RESTORING AND MANAGING LONGLEAF PINE ECOSYSTEMS

To provide knowledge and strategies for restoring, managing, and sustaining longleaf pine ecosystems

Initiated during the realignment of the Southern Research Station in 2007, SRS-RWU-4158 is a team of 6 scientists and support personnel whose mission is to provide knowledge and strategies for restoring, managing, and sustaining longleaf pine ecosystems in the southeastern United States.

Scientists in the Unit work on two overarching research problems. They design and carry out research studies that seek to solve these problems or overcome related limitations to our knowledge of longleaf pine ecosystems.

The Unit's scientists work with partners to provide knowledge and technologies needed to successfully restore and manage these ecosystems which are increasingly affected by a variety of human and natural influences in times of environmental stress and cultural and climatic change. The problem areas are as follows:

1. Providing fundamental physiological knowledge needed to understand the processes that affect longleaf pine seedling production, establishment, growth, and development.

2. Providing ecological information about population and community processes that affect restoration of longleaf pine woodlands and at-risk native plant species.

United States Department of Agriculture, FOREST SERVICE, Southern Research Station

PAST AND ON-GOING RESEARCH SUMMARIES

KRISTINA CONNOR, Project Leader
Auburn, AL (334-826-8700)

Dr. Connor received her Ph.D. in Forest Ecology from Utah State University in 1988. She researches the regeneration and reproductive biology of various plant species. Her early work focused on the physiology and biochemistry of "recalcitrant" forest tree seeds. Such seeds are sensitive to moisture loss and have short storage lifespans. Her work now addresses understory seed production, dormancy, storage potential, and longevity in the seed bank. The Range-Wide Conservation Plan for longleaf pine lists understory restoration as a key element in its overall strategy. However, to be successful large-scale outplantings of understory plants will require (1) sufficient quantities of seeds from understory species and (2) information on the basic life history of these plants. While major understory species, such as wiregrass and bluestem, have been studied, little is known of less prominent native species such as pineland nerveray and various pitcher plant species. In addition to studies focused on seed bank survival of such species, Dr. Connor examines seed storage potential and various aspects of seed dormancy.

DALE BROCKWAY, Research Ecologist
Auburn, AL (334-826-8700)

Dr. Brockway received his Ph.D. in Forest Ecology from Michigan State University in 1979. Serving in the northern, western, and southern U.S., he has worked in management and research focused on water quality, soil productivity, ecological classification, conservation of biodiversity, fire ecology, ecosystem restoration, and forest management through selection silviculture. Now his work emphasizes developing approaches for restoring longleaf pine ecosystems and new methods for sustainably managing longleaf pine forests. His current research includes (1) a Comparative Analysis of Reproduction Techniques for sustainably managing longleaf pine forests, (2) field evaluation of the newly-developed Proportional-B (Pro-B) Method for Selection Silviculture, (3) development of effective approaches (mechanical, chemical, and fire) for efficiently restoring longleaf pine forests following hurricane-wind damage, and (4) studies with several university cooperators on the accuracy of new remote sensing technology, overstory-understory stand structure and its influence on regeneration, and fundamental soil and plant carbon dynamics in longleaf pine ecosystems.

JAMES D. HAYWOOD, Research Silviculturalist
Pineville, LA (318-473-7226)

Dr. Haywood has worked in Pineville, Louisiana since 1978 and has a PhD in Forestry, from Louisiana State University, Baton Rouge, Louisiana. He works collaboratively with Mary Anne Sword Sayer and Shi-Jean Susana Sung to: (1) evaluate longleaf pine seedling container sizes and types, field nutrition trials, and influence of prescribed fire on seedling physiology; (2) assess the effects of prescribed fire, herbicide application, and fertilization on the growth and stand structure of young longleaf pine plantations; and (3) assess the effects of harvesting and regeneration practices on long-term productivity of pine stands through multiple rotations. This body of research is supporting the America's Longleaf Initiative to increase the acreage of longleaf pine across the South. He also collaborates with the Kisatchie National Forest, prescribed fire and longleaf pine restoration efforts, Louisiana Tech University, and other Research Work Units in the Southern Research Station.

PAST AND ON-GOING RESEARCH SUMMARIES

Shi-Jean Susana Sung, Research Plant Physiologist

Pineville, LA (318-473-7233)

Dr. Sung received her Ph.D. from Auburn University. Her early work focused on the physiology and biochemistry of carbohydrate metabolism of crops and forest trees. She has investigated the effects of nursery fertilization protocols, tree genetics, and silvicultural management practices on bareroot seedling quality and field performance for loblolly pine and several oak species. Her research now focuses on the artificial regeneration of longleaf pine ecosystem. More than 75% of seedlings planted for longleaf pine restoration are of container stock. However, sapling physical instability, such as leaning and toppling, is observed mostly in container stock stands, especially in the hurricane impact zone. Although naturally established longleaf pine normally has good stature and a deep taproot, its seedlings may stay in the grass-like stage for up to 7 years. Dr. Sung addresses short- and long-term effects of container cavity type, and volume, nursery fertilization regime, and site preparation on container seedling survival, accelerated height growth, and sapling physical stability.

Mary Anne Sword Sayer, Research Plant Physiologist,

Pineville, LA (318-473-7275)

After earning her Ph.D. in forestry at the University of Missouri in 1991, Dr. Sword Sayer began her Forest Service research by focusing on interactions between the root system and crown that affect pine production and how these relationships are affected by silviculture. Interest in root-crown linkages in burned stands led her to study physiological processes that ensure vigor regardless of scorch. This effort is ongoing with co-located scientists and Louisiana Tech University. Other research addresses how non-industrial pines adapt to sustain vigor and how silviculture supports these adaptations. With Auburn University, one area of emphasis is secondary nutrition imbalances that arise in response to environmental extremes. Another topic is limitations to root growth by interaction among soil properties, site vegetation, and drought. Also, in support of the America's Longleaf Initiative, cooperative research with co-located scientists strives to increase longleaf establishment on private lands by improving root system attributes that add to structural soundness, and the initiation and rate of juvenile height growth.

Joan Walker, Research Plant Ecologist

Clemson, SC (864-656-4822)

Dr. Walker began working in longleaf pine ecosystems as a graduate student at the University of North Carolina at Chapel Hill where she earned M.S. (Botany, 1980) and Ph.D. (Biology, 1985) degrees. She has held both National Forest management and research positions within the Forest Service. Dr. Walker studies the ecology of longleaf pine communities to develop effective restoration strategies. She focuses on the ground layer community, but also tests alternative silviculture approaches to pine establishment. A current project investigates methods for gradually converting stands from loblolly pine to longleaf pine dominance. She studies the ecology and population biology of both common and rare species of the longleaf ecosystem. This work ranges from describing genetic diversity and evaluating management effects, to tracking population changes in long-term studies, work that will be especially valuable as climate change impacts are realized.

Erwin Chambliss
Auburn, AL

Hilliard Gibbs
Auburn, AL

Ron Tucker
Brewton, AL

Vicki Knepp
Auburn, AL

LABORATORY/OFFICE FACILITIES, SPECIALIZED EQUIPMENT

Auburn, AL

The Unit occupies offices and laboratory space in the Forest Service-owned G.W. Andrews Forestry Sciences Laboratory, located at the edge of the Auburn University campus. The building is shared with two other Forest Service units. The Seed Biology Laboratory is equipped with two growth chambers and a cold storage chamber.

Brewton, AL

The Escambia Experimental Forest, located near Brewton, AL, is the base of operations for long-term field research. In addition to office space, a storage shed/warehouse sheltering tractors and all-terrain vehicles is located on the property.

Clemson, SC

The Unit occupies offices and a small research laboratory in Clemson University's School of Agricultural, Forestry, and Environmental Sciences and leases a greenhouse in the Biosystems Research Complex where temperature controlled growing space and propagation facilities are available. The location affords ready access to the University library system, the South Carolina Botanical Garden, and the Clemson Experimental Forest. Cooperators provide access to additional laboratory space and basic research equipment.

Pineville, LA

The Unit is co-located with Kisatchie National Forest Headquarters and the Forest Health Protection Western Field Office, occupying offices, laboratories, a headhouse, and greenhouses at the Alexandria Forestry Center. Laboratories are furnished with freeze driers, spectrophotometers, centrifuges, a fluorometer, ovens, refrigerators, and freezers for storing samples. The Palustris Experimental Forest with its offices and storage buildings, Li-Cor portable photosynthesis systems, penetrometer, laser measurement devices, large forced-air oven, tractors, and all-terrain utility vehicles, serves as a stage for field experiments.

Shawna Reid
Clemson, SC

Bill Boyer
Auburn, AL

David Dyson
Brewton, AL

Kristi Wharton
Pineville, LA

RESEARCH SUMMARIES

Silvopasture: Management systems that combine timber production and grazing are being evaluated for longleaf pine to allow landowners, especially those with limited resources, to generate an annual income from grazing livestock, like cattle or goats, while producing high quality sawlogs.

The Root-Soil Interface: Longleaf pine relies on the development of an extensive root system for adequate supplies of water and nutrients. Extreme soil properties, like high bulk density, and root damage from poorly timed prescribed fire can limit root system development and longleaf productivity.

Restoration & Hurricane Recovery: Loblolly pine forests planted on coastal plain sites previously dominated by longleaf have been prone to severe damage from hurricanes. Cost-effective methods to restore longleaf pine ecosystems that are inherently more resistant to wind and hurricane impacts are being developed.

Sustaining Longleaf Vigor: Carbohydrate support of longleaf's expansive root system is the key to ensuring tree vigor. However, tree productivity and health can be derailed by improperly applied prescribed fire, prolonged drought, and climate change. Silvicultural methods to balance the demand for carbohydrates are being developed.

Regeneration & the Pro-B Method: Longleaf pine management is best suited to uneven-aged methods like Pro-B. This is a cost effective, single-pass approach to selection silviculture that is easy to learn. It establishes a stable stand structure that can yield a sustainable stream of forest products while providing a full array of ecosystem services.

Seedling Quality: Improving early field performance of container-grown longleaf pine seedlings is essential for restoration of this species to its natural range. Defects in longleaf seedling nursery stock quality can persist for many years after planting, affecting productivity and survival rates.

Pitcher Plants: There are seven species of the pitcher plants native to the Gulf Coast region. They grow in bogs and wet longleaf pine savannahs. The plants are carnivorous, trapping insects in hollow, water-filled tubes. Conservation and restoration efforts are underway requiring further study of their seed biology and ecology.

Prescribed Fire: Longleaf pines can tolerate intense fires that move quickly through very flammable fine fuels comprised of grasses, forbs, and low brush. This is largely due to the trees' thick bark, new terminal shoots that have a large girth, dense tuffs of needles that protect the new buds, and a physiology that rapidly replaces dead foliage.

Displacement of Sapling Stems: This phenomenon is observed in some young longleaf pine stands regenerated with container stock but not when bareroot stock is used. The problems appears to be linked to the root system architecture of the seedling stock, resulting in saplings that are more vulnerable to the impact of wind and ice storms.

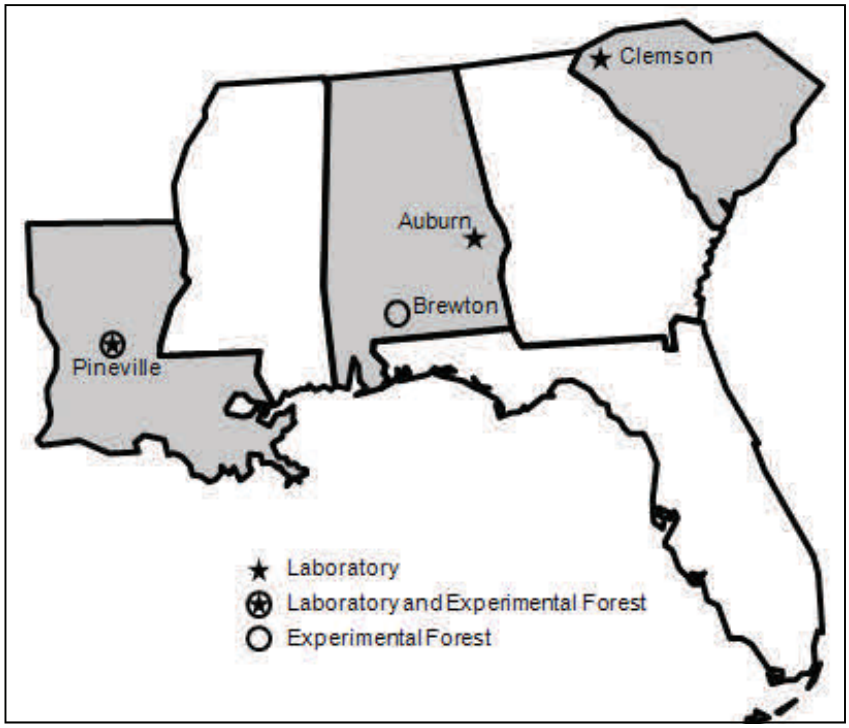
Groundcover Restoration: Groundcover in longleaf stands is species-rich, provides habitat for wildlife, and produces fuel needed to carry surface fires. A vigorous groundcover facilitates prescribed burning, an economical method for achieving landowner objectives. Managers need protocols and affordable plant materials which our research team strives to provide.

Plant Species of Management Concern: To manage rare plant species sustainably, their basic ecology must be understood Our team features expertise in reproductive biology, physiology, and population dynamics. We focus on the many fire-adapted rare species associated with LLP, but also study other understory species native to longleaf pine ecosystem.

EXPERIMENTAL FORESTS

The Escambia Experimental Forest (Escambia County, Brewton, AL)
The forest was established in 1947 through a 99-year lease agreement with the T.R. Miller Mill Company of Brewton, AL. The 3,000-acre tract in southwest Alabama constitutes a unique example of longleaf pine ecosystems in all stages of development. Research involves all aspects of longleaf pine natural regeneration. Long-term studies and demonstrations include stand management and management alternatives; growth and yield of even-aged natural stands; fire ecology; and effects of seedling container types on root development and early seedling performance.

The Palustris Experimental Forest (Kisatchie National Forest, Pineville, LA)
The forest consists of two tracts totaling about 7,500 acres. The J.K. Johnson Tract, established in 1935, is the site of numerous long-term studies, such as a longleaf pine thinning regime study, now over 75 years old. The Longleaf Tract, established in 1951, is the site of some of the most intensive multi-resource research in the South. Both Tracts serve as areas for evaluating seedling container sizes and types, nursery and field nutrition trials, and the influence of prescribed fire on sapling physiology. Long-term studies are underway to evaluate management strategies that increase forest productivity and assess effects of forest management practices on sustainable soil productivity.




Jacob Floyd
Pineville, LA


Heather Irwin
Clemson, SC


Alan Springer
Pineville, LA


Bryan Mudder
Clemson, SC


Dan Leduc
Pineville, LA