Assessment of Regional Land Cover Fractions of Mongolian Semiarid and Arid Area Based on Multi-channel Radiance Data

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Semiarid and arid ecosystems present high spatial complexity of land use on the globe. Remote measurements of dominant land cover fractions (LCFs) such as photosynthetic vegetation (PV), nonphotosynthestic vegetation (NPV) and bare soil communities are critical for understanding regional climate regime of spatial and regional scales and land-use controls over the functional properties of arid and semiarid ecosystems of Mongolia.

An arid and semiarid area of Mongolia was chosen for investigation in the present study. A field vegetation properties and spectral dataset of PV, NPV, and bare soils were complied for 50 semiarid and arid ecosystems of Mongolia, representing wide type of data structure of plant species, vegetation conditions, and soil properties

In this context, this study focused on determination of regional LCFs of semiarid and arid area of Mongolia using multi-channel radiance data, by adopting methods of general probabilistic spectral mixture model (SUM) and bi-directional distribution function. Additionally, we applied supervised classification method (SCM) with maximum likelihood analysis to digital camera images for estimating land cover fractions.

The results of this present study indicate: (i) the bidirectional distribution function model can work in shortwave-infrared spectral region; (ii) a conservative value of 50 runs number is enough in Monte Carlo analysis; (iii) the accuracy of the supervised classification method is highly dependent on the section of specific area on image and the individual user; and (iv) the supervised classification method requires too much time and energy. The correlation coefficient of land cover fractions calculations using visually determined and the different methods for determining the LCFs can be summarized as SUM (R=0.98) is more than SCM (R=0.88) for PV, SUM (R=0.5) is more than SCM (R=0.4) for NPV and SUM (R=0.93) is more than SCM (R=0.80) for bare soil. Root mean square error of supervised classification method is less than the spectral unmixing model in arid area and more than spectral unmixing model in semiarid area. These results confirm that the spectral unmixing model including Monte Carlo analysis has the higher accuracy for estimation of land cover fractions better than supervised classification method in the study areas. However, application of the spectral unmixing model needs further improvement and more data and some additional spectral measurements.