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A NEW PHYSICALLY BASED VEGETATION INDEX FOR IMPROVED PHENOLOGY ESTIMATION BY REMOTE SENSING

L. Eklundh [a, *], H. Jin [a]

[a] Department of Physical Geography and Ecosystem Science, Lund University, Sölvegatan 12, SE-223 62 Lund, Sweden – lars.eklundh@nateko.lu.se, hongxiao.jin@nateko.lu.se

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ABSTRACT:

A new vegetation index for phenology estimation from satellite data has been developed. The index shows strong potential for estimation of vegetation productivity and carbon uptake in vegetation stands. The index is based on radiative-transfer theory, and is linearly related to green leaf area index (LAI). The linearity makes the index responsive to canopy variations in both sparse and dense vegetation. The index is, contrary to traditionally used indices such as NDVI and EVI, insensitivity to snow, making it useful for monitoring boreal forest also during early spring and late autumn.

Tests of the index using eddy-covariance measured carbon fluxes in boreal forests reveals that the index is strongly related to seasonal variations in GPP, outperforming both NDVI and EVI. This strong relationship is assumed to be due to its physical relationship with green canopy LAI, a feature that makes the index robust and easily interpreted. Thereby the index is useful as a basis for integrating remote sensing data with ecosystem models for estimating and upscaling carbon balance data. The index has been tested with radiative transfer modelling, spectral measurements, and data from global calibration sites.

The index is currently applicable to MODIS 1-km BRDF-corrected data, but will in future be useable also with high-resolution satellite data and ground-based measurements. New high-resolution data from the European Sentinel-2 satellites hold promise for very accurate future remotely sensed estimates of canopy productivity. Analysis of ground-based spectral data together with eddy-covariance flux measurements forms a solid basis for further understanding and applying the new vegetation index to a range of vegetation studies.

* Corresponding author. This is useful to know for communication with the appropriate person in cases with more than one author.