

APPLICATION OF HYPERSPECTRAL DATA OF THE PRISMA MISSION TO IDENTIFY SELECTED TREE SPECIES IN THE AREA OF ACTIVE LIGNITE EXTRACTION ALONG WITH THE ASSESSMENT OF THE VEGETATION STATE

Anna Buczyńska ^{*1}

¹ *Wrocław University of Science and Technology, Faculty of Geoengineering, Mining and Geology,
Division of Geodesy and Geoinformatics, 27 Wybrzeże Stanisława Wyspiańskiego st. 50-370 Wrocław, Poland*

*Corresponding author: anna.buczynska@pwr.edu.pl

Keywords: PRISMA, spectral indices, supervised classification, lignite mine, vegetation

The main goal of this research was to identify selected tree species located within the area of the Bełchatów lignite mine based on satellite hyperspectral imagery of the PRISMA mission and supervised classification using selected machine and deep learning methods. The state of plant cover was assessed using a set of spectral vegetation indices, as well. The methodology used in this study included the following stages: (1) acquisition of hyperspectral images and data from the Forest Data Bank, (2) preprocessing of PRISMA imagery, (3) preparation of training and test datasets, (4) supervised classification of images using 9 algorithms, (5) determination of 20 spectral indices describing various biophysical and biochemical parameters of flora, (6) accuracy assessment of the classification results. The determined values of accuracy measures demonstrated that the most accurate forest maps were obtained using the Support Vector Machine method with a 2nd-order polynomial as the kernel function. These maps were characterized by overall accuracy and Kappa coefficient values higher than 75%. The least accurate classification results were obtained using the Naive Bayes and Spectral Angle Mapper models. The values of user and producer accuracies indicated that all the algorithms used identified *Scots pine* most accurately, while *black alder* was detected with the lowest precision. An analysis of the spectral indices proved a good overall condition of the flora and an appropriate concentration of water, chlorophyll, carbon and carotenoids. However, woody vegetation is characterized by a moderate nitrogen content and a high concentration of anthocyanins. Summing up, this research demonstrated the potential and limitations of hyperspectral PRISMA imagery in comprehensive analyses of the tree stand in areas of active lignite exploitation.

This study has been realised within the frames of the research project “Analysis of selected methods of information extraction from satellite hyperspectral data of the EnMAP and PRISMA missions in the context of study the environmental state of mining and post-mining areas” financed from the MINIATURA-7 National Science Centre Funding Scheme (2023/07/X/ST10/00417).