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## Improving Tree Growth Models

Models of tree growth often neglect important differences between species, and the form of these models may not allow for potential complexity in the relationship between tree growth and tree size. But computational advances now allow ecologists to develop a more realistic picture of the web of relationships that determine an individual tree's growth rate.

A USGS study published in the *Canadian Journal of Forest Research* analyzed old-growth forests in the Sierra Nevada of California, developing detailed models of tree diameter growth for four major species. The study demonstrated that there are substantial differences among species in their response to competition from neighboring trees.

Furthermore, common hypotheses about which species should be the strongest competitors often did not hold, with competitive effects of each species varying considerably. Both results indicate that accurate predictions of tree growth will require models that account for species-specific properties.

Results also showed that commonly used models of tree growth can fail to capture important variation in how a tree's growth rate changes with size. For example, three of the four species showed an unexpected decline in potential diameter growth rate with size for the smallest trees in the dataset (which often comprise the bulk of a forest's density and represent the pool of trees from which future forest structure is drawn). This pattern would not have been detected with standard tree growth models.

Biologically realistic models provide important insights into the fundamental properties governing tree growth and should allow managers to make better assessments of growing conditions in a given forest — substantially improving our ability to model forest processes against large-scale environmental changes.

### Management Implications

- More biologically realistic models can provide better estimates of tree growth for managers contemplating alternative treatments in a given forest stand.
- Competitive interactions vary considerably among tree species, suggesting that accurate assessment of the growth potential of a mixed species stand requires detailed consideration of both the composition of species on the landscape and their arrangement on the landscape.
- The relationship between tree growth and tree size can potentially be complex. Models that use overly simplistic assumptions may fail to capture this complexity, potentially leading to unreliable predictions.

#### THIS BRIEF REFERS TO:

Das, A. 2012. The effect of size and competition on tree growth rate in old-growth coniferous forests. *Canadian Journal of Forest Research* 42(11): 1983-1995. doi: 10.1139/x2012-142

<http://www.werc.usgs.gov/seki>

<http://www.werc.usgs.gov/ProductDetails.aspx?ID=4836>



Accurate assessment of the growth potential of a mixed species stand requires detailed consideration of species composition and arrangement on the landscape.