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Woody Debris Dynamics in Interior West Forests and Woodlands

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Managers are interested in the dynamics of down woody material because of its role as a fuel component, a feature of wildlife habitat, a carbon pool, and other characteristics. We analyzed nearly 9,000 plots from the Interior West, spanning the range from sparse juniper and mesquite woodland to dense spruce-fir forests, in order to characterize down woody material as it relates to stand and site factors. Average abundance of down woody material increases predictably with climatic factors, as measured by several parameters, and with stand age. However, the patterns of abundance with stand age vary widely by forest type, with certain types exhibiting unique patterns that are at least partly explained by known patterns of their development and growth. One area where forest types differ substantially is in the amount and type of down woody material that is "inherited" by a newly regenerated stand from the previous stand on the site. These legacy characteristics are influenced by the type of transition — e.g., from one stand type to the next (successional) or from self-replacement (either late-successional types or mid-succession disturbance). In addition, the variability of legacy down wood within a given type and climatic regime may be informative with respect to site history (e.g., "encroachment" or "replacement" status of some pinyon-juniper woodlands). Our analysis should provide managers with a framework assessing the status of down woody material, as well as models for "typical" down woody dynamics over time.

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Evaluation of Growth Rates and Establishment Patterns of Water Elm

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Hydrologic alterations of forested wetlands frequently lead to vegetation changes. In central Louisiana, hydrologic alterations have apparently led to an expansion of water elm (*Planera aquatica*) into Catahoula Lake, a Ramsar Wetland of International Importance. Water elm is a flood-tolerant species; so as baldcypress we also expect it to respond more with hydrology. The expansion of water elm has reduced herbaceous vegetation valuable for waterfowl and shorebirds. In this study, we used dendrochronological techniques and aerial photography to test hypotheses that growth rates of water elm are correlated more with hydrologic regime than climate and that expansion of water elm in the lake is a consequence of construction of a diversion canal built on the lake in 1971 that resulted in reduced hydrologic variability. In contrast to our hypothesis, tree radial growth was correlated more with climatic variables than water levels in the lake. We also found that younger trees did not regenerate under older stands, but were a result of new colonization of former non-forested habitats. Hence, our results indicate that hydrologic conditions following the construction of diversion structure are responsible for establishment of numerous water elm trees in the lake. Their growth, however, is dependent on a combination of early spring to summer temperature, precipitation and available soil moisture content.

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Water Resources and Eucalyptus Culture in the Southern US

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The establishment of Eucalyptus for fiber and biomass offers great potential in the southern US. A complete evaluation of the potential benefits requires an analysis of both on- and off-site impacts to ensure that afforestation is sustainable. Impacts of Eucalyptus on water resources have been examined in many parts of the globe with variable and sometimes conflicting conclusions. We used a combination of modeling and synthesis of existing literature to evaluate potential watershed responses to Eucalyptus culture using a case study approach for the southern US. To bracket the range of potential responses, we used a species-specific stomatal conductance model, a Penman-Monteith transpiration model, and climate data from southwest Georgia to estimate water use for a well-watered and fully stocked *Eucalyptus grandis* plantation growing in southwest Georgia, as well as water-limited plantations across a range of LAIs (leaf area index). Including interception losses, Eucalyptus stand-level evapotranspiration (ET) estimates averaged about 1100 mm yr⁻¹ at the highest stocking level. This average ET estimate is comparable to well-watered loblolly pine plantations; however, it exceeds upland loblolly pine ET by approximately 50%, deciduous forest ET by 122%, and native longleaf pine scrub ET by 343%. If actually realized, these higher ET rates could translate into a reduction in annual streamflow and groundwater recharge. The significance of the impact on groundwater and stream flow will depend greatly on the area extent, size, and spatial distribution of the plantations, as well as the land cover type being replaced by the Eucalyptus plantations.

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A Field Assessment of Invasive Behavior by Eucalyptus Plantings in the Southern US

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Increasing interest in biomass-based energy equates to demand for fast-growing tree species to use in forest plantations across the southeastern United States. Several Eucalyptus species exhibit attractive growth characteristics in the bioenergy context, and have been planted in growth trials in several southeastern states. However, some of these species also possess traits in common with other successful invasive plant species. To estimate the actual rate of seedling establishment in the vicinity of Eucalyptus plantations, we conducted field surveys at 3 sites in South Carolina and 15 sites in Florida where various species of Eucalyptus had been planted. To optimize the likelihood of detecting the presence of seedlings, we used sampling methodology specifically designed for detection of rare species. Results showed that in Florida, there was substantial within-stand Eucalyptus seedling establishment at 4 of the 15 sites surveyed. Seedlings were also detected, at a lower rate of incidence, outside the boundaries of these same four plantations. From all the sampled plantations, only two seedlings were detected at distances greater than 45 m from the stand boundary. There was effectively a northern limit of seedling establishment; we sampled only one seedling above ~27 degrees N latitude, although we noted the presence of another seedling that had established 18 m inside the boundary of one SC plantation. Multivariate analysis of environmental conditions at each site including canopy cover, soil characteristics, and understory vegetation cover will be conducted to explore potential factors associated with successful seedling establishment.

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