

## **PINEMAP: COOPERATIVE FORESTRY RESEARCH, EXTENSION AND EDUCATION FOR A CHANGING WORLD**

**Tim Martin**<sup>1</sup>, Tom Byram, Gary Peter, Ross Whetten, Martha Monroe

<sup>1</sup>School of Forest Resources and Conservation, University of Florida, Gainesville, FL

For over 50 years, university-corporate-governmental tree improvement cooperatives and the US Forest Service have conducted extensive genetic analyses and breeding with loblolly and slash pine. Large breeding populations have been established and evaluated in extensive regionwide replicated field tests. Using recurrent selection for growth, stem form, and disease resistance, 3rd generation loblolly and slash pine seedlings yield ~30% more wood compared with unimproved material, and essentially all of the ~1 billion southern pine seedlings planted annually have been through at least one generation of genetic improvement. The NIFA-funded Pine Integrated Network: Education, Mitigation and Adaptation Project (PINEMAP) will build on this existing infrastructure and tech transfer network to develop and disseminate knowledge needed to enable southern pine breeders and land managers produce and deploy germplasm with enhanced climate change mitigation and adaptation traits. The genetics and breeding efforts in PINEMAP are focused in two areas. First, we will create a tool to inform future deployment decisions with projected climate change scenarios taking into account uncertainty and risk introduced by performance instability. To accomplish this goal, available growth, survival, genetic and environmental data from our participants' and cooperators' provenance, family, and clone trials will be used to parameterize uniform response functions. We will integrate response functions with geospatially specific climatic predictions in a dynamic model to estimate the relative productivity and adaptation of genetic material to specific climatic conditions analogous to that developed for Douglas fir. This analysis will be conducted by all three breeding cooperatives and climatologists to provide guidance for seed deployment. Second, we will investigate the genetic basis of important mitigation and adaptation traits in loblolly pine by conducting linkage and association mapping to identify alleles that can be screened in breeding populations, helping to accelerate improvement of productivity and adaptive traits. Furthermore, the project provides an unprecedented opportunity to integrate genetics and breeding research with efforts in growth and yield, ecophysiology, economics, policy, and lifecycle analysis to refine future breeding objectives, and to produce enhanced, resilient forest management systems for changing climate. Research will be disseminated to stakeholders through a two-pronged extension program incorporating the land grant extension network coordinated by the Southern Regional Extension Forester, and the well-established corporate genetics and breeding research cooperative network. An innovative education program provides material and training for the next generation of scientists and informed citizens.