THE APPLICATION OF HYPERSPECTRAL IMAGES IN THE ANALYSIS OF VEGETATION CONDITION OF MOUNTAIN NON-FOREST COMMUNITIES

Anna Jarocińska[1], Monika Kacprzyk[1], Adriana Marcinkowska-Ochtyra[1], Adrian Ochtyra[1,2], Bogdan Zagajewski[1], Koen Meuleman[3]

1. *Department of Geoinformatics, Cartography and Remote Sensing, Faculty of Geography and Regional Studies, University of Warsaw, Warsaw, Poland, ajarocinska@uw.edu.pl, kacprzyk.monika@gmail.com, adriana.marcinkowska@uw.edu.pl, adrian.ochtyra@uw.edu.pl, bogdan@uw.edu.pl*
2. *University of Warsaw, College of Inter-Faculty Individual Studies in Mathematics and Natural Sciences, Poland*
3. *VITO – Centre for Remote Sensing and Earth Observation Processes, Mol, Belgium, koen.meuleman@vito.be*

ABSTRACT

Due to low accessibility of mountain ecosystems, unstable weather conditions and relative short vegetative season assessing vegetation condition is often constrained or even prevented using traditional field techniques. On the other hand, these areas plants are exposed to different stress factors. Mountain plant species have very specific environmental adaptations to protect them from harsh conditions. Remote sensing can offer assessments of vegetation condition across a range of spatial scales. It is mainly automatized, repeatable and can be used for large areas. It provides a uniform treatment of the entire study area. Also, based on spectral bands connected with plant physiological and structural characteristics it is possible to calculate vegetation indices (VIs) to analyse vegetation condition. The aim of the study was to analyse the condition of mountain non-forest communities in the Karkonosze based on field measurements and APEX hyperspectral images.

Research area are Karkonosze Mountains located on the border of Poland and the Czech Republic (Figure 1). In 1993 The UNESCO's Man & Biosphere Programme created Transboundary Biosphere Reserves, which includes national park area. The detailed analysis presented in this study were performed on three areas of Karkonosze Mountains: around Mala Úpa on Czech and Polish part, Velká Úpa and Pec pod Sněžkou in the Czech part. In this work were analysed two types of non-forest communities: grassland and synanthropic. For grasslands included alpine swards, meadows and also dwarf shrubs.

Two kinds of data were used in the analysis. During the field measurements were collected biophysical parameters (Leaf Area Index – LAI and fraction of Absorbed Photosynthetically Active Radiation – fAPAR) and values of spectral reflectance using ASD FieldSpec 3. The measurements were done in August 2013 on 40 research. Also, APEX hyperspectral images with spectral reflectance 400 to 2500 nm were used.

To estimate vegetation condition on APEX images were calculated vegetation indices (modified Normalized Difference Vegetation Index 705, Photochemical Reflectance Index, Normalized Difference Nitrogen Index, Moisture Stress Index and Water Band Index) and located field measurements polygons. Afterwards, were calculated relationships between biophysical parameters and vegetation indices for grasslands and synanthropic communities separately. Simultaneously, was done classification Support Vector Machines to distinguish 3 classes: grasslands communities, synanthropic communities and others. After that, were prepared maps of vegetation condition, distribution of vegetation indices and biophysical

parameters. Based on the vegetation indices was estimated vegetation condition of mountainous non-forest communities. The results showed that the non-forest vegetation communities in research area are in good condition. Condition and values of biophysical parameters were better for synanthropic communities.

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