PINEMAP Monitoring Network

Pine Integrated Network: Education, Mitigation, and Adaptation Project (PINEMAP) is one of three Coordinated Agricultural Projects funded in 2011 by the USDA National Institute of Food and Agriculture (NIFA). PINEMAP focuses on the 20 million acres of planted pine forests managed by private landowners in the Atlantic and Gulf coastal states from Virginia to Texas, plus Arkansas and Oklahoma. These forests provide critical economic and ecological services to U.S. citizens. Southeastern forests contain 1/3 of contiguous U.S. forest carbon and form the backbone of an industry that supplies 16% of global industrial wood, 5.5% of the jobs, and 7.5% of the industrial economic activity in the region.

One of the primary requirements of the NIFA grant which funded PINEMAP was to establish a monitoring network to develop carbon, water, and nutrient storage and flux baselines and responses to climate and management. The three-tiered monitoring network developed by PINEMAP leverages the enormous investments in cooperative research trials from the past several decades and creates an unprecedented resource for regional pine plantation research.

The Tier I (legacy) network (Figure 1) consists of hundreds of existing silviculture experiments and growth-and-yield plots that blanket the region and provide extensive, spatially-explicit information on regional variability in productivity. The Tier II (active experiments) network (Figure 2) contains 125 existing silvicultural trials that cover the full range of climate and soils in the region on which detailed carbon and nutrient balance will be measured. Finally, the Tier III (throughfall exclusion x fertilization) network (Figure 3) was established on four sites situated at the edges of the range in which nutrients and water are manipulated (Figures 4-7).

The PINEMAP monitoring network will provide a wealth of data for model development and validation for better understanding and predicting the response of southern pine productivity to climate and soils both now and in the future.

Figure 1. Tier I (legacy) network.

Figure 2. Tier II (active experiment) network.

Figure 3. Tier III (throughfall exclusion x fertilization) network.

This table summarizes the characteristics of the three tiered monitoring network, including number of sites to be measured in each tier, treatments, measurements to be taken, and questions addressed in each Tier.

Network Level	# Sites	Treatments	Measurements	Questions to be Addressed
Tier I (legacy network)	~ 700	Combinations of fertilization, competition control, planting density, thinning, stand age	Existing inventory data shared among regional forestry research cooperatives	How does tree productivity vary with climate, soils, stand development, and management factors? Verification and validation of growth and yield and carbon models.
Tier II (active experiments network)	~ 125	Combinations of fertilization, competition control, planting density, thinning, stand age	Inventory, C & N pools, soil GHG fluxes, and key ecophysiological model parameters on subset	How do above- and below-ground C and N pools and fluxes, as well as key ecophysiological modeling parameters, vary with climate, soils, stand development, and management factors? Parameterization, verification, and validation of growth and yield and carbon models.
Tier III (throughfall exclusion x fertilization network)	4	Factorial combination of fertilization (control and "optimum") and precipitation (rainfed and 30% reduction)	Same as Tier II, plus intensive C, N, and H_2O ecophysiology	Same as Tier II, plus extension of parameter space to climatic conditions likely not experienced within the historic loblolly pine range, and verification and validation of growth and yield, carbon, and water models.

Figure 4. Tier III site in McCurtain County, Oklahoma. Photo by Duncan Wilson.

Figure 5. Tier III site in Taylor County, Florida. Photo by Jessica Ireland.

Figure 6. Tier III site in Buckingham County, Virginia. Photo by Andy Laviner.

Figure 7. Tier III site in Taliaferro County, Georgia. Photo by Leslie Boby.

USDA United States Department of Agriculture National Institute of Food and Agriculture

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