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The Influence of Age and Geography on the Climatic Sensitivity and Growth Rates of Southern Temperate Tree Species

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Forests are important to the flux of atmospheric CO2. The relative importance of factors like land-use history, age structure, exogenous nutrient fertilization (N & CO2) or climate change on carbon uptake is not yet completely clear. A tree-ring based network of more than 1200 total Quercus alba, Q. montana, Q. rubra, Liriodendron tulipifera and Chameacyparis thyoides trees in cut and uncut forests across much of the eastern U.S. is used to examine age and geographic location (local climate) as it influences tree growth (carbon uptake). Results indicate that age does not limit growth. The oldest trees experienced their highest growth rates in recent decades. Growth rates of Q. alba, Q. montana, and L. tulipifera are increasing across much of the eastern US as the region is generally becoming more moist. Growth rates of Q. rubra are stagnant over the last two decades in the northern while rates of southern populations are increasing. Northern C. thyoides have a stronger positive trend in carbon uptake. The leading factors for these geographic patterns appear to be changes local climate and the climatic sensitivity of each species. Growth of C. thyoides is more limited by temperature in the northern end of its network than in the south. Q. rubra is generally drought sensitive across it's network and the south have been wetting more than the north. Taken together, these results suggest that local climate influences growth more than other factors and that old-growth trees can be significant sinks of anthropogenic CO2.