SRS-4159 -- Ecology and Management of Southern Pines
Monticello, AR; Hot Springs, AR; Pineville, LA; Nacogdoches, TX
Project Leader: James M. Guldin

Mission: Our mission is to develop and disseminate the scientific information necessary to realize the full range of benefits from vegetation, wildlife, and soils in pine-dominated forest ecosystems of the southeastern United States. Our emphasis is on mixed loblolly-shortleaf pine and pine-hardwood forests of the West Gulf Coastal Plain and the shortleaf pine and pine-hardwood forests of the Ouachita and Ozark Mountains.

Area of Research Applicability: Regional—Ecosystems dominated by southern pine and mixed pine-hardwood forest cover types in the southeastern United States; National—Comparative relationships in ecology and management of southern pine forest types with other pine-dominated forest types in the United States; International—Comparative relationships in ecology and management of southern pine forest types with other pine-dominated forest types around the world.

Problem 1. We will discover and develop new knowledge about the ecology of southern pine-dominated forest ecosystems, to refine the silvicultural principles and practices for these ecosystems, so that land managers can make better management decisions and take more effective action to achieve desired results on public and private forest lands in the South.

Problem 1a. We will quantify the establishment and early development of natural and artificial regeneration of pines and hardwoods, and will use that knowledge to manage and restore pine-dominated forest stands in the South.

Problem 1b. We will discover and develop knowledge about the ecological patterns and processes that govern forest stand dynamics and development, so that we can improve the silvicultural practices used to manage immature, mature, mixed-age, and old-growth pine-dominated forest stands in the South.

Problem 1c. We will quantify the cumulative and long-term responses of ecosystem dynamics to changes in soil quality brought about by management practices such as harvesting, fire, fertilizers, herbicides, and various forms of mechanized traffic, so that managers can more effectively maintain and improve the health, sustainability, and productivity of southern pine-dominated forest stands.

Problem 1d. We will discover and develop knowledge about the interactions of soils and silvicultural practices, so that managers can more effectively manage southern pine-dominated forests for diverse resource outcomes and outputs such as timber, cellulosic biomass for bioenergy, high quality wildlife habitat, and abundant and clean water.

Anticipated outcomes in Problem 1:
-develop predictive models for resprouting of planted and naturally-regenerated

shortleaf pine seedlings when topkilled by prescribed burning, which will provide guidance for land managers when young stands are part of a landscape-scale prescribed fire burning program (1a)

-provide guidelines for land managers on the use of planted pine seedlings to ameliorate failures or shortfalls in natural regeneration under even-aged and uneven-aged reproduction cutting methods (1a)

-develop guidelines for thinning to accelerate development of mixed pine-hardwood stands, which meet needs of landowners interested in optimizing diversity (1b)

-make recommendations on modifying traditional uneven-aged silvicultural prescriptions to integrate retention of biological legacy elements above recommended diameter limits while maintaining acceptable development of new age cohorts, so that timber production can be integrated with greater structural and habitat diversity for wildlife (1b)

-develop one-pass marking rules for uneven-aged silvicultural prescriptions that allow a forester to inventory and mark those stands at the same time rather than in separate entries, saving both time and money (1b)

-refine computer models to better predict the effects of prescribed burning on growth and yield of southern pine stands (1c)

-give recommendations to landowners about the timing and intensity of forest operations to limit soil compaction, and to improve soil structure adversely affected by compaction (1c)

-make recommendations on silvicultural treatments needed to maintain forest health and productivity under different intensities of site preparation and utilization, so that foresters can sustainably manage for biomass and biofuels (1d)

-provide guidance on maintaining productive soils that managers can use when managing for different mixtures of forest resources on public and private forest lands. (1d)

Problem 2. We will synthesize and evaluate the influence of regional, continental, and global forcing factors on pine-dominated forest ecosystems in the South, and will provide land owners and managers with the tools to manage healthy, diverse, and productive southern pine ecosystems that are resilient in response to these changes

Problem 2a. We will discover and develop knowledge about the effects of climate change, large-scale natural disturbances, and other anthropogenic influences on forest ecosystems so that managers can anticipate and detect when forest ecosystems may be affected by these events, and make appropriate changes in management plans and prescriptions

Problem 2b. We will synthesize and evaluate the cumulative ecological effects resulting from management activities imposed in varying patterns and intensities across a forested landscape, so that stand and forest management decisions may be made and actions taken in the context of larger landscapes fragmented by different ownership patterns.

Problem 2c. We will develop and discover knowledge on natural patterns, processes,

historical conditions, and disturbances in southern pine-dominated stands and landscapes so that managers can identify trajectories and alter management actions to restore and enhance southern pine ecosystems

Anticipated outcomes for Problem 2:

-refine computer models to include the influence of regional ice storms on growth and yield of southern pines (2a)
-develop internet-based models of hazard, exposure, and risk for outbreaks of native insect species such as southern pine beetle and red oak borer that landowners can use to make better decisions about management alternatives in pine, pine-hardwood, and hardwood-pine stands (2a)
-publish subjective decision models on the flexibility of different silvicultural systems in southern pine-domated ecosystems under projected changes in regional climate (2a)
-develop GIS-based decision support models for southern pine stands that give landowners the tools they need to make resource management decisions on their property, in the context of management action or inaction on adjacent properties within and across forested landscapes (2b)
-quantify presettlement forest stucture and function so that those wishing to recreate those conditions have tools available to guide and inform their management decisions (2c)
-evaluate and synthesize information from ongoing forest restoration prescriptions in southern pine stands across the South, to provide management guidelines and expected outcomes as restoration prescriptions are implemented across a wider variety of forest types (2c)

Problem 3. We will discover, develop, and synthesize knowledge about the effects of forest management, insect pests, and climate change on wildlife and wildlife habitat in southern pine-dominated ecosystems, so that managers have better tools to restore and manage wildlife populations that are healthy, diverse, and sustainable.

Problem 3a. We will develop and discover knowledge about how forest management, forest fragmentation, and climate change affect the quality and quantity of riparian/aquatic habitats and associated wildlife species, so land managers can make better decisions about managing riparian zones and wetlands for resource benefits that feature wildlife species of interest.

Problem 3b. We will synthesize and evaluate the interactions of silviculture on red-cockaded woodpeckers, other cavity nesters and southern pine bark beetles, so that land managers interested in managing for this endangered woodpecker can make more effective management decisions.

Problem 3c. We will quantify, evaluate, and synthesize the effects of even-aged and uneven-aged silvicultural systems on widlife habitat and wildlife communities, so silvicultural prescriptions can be made and applied in stands and landscapes to more effectively create and maintain desired wildlife communities and habitats across the

landscape.

Problem 3d. We will quantify and model how ecosystem restoration, forest management and altered fire regimes affect fire-maintained animal and plant communities and species of conservation concern, so that managers can make better decisions about conservation and management of animal and plant communities across the landscape.

Anticipated outcomes in Problem 3:

-make recommendations about streamside management zone widths that optimize conditions for various species of small mammals and birds for managers on public and private forest lands (3a)

-model the effects of weather on frog and toad breeding activity to give managers a better understanding of the implications of climate change on this suite of species (3a)

-determine the status of the alligator snapping turtle within its historic range in Texas, to provide basic information required to manage this species (3a)

-use internet-based imagery to reconstruct stand and landscape conditions to predict hazard and risk from southern pine beetle, emphasizing landscape analysis of stands supporting the endangered red-cockaded woodpecker, to improve and integrate habitat management for this bird (3b)

-quantify the effects of windstorms on red-cockaded woodpecker cavity trees, to better advise managers about the species, size, and distribution of cavity trees and nesting clusters to minimize breakage and blowdown from hurricane-force winds (3b)

- model the use of even-aged and uneven-aged southern pine stands by small mammals and birds, so that landowners interested in these species can make better decisions about desired stand structures to create through management (3c)

-model habitat relationships for amphibians and reptiles in the Ouachita Mountains of Arkansas and Oklahoma, to help land managers understand the effeetcs of stand and landscape features on the occurrence of these species (3c)

-determine roosting behavior of six species of tree-roosting bats in the Ouachita Mountains and provide forest managers with guidelines on the effects of different forest management practices on bat roosting habitat (3c)

-quantify the effects of shortleaf pine-bluestem restoration and prescribed fire on the structure of lepidopteran communities and their nectar resources, so that managers have better tools to manage for these important pollenators (3d)

-quantify wildlife community response to forest restoration activities that include prescribed fire, so that managers can make better decisions about the frequency, area, and timing of burning as a component of forest restoration for both plant and animal species (3d)

-Develop guidelines for suitable habitat conditions for Louisiana Pine Snakes to enable managers to improve management of this species, and to work with cooperators to establish a captive pine snake breeding population so that the species can be reintroduced to restored habitats (3d)