# Patterns and Processes: Monitoring and Understanding Plant Diversity in Frequently Burned Longleaf Pine (Pinus palustris) Landscapes (RC-2243)

## Objective

Longleaf pine (*Pinus palustris*) ecosystems are remarkably rich in plant species and represent the dominant upland forest type in several southeastern military installations. Management of these forests on installations is critical both to fulfill the military mission and to conserve this unique natural resource. The researchers will couple a series of field experiments with data mining exercises to help managers meet their objectives for monitoring the impact of various activities on the understory plant community. Results from this project will also aid development of modeling tools to help evaluate different management scenarios based on the intimate link between overstory structure, fire, and understory plant diversity. The project goals are to: (1) understand how the accuracy and effectiveness of sampling and monitoring programs are affected by the scale and timing of measurements, (2) increase plant sampling efficiency and efficacy by identifying and developing statistical approaches for dealing with complex spatial patterns of species distributions, and (3) examine the mechanisms driving patterns of plant diversity and then use this information to find linkages between small scale patterns in understory plant diversity and coarser scale stand characteristics that are more easily monitored and manipulated by managers. The overarching goal will be to develop sampling tools and spatially explicit models that predict the outcomes of various fire- and stand-management practices relative to understory diversity.

## Technical Approach

The researchers plan a twofold approach to meet project objectives. First, the researchers will exploit and mine existing data from previously funded SERDP studies (Developing Models of Dynamic References for Sandhill Restoration, SERDP project RC-1696) and the Eglin Air Force Base, Florida monitoring program to examine how sampling intensity (number of plots and area sampled) and timing affect plant biodiversity estimates. These data will be augmented with additional sampling as necessary. The researchers also will exploit multivariate techniques for dealing with complex data sets and examine the utility and sensitivity of latent indices of biodiversity (functional or taxonomic groups) for capturing patterns of plant diversity as affected by site and management interventions. Second, the researchers will perform a series of field experiments to explore how fire and forest structure interact with neutral processes to drive understory plant community assembly. These experiments will examine the mechanistic links among fine scale spatially explicit fire behavior measurements, understory plant community composition, post-fire mortality, and fuels. These

fine-scale measurements will then be linked to coarser scale measurements of stand structure (using Light Detection and Ranging [LiDAR] imagery), because ultimately it is canopy-derived fuels that drive fire behavior in longleaf pine ecosystems.

## Benefits

This project will benefit Department of Defense managers by (1) providing an effective framework for the sampling and monitoring of plant biological diversity in the species rich longleaf pine communities found on military installations throughout the Southeastern Coastal Plain and (2) streamlining these sampling efforts and identifying sensitive functional groups for the evaluation of management effectiveness. The project also will identify the ecological mechanisms driving the extraordinarily high levels of diversity in understory plant communities in longleaf stands, and it will link these mechanisms to forest structure to evaluate theory and derive a modeling framework for testing the outcomes of various management actions on plant biological diversity.

## Points of Contact

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