bird Habitat Initiative which created 470,000 acres of habitat for wintering waterfowl in eight states.

A close look at the numbers tells the story of how scientists in the FWRC are contributing to new discoveries while training future leaders. For every dollar received in public support, the FWRC generates two dollars in extramural support. Last year, 59 faculty mentored 135 graduate students on research projects which conserve, manage, and sustain our natural resources for future generations.

I hope that you enjoy reading about the great work by scientists in the Forest and Wildlife Research Center. I appreciate your participation in these endeavors and the generosity of our many supporters.

George M. Hopper
Director

WILDLIFE, FISHERIES & AQUACULTURE

The Department of Wildlife, Fisheries and Aquaculture is committed to providing leadership for the conservation of fish and wildlife resources through applied research and graduate training.

RESEARCH FOCUS AREAS:

1. Ecosystem Restoration and Conservation
2. Ecology and Management of Fish and Wildlife Populations and Their Habitats
3. Fish Culture and Management Systems
4. Human-Wildlife Interactions and Conflict Management
5. Watershed, Wetland, Estuarine, and Water Quality Management
6. Climate Change Adaptation and Mitigation
7. Natural Resource Policy, Economics, and Education
8. Integration of Conservation in Working Landscapes

FACULTY

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FWRC EVALUATES MIGRATORY BIRD HABITAT INITIATIVE





Joe Lancaster, a graduate student in the College of Forest Resources, releases a female mallard that has been fitted with a radio-transmitter as part of the Migratory Bird Habitat Initiative evaluation. (Photo by Ken Goss)

MSU SCIENTISTS IN THE JAMES C. KENNEDY Chair for Waterfowl and Wetlands Conservation released a study evaluating the Migratory Bird Habitat Initiative, or MBHI, a program created by the United States Department of Agriculture’s Natural Resources Conservation Service, or NRCS, in response to the 2010 Deepwater Horizon oil spill in the Gulf of Mexico.

While certain phases of the study remain ongoing, preliminary results show MBHI—which provided alternate wetlands for migratory and resident waterbirds inland away from the oil spill area—delivered ecological, environmental and economic benefits throughout the southeastern U.S. bordering the Gulf Coast.

NRCS allocated \$40 million to landowners in eight states to manage 470,000 acres of habitat for one to three years and commissioned FWRC to lead an independent evaluation of MBHI.

The project team included FWRC scientists Brian Davis, Francisco Vilella, Guiming Wang, and recently retired Richard Kaminski, along with University of Missouri scientist, Lisa Webb. Seven graduate students from MSU, Arkansas Tech University and the University of Missouri also worked on the project.

The scientists studied waterbird species, populations, available food and cost-effectiveness on MBHI land that included production and idled rice fields, idled catfish ponds and natural

wetlands enrolled in the Wetlands Reserve Program, or WRP.

Researchers estimated how many and which species of waterbirds were utilizing the habitats, how much food was available for the birds and cost-effectiveness of the program in terms of potential food energy available for maintaining birds during migration and wintering periods.

MBHI lands proved a haven for migrating and wintering waterfowl and birds; providing an abundance of potential food in a cost-effective manner. For instance, MBHI-flooded rice fields and wetlands averaged seven times more waterbirds and shorebirds, respectively, per acre compared to non-MBHI counterparts. Other MBHI lands had almost three times more ducks and twice as many waterbirds compared to non-MBHI sites. Idled catfish ponds enrolled in the MBHI supported diverse communities of more than 40 water bird species. Mississippi MBHI catfish ponds satisfied nearly all of the wetland habitat required for shorebirds migrating through the MAV and Western Gulf Coastal Plain in the fall. Seed abundance and aquatic invertebrates were both greater on MBHI wetlands compared to non-managed and public wetlands. Finally, MBHI lands satisfied 28% of the duck energy needs designated by the Lower Mississippi Valley Joint Venture in the MAV on only one percent of the land. ❖

IT'S ALL ABOUT LOCATION

BLACK BEARS HAVE BEEN PART OF MISSISSIPPI'S landscape since long before the state was founded. The tale of president Theodore Roosevelt hunting bear in Sharkey County is known by most Mississippians. Despite the historic linkage of bears to Mississippi, the populations have been declining since the early 1900s.

Population decline in Mississippi and throughout much of the black bear's southeastern range is primarily linked to habitat loss. Scientists and graduate students in MSU's Forest and Wildlife Research Center, in cooperation with state conservation agencies, hope to reverse this downward trend by understanding how bears select habitat, including their denning locations.

The team, which is led by Mississippi State wildlife biologist Jerry Belant, has taken a broad geographic approach to understanding habitat suitability, connectivity and recolonization of black bears in Mississippi, Missouri and Michigan.

Understanding the distribution of bears in relation to the environment at a landscape-scale is an important aspect of conservation. Documentation and establishment of movement corridors which link populations of black bears with high quality habitat across their range is essential in restoring populations.

To understand their movements and denning sites, scientists tracked 31 female black bears, which had been collared with global positioning systems. The study included two recolonizing populations in Mississippi and Missouri that were not hunted and one established and hunted population in Michigan.

The scientists were testing how food supply, travel corridors



Students collar a black bear in south Mississippi during March 2015. (Photo by Joe Mac Hudspeth)

and proximity to roads explained den selection during the five year study.

Previous MSU studies have shown that bears improve their lifetime reproductive success by making decisions on the trade-offs between the best den site with ample nearby food and avoidance of potential risks including hunters and roads. While numerous aspects of black bear ecology, including den-site selection and relationships to roads have been reported, little is known about the spatial scale at which these trade-offs are made.

Researchers found that bears in Michigan and Mississippi selected travel corridors near main roads with greater food abundance but avoided areas near secondary roads and vegetated areas which run parallel to water, also known as riparian corridors. Scientists suggest that an abundance of riparian areas in the study sites were most likely frequented by other bears, so the females considered these a potential risk area. In addition, humans are more likely to pursue outdoor activities from secondary roads, which bears may also interpret as risk.

In contrast, bears in Missouri selected riparian corridors with ample food supply but avoided main and secondary roads. Scientists suggest that the small scale of riparian corridors and greater topography in this site explained bear movement.

The study found that habitat management that promotes movement corridors and food resources away from human-dominated areas such as roads is essential to maintaining adequate reproductive success in black bear populations, especially in Missouri and Mississippi, where population recolonization is paramount. ❖

ENHANCED CRAPPIE PRODUCTION

SCIENTISTS IN THE FOREST AND WILDLIFE RESEARCH Center and the Mississippi Department of Wildlife, Fisheries and Parks are studying methods to better manage and optimize crappie reproduction.

Assistant professor and fisheries biologist Peter Allen and graduate student Charlie Culpepper are evaluating hormone-induced and out-of-season spawning, as well as the cryogenic preservation of sperm.

Current methods require the collection of females for captive spawning within a very narrow and difficult-to-determine time frame for fertility. While sperm is present in male crappie at any time, it's typically collected when needed for fertilization.

This approach means hatchery personnel are collecting material from both males and females during the same time frame, which often overlaps the reproductive windows for multiple fish species produced at the hatcheries.

Mississippi hatcheries produced more than 3.7 million fish between June 2013 and December 2014. Of these, more than 500,000 crappie were used to stock Mississippi lakes.

Being able to preserve viable sperm and to induce female spawning in a tank system without seasonal restriction would allow fish hatchery biologists to manage the reproduction process and timing. This ability would stabilize the workflow and potentially increase hatchery production of crappie fry, which are raised to fingerling size before being released. Culpepper's research has identified effective methods that could be used to improve current practices.

He tested three common spawning-induction hormones and identified a preferred treatment. If this research were applied, fish hatcheries would be able to collect female crappie without missing the natural spawning window. The new method would save time and money, and it could also improve the success rate of reproduction because more variables are controlled.

If the research induces spawning early, larger fingerlings can be stocked, which may improve survival, which is good news for the recreational fishing industry, which generates \$528 million in economic activity in the state. ❖

Graduate student Charlie Culpepper is studying methods to better manage and optimize crappie reproduction. (Photo by Kat Lawrence)



FORESTRY

The Department of Forestry's research is focused on sustainably managing and utilizing forest resources.

RESEARCH FOCUS AREAS:

1. Forest Biology, Forest Health, and Watershed Management
2. Forest Economics, Management, and Policy
3. Forest Measurement, Inventory, and Spatial Technologies
4. Wood Supply Systems

FACULTY

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ADVANCED GENETIC SEEDLINGS

Randy Rousseau, a forestry professor in the Forest and Wildlife Research Center, examines pine seedlings in an MSU greenhouse Feb. 18, 2015, in Starkville, Mississippi. (Photo by Kat Lawrence)

AGV-123 VARIETAL



A NEW PROJECT IN THE FOREST AND WILDLIFE Research Center is encouraging landowners to invest in pine seedlings that possess better genetics.

Randy Rousseau, forestry professor, developed the Landowner Tree Improvement Cooperative to encourage landowners to plant advanced genetic seedlings so they can see firsthand how these compare to their normal planting stock.

The project is focused on two problems: a depressed pulpwood market and the future need for high quality pine products including sawtimber and poles.

A simple way for landowners to increase future revenues from their pine stands is to be keenly aware of how the planting of high-level genetic seedlings can greatly aid in that goal. Rousseau worked with ArborGen to provide four different genetic seedling types to participating landowners throughout Mississippi. These different varieties will be evaluated by MSU scientists to determine the difference that high-level genetics can make in stand revenue as well as allowing the landowner to judge performance.

Two of the four seedling types selected are significantly higher-level genetics than those typically purchased. However, as the level of genetics increases so does the cost of the seedlings because of the technology it takes to produce them.

The price, however, is an excellent investment because as stand variability decreases the number of higher quality stems increases. Better genetic seedlings equate to higher returns on timber.

Getting landowners to pay three times more per seedling can be a hard sell. But Rousseau has been sharing the message with landowners throughout the state that these seedlings will increase stand revenue and has numerous individuals participating in the Landowner Tree Improvement Cooperative.

The typical planting pattern for southern yellow pine is planting a lot of seedlings, and then thinning them for pulp at 12 years, followed by a second thinning some years later for a combination of pulpwood and some chip-n-saw. A final harvest at 30 years generally results in high valued timber.

By planting seedlings of better genetics, landowners plant fewer trees, generally forgo the 12 year thinning, and produce high valued timber for harvest.

Landowners are planting these trees on their land and seeing the difference firsthand. Each site is measured by MSU personnel and the results distributed to all of the participating landowners, so they can see how these trees are doing across the entire state.

Rousseau's goal is to move landowners toward planting fewer trees but getting more trees of higher quality on Mississippi forestland. Planting fewer trees per acre will lessen the need for early thinnings. Participating landowners are able to produce a better, higher-end timber product that can be used as sawtimber, veneer or utility poles.

Properly selected, high-quality genetic seedlings play a key role in growing more valuable material. While genetics alone will not increase timber yields, superior trees coupled with good management will provide increased revenues for landowners. ❖

GREAT RECESSION

HAS THE FOREST PRODUCTS INDUSTRY CHANGED over time? A recent study in the university's Forest and Wildlife Research Center answered this question across eight regions of the U.S.

Using IMPLAN data and software, forestry scientists and a graduate student studied the size and composition of the industry from 1996 to 2012. The scientists used the eight U.S. regions defined by the Bureau of Economic Analysis.

The industry was grouped into three sectors or categories: solid wood products, pulp and paper, and wood furniture manufacturing. Examined changes in structure included employment, wages, value-added and total industry output over time and by region of the U.S.

The study found that two recessionary periods over the 16 year period had a dramatic impact on the industry and its recovery. The first recessionary period occurred from March 2001 to November 2001 and the second was from December 2007 to June 2009, a period commonly known as the Great Recession.

In solid wood products manufacturing, employment incurred

sustained decreases across regions over the examined time period. The Southeast region—which includes Mississippi—the Farwest, and Great Lakes saw the sharpest decreases in employment compared to other regions. Labor income decreased with each recession but then increased across regions immediately following a recession. This reflects that jobs and worker hours were decreased with each recession and then worker hours increased while the number of jobs remained flat. Industry output also declined during the 2007-2009 recession with output decreasing by more than half for five of the eight regions, including the Southeast.

In the wood furniture manufacturing sector, employment and labor increased until the Great Recession and then decreased for all regions. In labor income, the Southeast experienced a post great recession increase, along with the Great Lakes and Farwest. The 2001 recession had little impact on total industry output while the 2007 recession produced notable declines. The Southeast experienced growth in total industry output following the recession.

Paper and allied products manufacturing employment exhibited a downward trend from 1996 to 2012, and the rate of decline increased with both recessions. The Southeast did experience growth following the 2007 recession in labor income. Industry output grew after both recessions; however, jobs in this sector did not experience growth following recessions.

Value-added—which is the revenue less material and service costs—typically mirrors output. However, between 2001 and 2007, value-added did not mirror output for wood furniture and paper manufacturing which indicates that input costs for materials increased during this time period.

Clearly, both recessions had an impact on the forest products industry, with some regions and sectors of the industry being impacted more than others. Future analysis will include rate of growth by region for pre- and post-recession and comparing timing with housing starts, existing home sales and U.S. Gross Domestic Product.

The forest products industry is an economic driver throughout the Southeastern region. Understanding the impacts of recessionary periods will assist policy makers in planning.

The study was conducted by forestry scientists James Henderson, Ian Munn, Donald Grebner, Robert Grala, and graduate student Ram Dahal. ❖





IMPACT OF CHINA'S ROUNDWOOD IMPORT

CHANGYOU SUN, FORESTRY PROFESSOR IN THE Forest and Wildlife Research Center, recently conducted a study on the global implications surrounding China's increasing importation of roundwood.

China's booming economy over the past few decades resulted in the country becoming the world's largest importer of roundwood, or unprocessed wood or logs. China spends \$10 billion annually for 38 percent of the world's roundwood exports.

The study anticipates the long-term trend of China's increasing roundwood consumption to continue through 2020, impacting Mississippi's rich timber resources through globalization and possibly direct trade at some point in the coming years.

In this study, Sun analyzed the growth rate of China's roundwood imports from 1995 to 2012 to determine the global impact, which will help policymakers, industry and environmental groups understand how the demand effects economic development and environmental protection on a global scale.

Sun evaluated product type and supply source. He determined that total roundwood imports during the time period were 36% coniferous roundwood, 17% tropical roundwood and 38% other non-coniferous roundwood and that China's imports have become more diversified with more suppliers. Historically, China imported roundwood from just a few Southeast Asian countries with one or another country having more than 50 percent of the import market over time. Since 2009, that has shifted consider-

ably and now China imports from 18 countries across the globe and no one country has more than 20 percent of the market share at any given time.

This diversification should benefit both importer and exporters. It benefits China because the risk is diversified. If a trade barrier exists with one exporting country, demand will still likely be met. It benefits exporters because it puts less pressure on forests and the environment in individual exporting countries.

The study also illustrated how China's roundwood import growth trend both informs and is influenced by the global economy on a larger scale. While their consumption of raw materials has a significant impact on the countries of their suppliers, their demand is influenced by world economy, especially in Europe and the U.S., since most of the roundwood is exported from China as value-added manufactured products, like furniture.

The study also discusses the potential environmental impact this growing demand has on supplier countries, specifically those countries with the greatest risk of deforestation based on a lack of forest management infrastructure and resources.

In subsequent studies, Sun plans to broaden the environmental discussion, evaluating forest products as a key determinant in the climate change discussion and studying how roundwood production might affect carbon emission and sequestration. ❖

SUSTAINABLE BIOPRODUCTS

The Department of Sustainable Bioproducts has the research priority of developing wood and non-wood products and manufacturing systems for bio-based industries.

RESEARCH FOCUS AREAS:

1. Solid and Engineered Structural Products from Wood and Other Bio-based Materials
2. Environmental Protection, Conservation, and Industrial Ecology in Wood and Bio-based Products Manufacturing
3. Sustainable Durability and Property Enhancement
4. Renewable Energy and Chemicals from Wood and Other Sources of Biomass

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Professor

Philip Steele
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AFTER THE FLOOD





Nationally, floods force 300,000 persons from their homes and result in property damage in excess of \$2 billion each year. (Photo courtesy of Federal Emergency Management Agency)

IN THE PAST FIVE YEARS, ALL 50 STATES HAVE EXPERIENCED floods or flash floods. Nationally, floods force 300,000 persons from their homes and result in property damage in excess of \$2 billion each year.

Flooding causes numerous problems in homes including mold, fungi and deterioration of building components.

Hamid Borazjani and Susan Diehl, Sustainable Bioproducts professors in the Forest and Wildlife Research Center, recently conducted two separate studies on a study house constructed by Tuskegee University in Alabama.

The first study examined the effect of long-term flooding and subsequent drying on molds present in the air and on different building materials used for construction of residential walls. The second study tested moisture and mechanical integrity of wall materials in a flooded structure.

To resemble conditions found in a flood, scientists constructed a house using conventional building materials. The house was flooded with pond water and left for three weeks and then drained. After draining, the unit remained untouched for an additional three weeks.

To test for mold in the air and on building materials, three types of sensors were embedded into the walls of the flood unit. The sensors measured temperature, humidity and moisture during the flood and during the drying period.

The study found that insulation supported the greatest concentration of fungi compared with all other wall materials and

also contained the most moisture. Gypsum, which is similar to drywall, did not support the presence of fungi on the interior of the board, but both paper sidings supported high levels of fungal growth.

Drying of the flood unit and subsequent remediation produced a suitable indoor environment, reducing mold spores significantly.

In the second study, scientists found that forced drying, as opposed to natural drying, minimizes water damage to building materials. Force drying includes dehumidification and/or air conditioning.

Scientists found that three days of flooding had little effect on gypsum board while long-term flooding rendered the material useless. Scientists recommend that gypsum board sheets be placed horizontally rather than vertically in flood-prone zones. By orienting the boards horizontally, only the bottom sheets would need to be replaced.

This work was funded by the Department of Homeland Security, the Southeast Region Research Initiative at the Department of Energy's Oak Ridge National Laboratory and the National Science Foundation. Professor emeritus Terry Amburgey and former assistant professor Shane Kitchens also worked on this research. ❖

BUILDING A BETTER DECK

CURRENTLY, MOST HOMEOWNERS HAVE TO POWER wash their deck annually to keep it looking good. Because of this, wood fiber plastic decking has gained popularity as an alternative to wood decking in recent years. This alternative system is significantly more expensive than traditional wood deck boards.

Water, ultraviolet rays and microbial organisms impact wood. Water penetrates the wood, creating checking, or splitting. Ultraviolet rays compromise the wood's color, turning it gray. Microbes attack the surface of the wood turning the gray to black.

Preserving the wood requires a three-pronged approach, according to Darrel Nicholas, Sustainable Bioproducts professor in the Forest and Wildlife Research Center. He along with Hui Wan, also a Sustainable Bioproducts associate professor in FWRC, is evaluating ways to improve the performance of southern pine deck boards. Profiling, preservative treatment and surface coating all help reduce the signs of weathering.


Deck boards typically have a flat, smooth surface. In profiling, a machine creates a ribbed, or grooved, surface profile, which helps reduce the visual signs of checking. Checking tends to occur in the grooves so the damage is less visible overall.

Preservative treatment creates a barrier, protecting the wood against biodegradation from water, decay and insect attack. While boards are normally treated with copper-based preservatives, EL2, a new water-repellant preservative system, seems to provide better overall protection.

The surface coating works like a sunscreen protecting the wood from ultraviolet rays. This protection helps wood keep its color. Nicholas applies micronized zinc oxide and titanium dioxide particles as separate surface coatings to deck boards, hoping to improve the wood's color retention. While both surface coatings provide protection, titanium dioxide helps prevent discoloration over a longer period of time. Research is ongoing.

As the surface coating research continues, FWRC scientists also hope to conduct research to improve existing treatments, by testing different preservative chemicals and polymers to help stabilize the wood, reduce checking and improve color retention.

Their long-term objective is to create a process that improves the appearance, longevity and decay resistance of southern pine deck boards. ❖



Wood decks are impacted by water, ultraviolet rays and microbial organisms.



Graduate student Frederico França measures lumber. (Photo by Kevin Hudson)

ADDING VALUE TO SOUTHERN FORESTS

DAN SEALE, SUSTAINABLE BIOPRODUCTS PROFESSOR in the Forest and Wildlife Research Center, specializes in forest products and is passionate about Mississippians making the most of this abundant natural resource. With a background in agricultural economics, he is also fascinated by data, and how it can be used in support of sustainable forest products.

In 2015, Seale, along with co-principal investigators Rubin Shmulsky, head of the Department of Sustainable Bioproducts and associate director of the Sustainable Energy Research Center, and former associate extension professor David Jones, began a project designed to add value to Southern forests.

Quick growth, coupled with early thinning of stands to generate income, results in forest products with different characteristics than those created from older timber harvested generations ago.

Seale, Shmulsky, Jones and a team of graduate students are gathering lumber processed at mills from across the Southeast and conducting a series of tests related to the lumber grade, stiffness, and strength. They will characterize the physical attributes of each board, use non-destructive techniques including stress

wave analysis to predict strength and stiffness. They will break the boards and analyze the accuracy of the tools used to predict lumber values. Once broken, industry methods will be used to characterize the break or failure of each board. Each board will have more than 50 measurements and resultant calculations.

Finally, they will synthesize the data and create statistical models that can be used to develop new forest products valuation techniques and standards, investigate new products and markets and address any challenges they encounter.

To conduct this testing, an elaborate system has been set up at the Department of Sustainable Bioproducts. It includes a video system that will record each board as it is broken, as well as a variety of instruments that test different strength factors, such as stress waves and vibration; all with the aim of improving lumber performance and valuation.

“No other university has a set up like this,” Seale said. “We’re the only one in the wood industry using this type of instrumentation. We are serious about finding ways to enhance the value of Southern forests.”

The U.S. Department of Agriculture is funding the project. ❖

FRANKLIN FURNITURE INSTITUTE

The mission of the Franklin Furniture Institute is to help sustain and increase the competitiveness of the furniture and related industries in Mississippi and beyond.

RESEARCH OBJECTIVES:

1. Become a National Resource Center for Furniture-related Issues
2. Enhance Sustainable Design in Furniture and Home Furnishings
3. Provide Testing Capabilities in Components, Frame, Fabric, Flammability and Packaging



TAKE A SEAT

RESearchers in the MSU Forest and Wildlife Research Center and the Franklin Furniture Institute recently partnered with the Business and Institutional Furniture Manufacturers Association, or BIFMA, to update office chair standards.

Jilei Zhang, Sustainable Bioproducts professor; Robert Tackett, Sustainable Bioproducts senior research associate and Bill Martin, director of the Franklin Furniture Institute conducted research that helped establish office chair standards for five percent of the population not considered by previous standards.

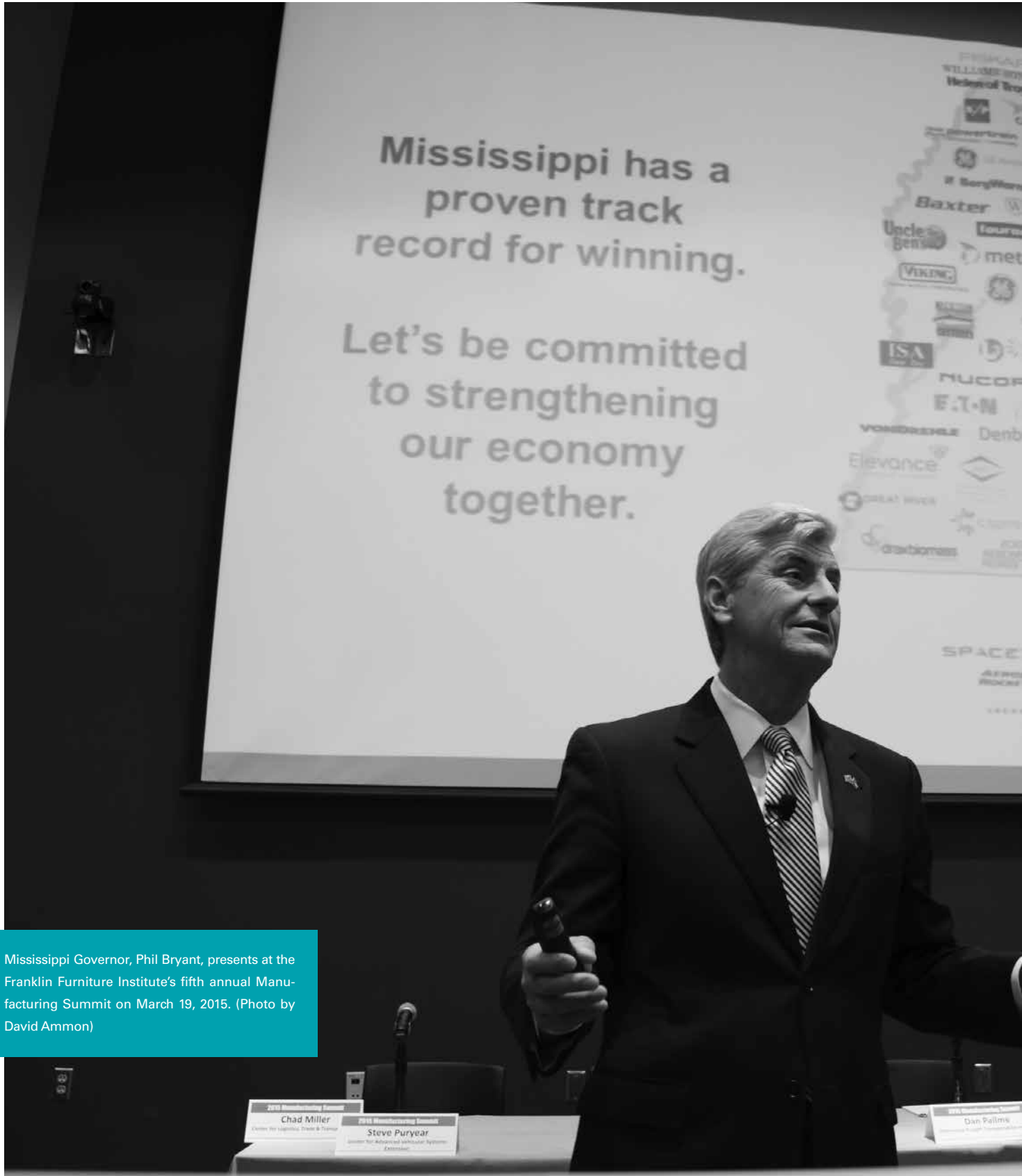
Prior to the research, the American National Standard for Office Furnishings based standards for general-purpose office chairs on 95 percent of the U.S. population. As such, a male in the 95th percentile weighed approximately 253 pounds while a male in the 99.5th percentile weighed about 400 pounds. To bridge that gap, researchers sought to establish standards for occupants between 350 and 400 pounds, the five percent of the population not represented.

Researchers examined the forces exerted on the arms, legs, seat and back of office chairs during sitting by human subjects in that weight range.

Subjects completed tasks that emulated actions in an office environment including sitting normally, sitting hard and shifting weight while sitting by turning and reaching for an object. Seat, back, arm and leg loads were tested and evaluated. Maximum loads were determined. On average, 157 percent of a person's body weight impacted the seat when sitting and 33 percent and 22 percent impacted the back and arms, respectively during sitting.

The results of the study informed an updated standard for general-purpose large occupant office chairs published by BIFMA in January 2015. This standard is verified by the Approved American National Standard, or ANSI, and serves as an American National Standard for Office Furniture.

While adhering to the standard is voluntary, it defines perimeters for furniture manufacturers when assessing the safety, durability and structural adequacy of general-purpose large occupant office chairs, helping them build a better, safer chair. ❖



Mississippi Governor, Phil Bryant, presents at the Franklin Furniture Institute's fifth annual Manufacturing Summit on March 19, 2015. (Photo by David Ammon)



MANUFACTURING SUMMIT

GOVERNOR PHIL BRYANT AND HAL SIRKIN, SENIOR partner and managing director of the Chicago-based Boston Consulting Group, were featured guests at Franklin Furniture Institute's fifth annual Manufacturing Summit on March 19, 2015. With over 100 attendees, the theme for this year's Summit was "Focus on the Future." Former MSU President Malcolm Portera and vice president of MSU research and economic development David Shaw also joined in addressing the manufacturing trends in Mississippi and the surrounding region.

Additionally, Bill Perdue, vice president of regulatory affairs at American Home Furnishings Alliance, shared the latest regulations furniture manufacturers must meet to remain competitive. Chad Miller, director of the Center for Logistics, Trade and Transportation at University of Southern Mississippi, led a panel discussion about the future of logistics and transportation in manufacturing. Panelists included Bryan Hunt, Seacor AMH (America's Marine Highway) LLC; Steve Puryear, with MSU's Center for Advanced Vehicular Systems Extension; and Dan Pallme, of the University of Memphis' Intermodal Freight Transportation Institute.

The Summit, held by MSU and American Home Furnishings Alliance, was sponsored by Mississippi Manufacturers Association, Mississippi State University and the Rural Jobs Accelerator Grant Program. ❖

CENTER FOR RESOLVING HUMAN- WILDLIFE CONFLICTS

The Center for Resolving Human-Wildlife Conflicts seeks to improve human-wildlife coexistence and reduce conflicts through research, education and service.

RESEARCH OBJECTIVES:

1. Improve Wildlife and Habitat Management
2. Support Ecosystem Restoration
3. Remove Invasive Species



The Federal Aviation Administration reports that more than 108,000 wildlife strikes to airplanes occurred in the last 19 years, with an average of 20 wildlife strikes reported daily from 2004-2008. (Photo by Caters News Agency)

CLEARED FOR LANDING

GOING THROUGH SECURITY, ARRIVING IN TIME for boarding and making a connecting flight are a few of the concerns passengers worry about when flying. Collisions with wildlife in an aircraft during take-off or landing are usually not on the minds of travelers flying the friendly skies.

However, airport managers and the Federal Aviation Administration work routinely around airport properties to ensure wildlife do not threaten lives or cause economic damage.

Several projects in the university's Forest and Wildlife Research Center, in collaboration with the U.S.D.A. Wildlife Services National Wildlife Research Center, are assisting airport managers in creating habitat that deters wildlife around the airport. The project is aimed at replacing landscape around the airport to discourage wildlife from using the vast space for nesting, feeding and hunting.

The problem of wildlife-airplane conflicts is costly. Between 1990 and 2010, about \$1.4 billion in economic losses were incurred from wildlife-airplane collisions.

More than 97 percent of wildlife incidents with U.S. aircraft involve birds; however 87 percent of these incidents do not cause damage. In contrast, only 3 percent of wildlife incidents are caused by mammals, including deer, coyote and dogs, but over half of these encounters cause damage to the aircraft.

Scientists found that during the same 20 year period, 2,558 mammal incidents with aircraft were reported. This included 346 incidents with coyotes and 909 with white-tailed deer.

Keeping mammals off the tarmac is relatively easy with fencing being the most effective control technique for airports. Controlling birds at airports is a little more complex.

Nearly 100,000 bird strikes were reported during this same time span, according to the Federal Aviation Administration's National Wildlife Strike Database. Birds causing the most damage have a larger body mass and include geese, ducks and turkey vultures. Ten out of the 15 most hazardous bird species or species groups are strongly associated with water.

Jerry Belant, Wildlife, Fisheries and Aquaculture professor, has identified several factors that can affect the abundance of birds occupying the airport. These include grass type, grass height when mowed and even mowing time.

Scientists have also found that the availability of water surrounding the airport is a huge draw for waterfowl and waterbirds, some of the most hazardous for airplanes. Agricultural crops surrounding the airport also must be considered. Grain crops attract wildlife more than other types of crops and may create additional hazards.

Wildlife biologists encourage airport managers to implement programs that reduce wildlife habitat where feasible. While each wildlife management plan is regional in scope, scientists at Mississippi State have found that deliberately altering the habitat can reduce the potential hazards of collision. ❖



THE ONSLAUGHT OF WILD HOGS



CURRENTLY, ANNUAL COSTS IN THE U.S. ASSOCIATED with wild hog damage and control top \$1.5 billion. Experts anticipate that number to climb.

Bronson Strickland, Forest and Wildlife Research Center wildlife scientist and associate extension professor, and Jessica Tegt, assistant extension professor, are conducting two wild hog studies to learn more about this endemic issue plaguing Mississippi.

The first study takes a big picture approach assessing wild hog damage throughout the state. The second study involves site-specific wild hog research.

In the first study, scientists developed a survey focused on measuring the broad spectrum of damage across the state, from destruction in agricultural fields to golf course damage and everything in between. They collected information about the public's perception of wild hogs. More than 300 surveys revealed landowners across the state reported wild hog damage on their property. From there, scientists randomly sampled 75 surveys and began conducting in-person interviews and validating damage. Previously, a map produced by the Southeastern Cooperative Wildlife Disease Study in 2009 showed wild hogs occupied about 38 percent of Mississippi. Initial findings from the surveys, however, indicate hogs are much more widespread than previously thought. Data collection will be complete in August 2015, with a full report and analysis finished in August 2016.

The second study, which began in May 2015, assesses damage at the field level. Fifty wild hogs at two separate study areas near row-crop agriculture will be captured and tagged with GPS collars. Scientists will track movement and activity, evaluating how hogs navigate the landscape and record the damage caused to crops. Researchers will partner with MSU's Geosystems Research Institute to conduct flyovers by unmanned aerial vehicles to develop models that will hopefully result in accurate assessment of damage from the air. While the study is funded for two years, scientists hope to include a second phase over the course of five years. Phase two will include removing all hogs from the study areas and measuring the changes in crop damage. From there, scientists will be able to precisely quantify the costs and savings associated with controlling wild hogs.

Scientists in the Center for Resolving Human-Wildlife Conflicts hope this research will provide a clear picture of the problem and inform solutions to help landowners gain control of wild hogs in Mississippi. ❖

UNDERGRADUATE RESEARCH

College of Forest Resources students are excelling inside the classroom and now the laboratory, thanks to an initiative entitled the Undergraduate Research Scholars Program.



RODRIGO LEITE

Rodrigo Leite, a recent forestry graduate, was an undergraduate research scholar in the College of Forest Resources in 2014. Leite studied oak trees in the Lower Mississippi Alluvial Valley. Once the largest bottomland forest in the U.S., the LMAV takes up just 25 percent of its original land cover. Forest restoration in the LMAV has been implemented over the past several decades to restore forest cover for the enhancement of wildlife habitat, soil conservation, and water quality. Leite studied tree growth rates and created a stem profile model for oak trees ranging in age from 8 to 20 years located in afforestation stands. He expected the study to increase knowledge of oak growth and yield for afforestation stands in the LMAV. The information will be important in developing management approaches for afforestation stands, particularly as they mature. Dr. Brent Frey, assistant forestry professor in the College of Forest Resources and researcher in the Forest and Wildlife Research Center, served as Leite's advisor. Forestry graduate student, Jonathon Stoll, served on the project as well.



LISA GARRIGUES

Precipitation as a vital component of nutrient in forest ecosystems passes through the forest canopy as throughfall. Lisa Garrigues assessed the temporal variation in throughfall during the winter season, measuring soil nutrient composition and respiration, and determining the relationship between throughfall and soil properties. Her results determined that throughfall partitioning as a percentage of total precipitation increased exponentially with increased rainfall. She attributed this trend to the canopy saturation and intensity of rainfall. Throughfall remains low until saturation occurs, which happens during heavy or long rainfall events. She also found that the litter layer contained 31.5 percent carbon, which is likely due to nutrients stored within pine needles and hardwood

leaves. She noted carbon content decreased markedly with the soil horizon. She determined that nitrogen levels were relatively low and also decreased with depth in the horizon. She noted that soil respiration decreased in the winter season when the temperature was lower. Dr. Courtney Siegert, assistant forestry professor in the College and Forest Resources and researcher in the Forest and Wildlife Research Center; Dr. John Riggins, associate professor in the Department of Biochemistry, Molecular Biology, Entomology and Plant Pathology in the College of Agriculture and Life Sciences; and Dr. Natalie Clay, postdoctoral research associate also in the Department of Biochemistry, Molecular Biology, Entomology and Plant Pathology, helped facilitate and assist with Garrigues' research.



TERESA HILL

There is a need to attract more people into trapping in order to help mitigate animal-induced damage to flora and fauna. Teresa B. Hill, a senior in the Department of Wildlife, Fisheries and Aquaculture, is studying participation in furbearer trapping programs implemented to manage human-wildlife conflicts. She is trying to determine if trapper population is a homogenous group or if there is heterogeneity in order to assist management agencies in developing strategies to attract/retain participants in trapping. Her undergraduate research advisor is Dr. Kevin Hunt, wildlife, fisheries and aquaculture professor in the College of Forest Resources and researcher in the Forest and Wildlife Research Center.



BRYANT HALEY

Bryant Haley, as a senior in the Department of Wildlife, Fisheries and Aquaculture, studied the spatio-temporal distributions of the zooplankton community in a Puerto Rico reservoir. Since zooplankton provide an essential forage base for the development and maintenance of a balanced recreational fishery, Haley sought to learn more about the zooplankton community in the Carite reservoir in Puerto Rico. He assessed the movement of the zooplankton community over the course of a year. He observed little difference between densities of zooplankton collected at inshore sites compared to limnetic sites. Dawn and dusk comparison found lower population density at dawn. Seasonally, the greatest population abundances were observed in the autumn and the lowest were observed in the spring. The research was part of a project between Mississippi State University and the Puerto Rican Department of Environment and Natural Resources in hopes of improving sport fisheries in reservoirs by understanding the underlying water quality potential of each reservoir. Wildlife, Fisheries and Aquaculture graduate student, Clint Lloyd, contributed to the research. Dr. Wes Neal, associate wildlife, fisheries and aquaculture extension professor and researcher in the Forest and Wildlife Research Center was the project advisor. Haley has since graduated and is currently pursuing a graduate degree within the department.

CONNER ALMOND

Conner Almond, a senior majoring in Wildlife, Fisheries and Aquaculture, studied pond sliders to learn more about population dynamics and community interactions in aquaculture ecosystems. He studied the spatial and trophic ecology of pond sliders within unique ecosystems and learned how diet and selection for various food resources influenced the movements of aquatic turtles. He hopes his research will help inform the degree to which this organism interacts between different wetlands. Learning more about these types of interactions can provide insight into ecological patterns, wetland conservation, and ecosystem management. Almond's undergraduate research advisor was Dr. Scott Rush, assistant wildlife, fisheries and aquaculture professor in the College of Forest Resources and researcher in the Forest and Wildlife Research Center.



TAYLOR HACKEMACK

Taylor Hackemack, a senior in the Department of Wildlife, Fisheries and Aquaculture, studied buffering capacity, a measure of resistance to changes in pH of a substance, in hardwood and softwood sawdust in three universal buffers. She sought to detect how buffer chemistry affected the rate at which an equilibrium pH is reached. She hypothesized that while final pH of each combination of wood and buffering solution should yield significantly similar results, subtle differences in chemical composition of the buffers used would have some effect on the rate of pH equalization due to different buffering chemicals' strengths and amounts needed to react to the acetyl groups and other signature constituents in the wood. No significant difference between the wood samples were found, although it was shown that the universal buffer mix worked the best on both hard- and softwood due to its higher calculated buffering capacity abilities. Dr. Dragica Jeremic, Sustainable Bioproducts assistant professor in the College of Forest Resources and the Forest and Wildlife Research Center, served as Hackemack's advisor.



WESLEY BURGER

Wesley Burger, a senior in the Department of Wildlife, Fisheries and Aquaculture, sought to determine if Gulf killifish, a popular baitfish, could grow and survive in freshwater ponds. The species is known to tolerate a wide range of salinities. Burger based his study off of two classes of Gulf killifish: a brackish water class less than two months old and a freshwater class less than six months old. The project lasted 16 weeks and ponds were sampled biweekly. During sampling bulk weight and individual growth were measured. All fish were removed at the project's end. 100 fish from each pond were measured for individual weight and length. The remaining fish were measured in groups of 30 for bulk weight. Burger concluded that Gulf killifish can grow, survive and reproduce in freshwater ponds. He also noted promising results for the grow-out of juvenile killifish. Wildlife, fisheries and aquaculture associate professor Dr. Peter Allen served as Burger's advisor.

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THESES AND DISSERTATIONS

DISSERTATIONS

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BY THE NUMBERS

RESEARCH PROJECTS

PEOPLE

237

Projects Active During FY2015

81

Masters students

80

Research Sponsors

54

Doctoral students

138

Refereed Publications

59

Faculty

\$6.7M

Total Sponsored Research Funding

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U.S.D.A. Agricultural Research Service
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