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Simple estimates of cover perform as well as complex models for estimation of light transmission in understory layers

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Light transmission (light below ÷ light above vegetation) is a useful measure of competition and a promising technique for modeling the development of regenerating trees. Tree level light models have been developed (EFM Note 04/03); however, light transmission through shrub/herb layers in clearcuts and understories must also be modeled. Light transmission depends on the amount of foliage and its clumping, the angle that the foliage is displayed, the angle of incidence of the light, and scattering of light as it reflects from or passes through leaves. There are complex theoretical and mathematical relationships that have been developed to allow prediction of light transmission taking into account all of these variables. Managers and forest modelers trying to predict light transmission, however, usually do not have the data or the resources to measure all of these variables. Typical data that is easily collected includes percent cover of individual species or the understory as a whole. In this study we tested if percent cover values provide reliable estimates of light transmission compared to more complex models.

Using a point-frame (see photo), clinometer and light meter, we measured foliage density, leaf angle inclination, vertical distribution, foliage clumping and light transmission through complex shrub/herb canopies in boreal mixedwood forests. We compared percent cover estimated visually with point frame measurements. We tested 16 different empirical and theoretical models for light transmission.

Findings: In terms of accuracy and precision, the best models for predicting of light transmission through understory vegetation used simple models that required the leaf area index (LAI) or percent cover and one "extinction coefficient" for each species, or even a single coefficient for overall LAI or cover. These simple models produced little bias. The more complex models tended to underestimate light, with larger errors at mid to low light levels.

Implications: Simple estimations of cover and simple models are likely just as good as complex models when data are collected in a field setting. Our ability to estimate the detailed characteristics of canopies of shrub and herb is likely too poor to make good use of the more theoretical models.

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Further Information:

Stadt, K.J, and Lieffers, V.J. 2005. Comparing PAR transmission models for forest understorey vegetation. Applied Vegetation Science 8: 65-76.

http://www.rr2.ualberta.ca/research/EFM/

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