INTERNATIONAL JOURNAL OF REMOTE SENSING
2019, VOL. 40, NO. 18, 7153–7168
https://doi.org/10.1080/01431161.2019.1601282

Using the red-near infrared spectral to estimate ground cover based on vegetative indices

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ABSTRACT

Rapid and accurate estimation of Ground Cover (GC) at regional and global scales for agricultural management application is only possible by using remote sensing (RS). In this study, two Vegetation Indices (VIs) including the Perpendicular Vegetation Index (PVI) and Normalized Difference Vegetation Index (NDVI) were used for estimating GC. Since the parameters of the bare soil line have an important role in calculating GC based on PVI, this line was extracted based on the red-NIRmin (minimum near infrared) method with different intervals (0.0001, 0.0005, and 0.0010). In addition to traditional statistics such as Root Mean Square Error (RMSE), the sensitivity analysis (S) was also used to sharpen the accuracy of the models' estimations. The results indicated that the PVI-based method, in contrast to the NDVI-based approach, had a better performance in estimating GC of wheat. The highest correlation between the observed GC and the estimated GC based on PVI method was achieved in interval length of 0.0005 (R2 = 0.91) with RMSE equal to 8.82. This regression line (GCEST = -3.47 + 0.96 GCOBS) was not significantly different from the 1:1 line. As expected, the best estimation was achieved when the sensitivity of estimated GC based on PVI (length of the interval: 0.0005) was almost constant and low compared to the other models.

ARTICLE HISTORY
Received 8 September 2018
Accepted 9 February 2019

1. Introduction

Percentage of Ground Cover (GC) was expressed as the fraction of ground surface covered by vegetation (Zhang, Li, and Chen 2003). The vegetation cover typically represents two components of horizontal and vertical density. Horizontal density represents the area covered by the plant per unit of ground area. Vertical density expresses the number of leaf layers over the covered areas that control the amount of photosynthesis and evapotranspiration of plants (Gutman and Ignatov 1998). When ground surface is covered with developing vegetation, the percentage of ground cover increases from 0% (indicating bare soil) to 100% (indicating full canopy) (Zhao et al. 2009; Ritchie et al. 2010). Therefore, GC is a good proxy for estimating plant biophysical properties such as crop biomass or Leaf Area Index (LAI) (Zhao et al. 2009; Ritchie et al. 2010). Accurate estimations of GC are needed for a wide range of implications, including monitoring the susceptibility of land surface to wind erosion (Shao 2000), global climate change, nutrient, carbon, and hydrology cycles

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