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### MAPPING UNDERSTORY NORMALIZED DIFFERENCE VEGETATION INDEX (NDVIU) IN BOREAL FORESTS BY MODIS BRDF PRODUCTS

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Global products of leaf area index (LAI) usually show large uncertainties in sparsely vegetated areas because the understory contribution is not negligible in reflectance modeling for the case of low to intermediate canopy cover. Therefore, many efforts have been made to include understory properties in LAI estimation algorithms. Compared with the conventional data bank method, estimation of forest understory properties from satellite data is superior in studies at a global or continental scale over long periods. Therefore, a semi-empirical method to retrieve understory Normalized Difference Vegetation Index (NDVIu) for sparse boreal forests was developed in this study. The method is based on the fact that the bidirectional variation in NDVIu is smaller than that in canopy-level NDVI. To retrieve NDVIu for a certain pixel, linear extrapolation was applied using pixels within a  $5 \times 5$  target-pixel-centered window. The NDVI values were reconstructed from the MODIS BRDF data corresponding to eight different solar-view angles. NDVIu was estimated as the average of the NDVI values corresponding to the position in which the stand NDVI had the smallest angular variation. Validation by a noise-free simulation data set yielded high agreement between estimated and true NDVIu, with  $R^2$  and RMSE of 0.99 and 0.03, respectively. Using the MODIS BRDF data, we achieved an estimate of NDVIu close to the in situ measured value in the Poker Flat Research Range, Alaska (0.61 vs. 0.66 for estimate and measurement, respectively). Distribution map of NDVIu in boreal forests has also been generated. A potential application of the retrieved NDVIu is to improve the estimation of overstory LAI for sparse boreal forests and ultimately to benefit studies on carbon cycle modeling over high-latitude areas.

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