University of Idaho

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Modelling effects of overstory density and competing vegetation on tree height growth

ABSTRACT

Height growth models are important both in forest management and forest dynamics studies. Recently, juvenile tree height development has been of interest in silvicultural research. Most juvenile height growth studies considered competing vegetation from overstory trees. However, the effect of understory competing vegetation and hierarchical effects have only recently been incorporated into juvenile height growth modeling. Unfortunately, these juvenile models have been developed independently of height growth models for large trees. The objective of this research is to determine whether incorporating competition and hierarchical effects into height growth models improves their fit.

Using data from the Inland Northwest (USA), height growth of both juvenile and older trees of Douglas-fir (Pseudotsuga menziesii (Mirbel) Franco) were modelled using a linear differential equation with power transformation. The parameters of this model were non-linearly related to variables that represent competition due to overstory, understory (shrubs, herbs, and grasses) and small conifers. Hierarchical structure is modeled by the inclusion of random effects. All the model parameters are estimated by restricted maximum likelihood estimation. Our results show that density effects should be considered for modelling height growth. Allowing the asymptote to be a random parameter (mixed-effect model) improved the performance of the proposed model.