Individual Tree and Stand-Level Carbon and Nutrient Contents Across One Rotation of Loblolly Pine Plantations on a Reclaimed Surface Mine[1]

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Abstract: Loblolly pine (*Pinus taeda* L.) trees growing on reclaimed mined land in east Texas exhibit similar productivity compared to unmined land. However, rates at which carbon (C) and nutrients in aboveground components aggrade, are correlated to stem growth rates, or differ from forests on undisturbed land have not been documented. Numerous studies have previously assessed loblolly pine aboveground biomass, C, and nutrient contents; however, similar data is limited for loblolly pine on mined land. We investigated C, N, Ca, Mg, K, and P contents for first-rotation loblolly pine growing on reclaimed mined land in east Texas over a 32-year period using a chronosequence approach. At the individual tree level, we evaluated elemental content in aboveground biomass components using tree size, age, and site index as predictor variables. At the stand-level, we then scaled individual tree C and nutrients and fit a model to determine the sensitivity of aboveground elemental contents to stand age and site index. Generally, aboveground C and nutrients in loblolly pine on mined land either exceeded or followed similar trends to data for unmined plantations derived from the literature. DBH and height were the best predictors of individual tree C and nutrient contents for the stem biomass component ($R^2 \geq$ 0.7343 and 0.6095, respectively) followed by stand age ($R^2 \geq 0.5147$). Foliage produced weaker relationships across all predictor variables compared to stem, though still significant ($P \leq 0.05$). The model for estimating stand-level C and nutrients using stand age provided a good fit, indicating that contents aggrade over time predictably.

Additional Key Words: aboveground biomass, nitrogen, potassium, phosphorus, calcium, magnesium.

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