LEAF AREA AS A GROWTH PREDICTOR FOR RED SPRUCE AND BALSAM FIR IN MANAGED STANDS IN MAINE

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Abstract

Forest stand structure is a function of many natural, ecological and anthropogenic processes. Currently, most growth models are empirically based on size attributes in stands. These model types are based on the assumption that wood growth is a function of the amount of wood present. Using leaf area as a determinant of density and structure applies physiological and ecological processes to stand growth. Models based on leaf area may reflect growth dynamics (i.e. differentiation) within the stand, while others assume all trees of similar sizes to have the same growth rate. The well-established leaf area-sapwood area (LA:SA) relationship may be used to estimate biologically-significant growth model parameters. The objectives of this study are 1) to validate the relationship between the leaf area and the sapwood area for *Abies balsamea* (L.) Miller and *Picea rubens* (Sarg.) in Maine; 2) to quantify a growth modifier for individual trees; and 3) to better model the growth of managed stands based on crown dynamics.

Data from destructive sampling during the summer of 2003 was used to estimate tree-level specific leaf area (SLA) based on the LA:SA relationship. This instance of SLA estimation is comparable to that of Gilmore et al. (1996) and to a crown length model (Valentine et al. 1994) to evaluate its effectiveness for estimating leaf area. Analysis of variance (ANOVA) was used to evaluate the model's performance across several variables, including site, age, and crown position. Inter-model comparisons were evaluated following the methods of Kenefic and Seymour (1999) and Gilmore et al. (1996).

By using growth increment cores taken at all sites during the 2003 field season, this study attempted to reconstruct past leaf area based on constructed LA:SA equations. Stand growth was projected 5 years with Forest Vegetation Simulator (FVS - Northeast variant – U.S. Forest Service, Growth Management Service Center) using the reconstructed growth data. FVS results were compared to the actual growth change observed from the radial increment record. Volume increment (VINC) to projected leaf area relationships were compared across sites with ANOVA. Ratios of prior VINC to current VINC were compared to investigate its use as a growth potential modifier. Several parameters were tested in order to construct a growth potential modifier that most improves the FVS Northeast variant growth model performance.

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