EFFICIENCY OF TEXTURE MEASUREMENT FROM TWO OPTICAL SENSORS FOR IMPROVED BIOMASS ESTIMATION

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ABSTRACT:

Accurate biomass estimation is essential for greenhouse gas inventories, terrestrial carbon accounting and climate change modeling studies, and for the implementation of the Kyoto Protocol of the United Nations Framework Convention on Climate Change (UNFCCC). Unfortunately no universal and transferable technique has so far been developed to quantify biomass carbon sources and sinks over large areas, because of the environmental, topographic and biophysical complexity of forest ecosystems. Among the remote sensing techniques tested, the use of multisensors, and spatial as well as spectral characteristics of data have demonstrated strong potential for biomass estimation. However, the use of multisensor data accompanied by spatial data processing has not been fully investigated because of the unavailability of appropriate data sets and the complexity of image processing techniques for combining multisensor data with the analysis of spatial characteristics. Thus, this research investigates the texture parameters of two high (10m) resolution optical sensors AVNIR-2 and SPOT-5 in different processing combinations for biomass estimation. Multiple regression models are developed between image parameters extracted from the different stages of image processing and the biomass of 50 field plots, which was estimated using a newly developed “Allometric Model” for the study region. The results demonstrate a clear improvement in biomass estimation using the texture parameters of a single sensor (r2=0.854 and RMSE=38.54) compared to the highest accuracy obtained from simple spectral reflectance (r2=0.494) and simple spectral band ratios (r2=0.59). This accuracy was further improved, to obtain a very promising accuracy using texture parameter of both sensors together (r2=0.897 and RMSE=32.38), the texture parameters from the PCA of both sensors (r2=0.851 and RMSE=38.80) and the texture parameters from the averaging of both sensors (r2=0.911 and RMSE=30.10). Improved accuracy was also observed using the simple ratio of texture parameters of AVNIR-2 (r2=0.899 and RMSE=32.04) and SPOT-5 (r2=0.916) and finally a surprisingly high accuracy (r2=0.939 and RMSE=24.77) was achieved using the ratios of the texture parameter of both sensors together. This accuracy level strongly suggests that biomass estimation can be considerably improved using spatial characteristics of multisensor data, and further enhanced using the ratio of texture parameters.

TOPIC: Remote sensing applications
ALTERNATIVE TOPIC: Image processing and pattern recognition