CENTRE FOR ENHANCED FOREST MANAGEMENT
ADVANCES IN FORESTRY RESEARCH
DEPARTMENT OF RENEWABLE RESOURCES
EFM RESEARCH NOTE 04/2003

MIXLIGHT: a flexible light transmission model for mixed species stands

KEN J. STADT AND VICTOR J. LIEFFERS

Over the past 5 years, we have been developing a model to predict light transmission to seedling height in mixed species forests. Our aim was to develop a software tool for projecting the growth rate of understory trees, identifying stands for under-planting white spruce, and planning thinning and shelterwood removals. To be fully flexible, we modeled the resource that is most commonly limited in these forests, light.

MIXLIGHT calculates light transmission through a canopy by tracing rays from sections of the sky hemisphere to a point in the understory. As the rays pass through overlying vegetation layers the density of leaf and wood area is used to calculate how much light would be transmitted along the ray. Sections of the sky where the sun passes are weighted more as more light energy is emitted from these directions. Transmission along each ray is averaged to give the amount of light available at that position in the understory.
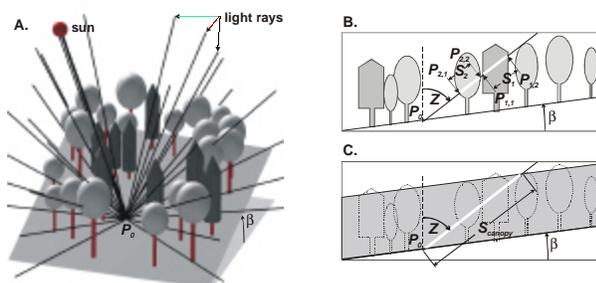
MIXLIGHT models light transmission at the tree scale, where the leaf and wood area is confined within discrete crowns and stems. This allows prediction of light to any point and height in the understory. A tree list with the species, size and x, y co-ordinates of the trees is needed as input. Leaf area densities, leaf inclination, crown depth and radius are also needed but can be calculated from relationships supplied by the model for aspen, balsam poplar, paper birch, white spruce, lodgepole pine, balsam fir. A contour map of the stand is developed, showing the light levels (% of seasonal light available). If detailed information on the spatial distribution of the trees is not available the model can be used to predict light on a stand average basis.
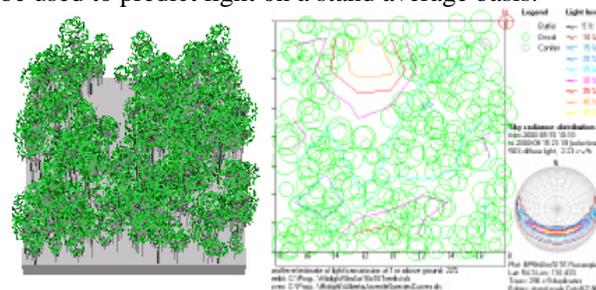
Tests of MIXLIGHT on Alberta mixedwood stands, on both its stand average and spatially-explicit modes, yielded good predictions with no detectable bias. Recent added features model the influence of understory vegetation on light transmission.

The model can be downloaded to any PC using EXCEL and Windows 98 or newer. It is 'user friendly' and menu driven. For more complete description of the model, how to operate it and downloading instructions see our web page:

http://www.rr.ualberta.ca/Research/EFM/Mixlight.htm

Further Information:
Stadt, K.J. and V.J. Lieffers. 2000. MIXLIGHT: A flexible light transmission model for mixed species stands. Ag. For. Meterol. 102:235-252.

Pinno, B.D., Lieffers, V.J. and Stadt, K.J. 2001. Measuring and modeling the crown and light characteristics of juvenile aspen. Can. J. For. Res. 31:1930-1939.

http://www.rr.ualberta.ca/research/EFM.htm
Centre for Enhanced Forest Management, Dept. of Renewable Resources, U. of A. Edmonton, AB T6G 2H1
kstadt@ualberta.ca

"Fundamental and applied research to enhance the productivity of Alberta's northern forests"