BOREAL FOREST LEAF AREA INDEX (LAI) ESTIMATION USING WIDE OPTICS AIRBORNE WINTER PHOTOS

Terhikki Manninen [1,]*, Lauri Korhonen [2], Pekka Voipio [3], Panu Lahtinen [1] and Pauline Stenberg [4]

[1]Finnish Meteorological Institute, [2]University of Joensuu, [3]Finnish Forest Research Institute (Metla), [4]University of Helsinki

The boreal zone land cover has a very significant influence on the northern hemisphere albedo and is an important component of the northern hemisphere carbon budget and is sensitive to changes in local and global climate. Forest transition zones react to changes in mean temperature and moisture conditions in the long term whereas changes in, for example, forest leaf area index (LAI) through defoliation indicate stress factors in shorter time scale. LAI is one of the Essential Climate Variables (ECV) defined in the Implementation Plan for the Global Observing System for Climate in Support of the United Nations Framework Convention on Climate Change **(**UNFCCC). The development and validation of satellite based LAI estimation methods require reliable *in situ* measurements of LAI. For large areas of tall vegetation it is difficult to get aerially representative ground truth using direct or indirect methods, especially in regions of difficult accessibility.

A new airborne method is presented here for leaf area index estimation. The basic technique is the same as used in hemispherical photo analysis [10, 8]. The difference is just that the background is the snow covered terrain instead of the sky. Boreal forests are typically dominated by coniferous species and the snow covered season is mostly long. Therefore the method is well suited for LAI estimation of boreal forest in larger areas and especially useful in the northernmost regions, where the roads are sparse and it is difficult to access the forests scattered between wetlands.

The R^2 value of the linear regression of the airborne and ground based LAI measurements was 0.9 for the whole test data set and 0.95, when the amount of deciduous species was reduced. The reason for this is that the ground truth was measured in the autumn, when the leaves were still present, but the airborne data was gathered in winter, when the deciduous trees were without leaves.