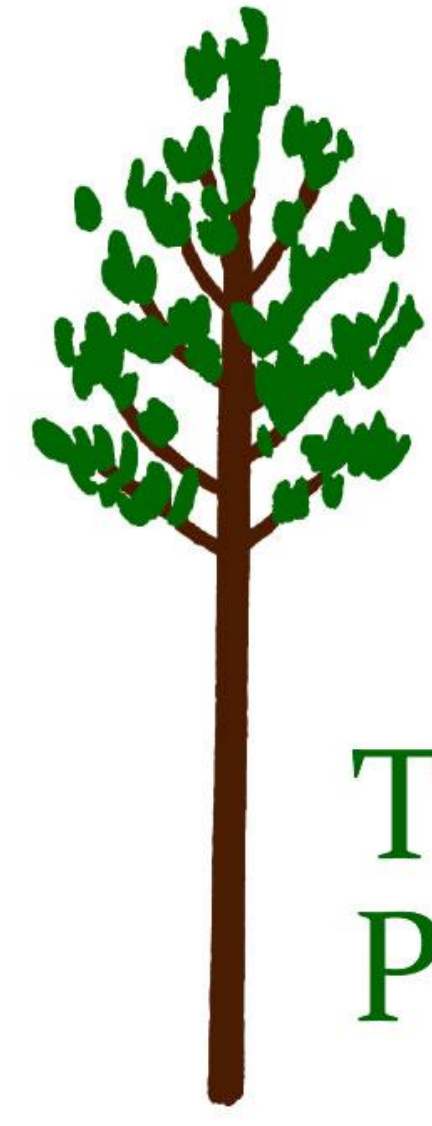


Carbon Sequestration from 40 Years of Planting Genetically Improved Loblolly Pine Across the Southeast United States



TREE IMPROVEMENT
PROGRAM NC STATE UNIVERSITY

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Objective: Highly productive, widely deployed, genetically improved loblolly pine (*Pinus taeda* L.) may play an important role in mitigating rising atmospheric carbon dioxide (CO₂) via carbon (C) sequestration. To understand the role of loblolly pine genetic improvement in future C sequestration strategies, we examined the historical (1968-2007) impact of operationally deploying improved families of loblolly pine on productivity and C sequestration across the southeast U.S.

Experimental Approach: To estimate the land area planted in the southeast U.S. with genetically improved loblolly pine, we used seed (and seedling) production numbers gathered by members of the NC State University Tree Improvement Cooperative (www.TreeImprovement.org/) between 1968 and 2007 (Figure 1). The time period between 1968 and 2007 encapsulates seed production within 1st-, 2nd-, and 3rd- generation open-pollinated seed orchards as well as the mass production of control cross seedlings. With each additional generation, selection and breeding of the most productive and disease resistant genotypes intensifies and increases genetic gain and plantation productivity.

We then used tree planting estimates compiled by the U.S. Forest Service, Georgia Forestry Commission, and Timber Market South to estimate the total number of loblolly pine hectares established each year between 1968 and 2007. Since these estimates included other southern pine species we used the assumption that ~81% of all pine planted in the southern U.S. is loblolly pine.

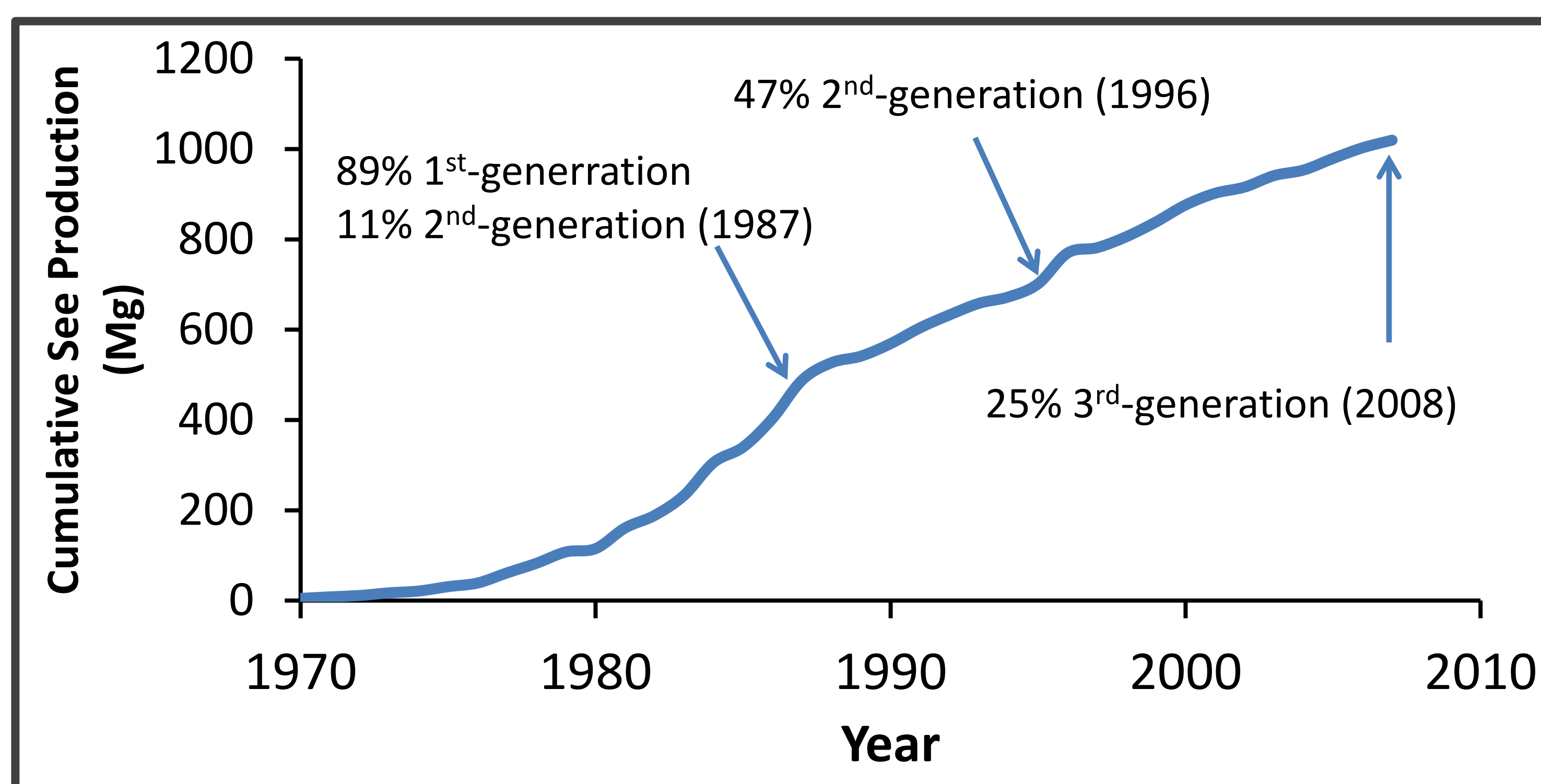


Figure 1. Cumulative seed production from members of the NC State University Cooperative Tree Improvement Program.

To estimate C sequestration with different loblolly pine genetic material, we used the North Carolina State – Virginia Tech Forest Productivity Cooperative (www.forestnutrition.org/) FASTLOB2 loblolly pine silviculture decision support system (LobDSS) (North Carolina State University and Virginia Tech, 2007) growth and yield model (FASTLOB2 Version 3.0 beta). To estimate stand-level C sequestration in both living tree biomass and CWD, we multiplied stand-level estimates of dry mass by conversion factors.

Results: Since 1977, nearly 100% of loblolly pine plantations in the southeast United States have been established with genetically improved loblolly pine. In recent years, more than 400,000 ha of genetically improved loblolly pine are planted annually. Between 1968 and 2007, we estimate that genetically improved loblolly pine plantations have produced a total of 25.6 billion m³ of stemwood volume and have sequestered 9,865 Tg C in live and dead biomass. We estimate that genetic improvement has resulted in an additional 3.7 billion m³ (17% increase) of volume production and 1,100 Tg C (13% increase) in C sequestration (Figure 2), relative to volume production and C sequestration with no genetic improvement.

We expect that loblolly pine plantation C sequestration will increase as more productive families and clones are deployed and as currently deployed genetic material continues to mature. Together, genetic improvement, intensive silvicultural, and longer rotations aimed at producing long-lived wood products will be important tools for maximizing C sequestration in loblolly pine plantations.

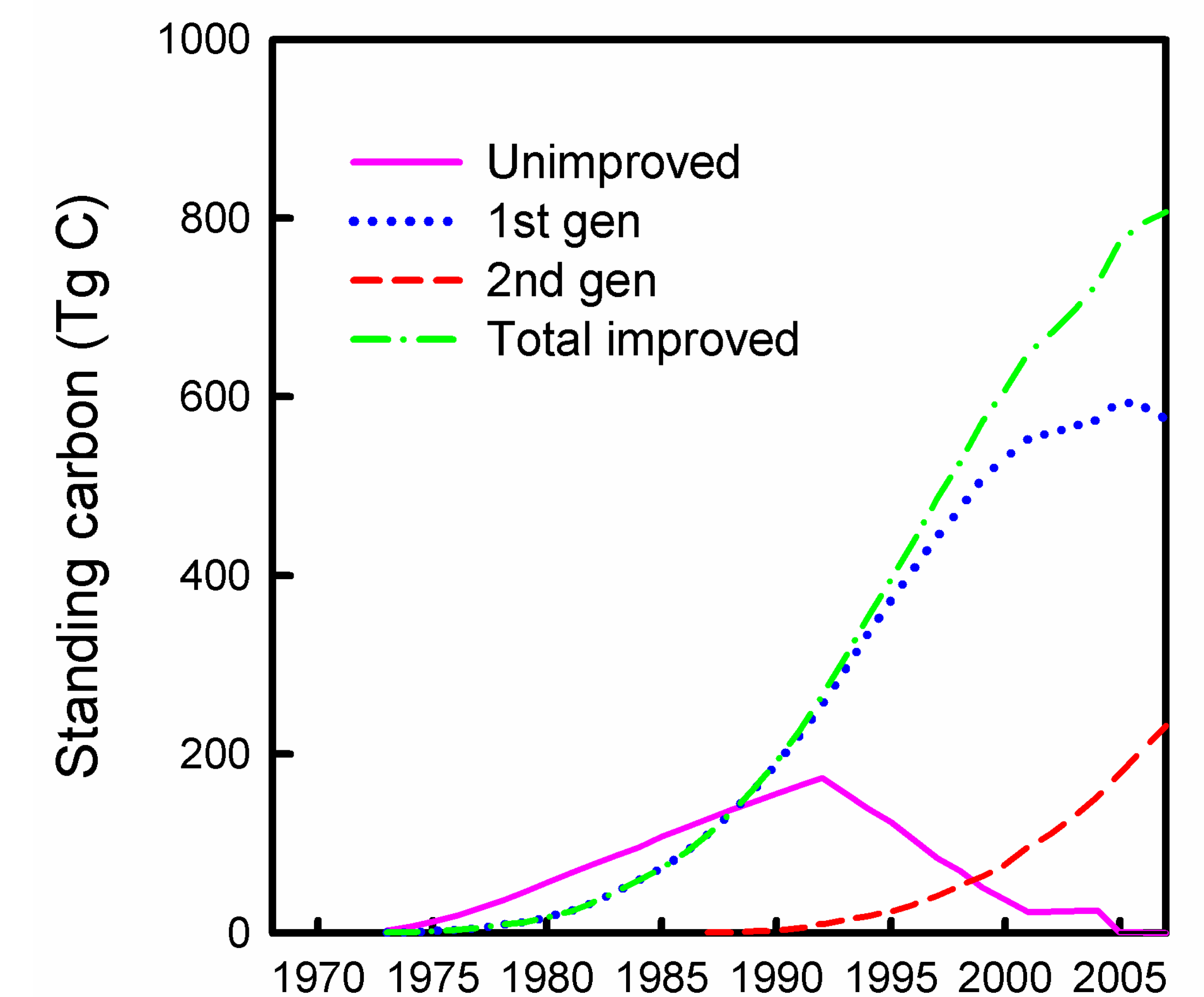


Figure 2. Comparison of estimates of carbon (in living tree and coarse wood debris) for different loblolly pine genetic material between 1968 and 2007.

This research was funded by the NCSU Donald Moreland Endowed Graduate Fellowship, the NCSU Cooperative Tree Improvement Program, and the NCSU Department of Forestry and Environmental Resources. Additional support was provided by the USDA Forest Service Eastern Forest Environmental Threat Assessment Center (EFETAC) and the National Institute of Food and Agriculture (NIFA) Coordinated Agricultural Projects (CAP) grant 2011-68002-30185 "Integrating Research, Education, and Extension for Enhancing Southern Pine Climate Change Mitigation and Adaptation. We thank members of the North Carolina State University Cooperative Tree Improvement Program for providing us with the seed production data.