

CONTROL ID: 687010

TITLE: Estimating Forest Species Composition Using a Multi-Sensor Approach

PRESENTATION TYPE: Poster Requested

SECTION/FOCUS GROUP: Biogeosciences (B)

SESSION: Remote Characterization of Vegetation Structure: Including Research to Inform the Planned NASA DESDynI and ESA BIOMASS Missions (B15)

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ABSTRACT BODY: The magnitude, duration, and frequency of forest disturbance caused by the spruce budworm and forest tent caterpillar has increased over the last century due to a shift in forest species composition linked to historical fire suppression, forest management, and pesticide application that has fostered the increase in dominance of host tree species. Modeling approaches are currently being used to understand and forecast potential management effects in changing insect disturbance trends. However, detailed forest composition data needed for these efforts is often lacking. Here, we used partial least squares (PLS) regression to integrate satellite sensor data from Landsat, Radarsat-1, and PALSAR, as well as pixel-wise forest structure information derived from SPOT-5 sensor data (Wolter et al. 2009), to estimate species-level forest composition of 12 species required for modeling efforts. C-band Radarsat-1 data and L-band PALSAR data were frequently among the strongest predictors of forest composition. Pixel-level forest structure data were more important for estimating conifer rather than hardwood forest composition. The coefficients of determination for species relative basal area (RBA) ranged from 0.57 (white cedar) to 0.94 (maple) with RMSE of 8.88 to 6.44 % RBA, respectively. Receiver operating characteristic (ROC) curves were used to determine the effective lower limits of usefulness of species RBA estimates which ranged from 5.94 % (jack pine) to 39.41 % (black ash). These estimates were then used to produce a dominant forest species map for the study region with an overall accuracy of 78 %. Most notably, this approach facilitated discrimination of aspen from birch as well as spruce and fir from other conifer species which is crucial for the study of forest tent caterpillar and spruce budworm dynamics, respectively, in the Upper Midwest. Thus, use of PLS regression as a data fusion strategy has proven to be an effective tool for regional characterization of forest composition within spatially heterogeneous forests using large-format satellite sensor data.
<http://rs.forest.wisc.edu/>

KEYWORDS: [0480] BIOGEOSCIENCES / Remote sensing, [0439] BIOGEOSCIENCES / Ecosystems, structure and dynamics.