

## Preliminary Results From Tier III Studies: Effects of Lower Precipitation and Fertilization on Loblolly Pine Plantation Growth and Physiology

Rod Will and Aim 1 researchers

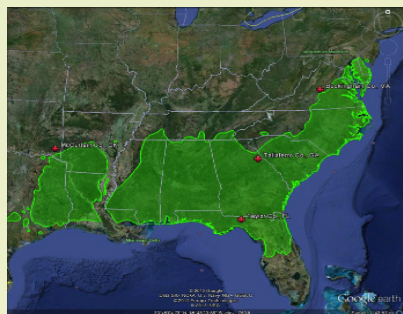
To determine the effects of a drier climate and increased nutrient availability on loblolly pine plantation growth, carbon accumulation, and physiology, PINEMAP installed the Tier III study at four locations across the commercial range of loblolly pine. The four sites capture the current range-wide variability of climate, precipitation, and productivity. Initiated in 2012, treatments at all four sites consist of a factorial combination of rainfall exclusion (30% reduction in throughfall) and fertilization with a complete suite of essential nutrients. This South-wide study is answering questions central to PINEMAP and is serving as a research platform to address a number of additional questions relevant to carbon sequestration and loblolly pine productivity.

Measurements of sap flux are being used to estimate tree water use of five trees per plot. Preliminary estimates from the Virginia site indicate increased sap flux associated with fertilization. Preliminary findings from the Georgia site are that sap flux is higher due to fertilization and lower due to rainfall exclusion.

Soil CO<sub>2</sub> efflux includes respiration from the tree roots (autotrophic; Ra) and from soil heterotrophs (Rh). Separating the two is essential to understand carbon cycling and the effects of the imposed treatments on productivity. At all four sites, we are separating Ra and Rh using root exclusion plots. Preliminary work for the Virginia site indicates that Rh accounts for 60-80% of soil CO<sub>2</sub> efflux.

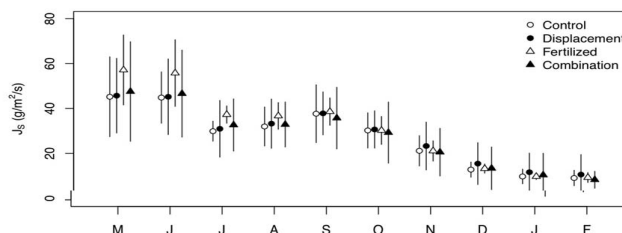
Increasing the uptake of fertilizer by pine trees will increase growth per amount of fertilizer applied thereby decreasing fertilizer cost and reducing possible offsite movement of nutrients. PINEMAP scientists from Virginia Tech are measuring the effects of season of treatment and understory vegetation on fertilizer uptake of loblolly pine trees using <sup>15</sup>N labeled urea at 18 locations across the Southeast. Preliminary data from the Year 1 winter application indicate that, depending on fertilizer type, between 23 and 48% of the nitrogen applied as fertilizer could be found in the aboveground biomass of pine trees.

The data from these studies and other ongoing and planned research at Tier III sites will allow us to better understand how loblolly pine plantations grow and function so that we can better predict growth, assess risk, and ultimately alter management to increase productivity and carbon sequestration.



Pictures shown from top to bottom are:

1. Location of Tier III sites.
2. Brett Heim measuring soil CO<sub>2</sub> efflux.
3. Rainfall excluders in action.
4. Adam Maggard measuring the radius of a pine needle.



Sap flux density from the Virginia Tier III site showing greater values for the fertilized stands in the summer.

This handout accompanies a presentation given at the 2013 PINEMAP Annual Meeting.

For more information, visit the project web site: <http://www.pinemap.org>.