**USDA/AFRI Program:** ***Soil Processes***

**TITLE: The Influence of Genetic Improvement and Fertilization on the Soil Organic Matter Dynamics of Loblolly Pine Forests**

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**NON-TECHNICAL SUMMARY:** Globally, the soil organic matter (SOM) in forested ecosystems is estimated to be nearly 787 Pg, which is slightly greater than the atmospheric C pool. Thus, a slight decrease in forest SOM could significantly increase the rate of atmospheric $CO_2$ buildup. Managers of loblolly pine forests in the southeastern United States routinely use fertilization and weed control treatments in conjunction with the deployment of improved pine genotypes to increase aboveground productivity. However, it remains unclear how these management decisions could affect the belowground processes that determine SOM dynamics. The overarching hypothesis for this project is that increased aboveground productivity from genetic selection corresponds to an increase in belowground C inputs, and that fertilization causes a decrease in microbial activity and rates of SOM turnover. If these processes occur as proposed in this hypothesis, the result should be an increase in SOM as management intensity increases. Changes in SOM are difficult to directly measure; in this project we are using "bomb" radiocarbon, SOM density fractionation and handpicking of roots to determine the size and turnover time of SOM pools as they respond to different levels of fertilization and genetic selection for aboveground growth. Moreover, we are using radiocarbon techniques to determine the response of roots and microbes to different levels of N and P fertilizer. Our objective is to identify mechanisms, by which rates of SOM turnover and storage might be changed, and to use this information to build a conceptual model that links soil biological processes, management decisions, and pine aboveground productivity. Thus, this project will address an important scientific question related to the effects of changing land use and management activities on soil processes related to C dynamics, with implications for mitigating atmospheric $CO_2$ buildup.

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