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Using normalized difference vegetation index to estimate leaf area index of forests doesn't work for sites where understory vegetation grow vigorously

Chung-Chun Chang, Guo-Zhang M Song, Yen -Chen Chao, Kai-Chi Hsu, Cang-Wei Chen, Hsin-Tien Lee, and Hung-Yen Hu

National Chung Hsing University, Department of Soil and Water Conservation, Taichung City, Taiwan (chun0126@smail.nchu.edu.tw)

Normalized difference vegetation index (NDVI) has been used widely to estimate vegetation conditions (e.g. leaf area index (LAI), biomass) for large areas. The preciseness of this technique hinges on the establishment of regression models which allow users to estimate vegetation conditions from the data of NDVI. Due to the fact that NDVI-LAI regression models are site-specific, the present study aimed to establish regression models for Taiwan naturally-regenerated forests which are characterized by high species diversity. There were two study sites. One was the 1.2-ha campus plantation (25°07'24"N, 121°40'26"E) of the National Chung Hsing University, consisting of more than 10 introduced coniferous species. The other was the 25-ha Lienhuachih Forest Dynamic Plot (23°54'49"N, 120°52'43"E) in central Taiwan, which harbored 144 tree species. NDVI was derived from images taken with a multi-spectral band camera carried by an unmanned aerial vehicle. For each site, more than 20 locations were sampled in an interval of 20 m to measured ground-truth LAI. Hemispherical photography was used to assess LAI 1.3 m above the ground. Results showed that the relationship between NDVI and LAI was linear (y=5.843x+0.148, R2= 0.371) and positive in the campus plantation (P= 0.006), but this relationship was insignificant in the Lienhuachih plot (P = 0.06). This is attributed to the interference effect of vigorously-growing understory vegetation (lower than 1.3m in height) on NDVI. Understory vegetation in the former was little due to intense human disturbance, while understory vegetation (mainly Diplopterygium chinensis) grew vigorously under canopy gaps in the later. The presence of understory vegetation kept NDVI high even where tree canopies were sparse (i.e. low LAI). For sites where understory vegetation can grow vigorously, using normalized difference vegetation index solely can't obtain precise estimates for leaf area index of forests. To reduce the interference of understory vegetation on NDVI, our next step is to obtain NDVI at least 1.3 m above the ground by incorporating digital elevation models of the ground surface into our analyses.