



PhD student: Anna Buczyńska, MSc, Eng.

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Supervisor: Jan Blachowski, DSc, PhD, Eng., Professor at WUST

Abstract of the PhD dissertation

Modelling of the impact of former, complex mining activities on the condition of selected components of the natural environment in the glaciotectonic area

Mining activities interfere significantly with the condition of the natural environment, causing: changes in water regimes, degradation of native vegetation, water and soil pollution with heavy metals, as well as changes in the topography. New, anthropogenic forms are also present in the mining landscape, such as: dumps resulting from the storage of waste rock, or large-scale mining excavations. It should be emphasized that the negative effects of mining activities can be observed even many years after the cessation of mineral exploitation, such as: sinkholes, ground subsidence, local flooding, fires of dumps. Therefore, monitoring of changes taking place in post-mining areas is an important issue. Due to the lack of sufficient financial resources and the time-consumption of classical ground measurements carried out in terrains with such a large surface area, post-mining regions are rarely subject to regular studies. However, current methods of data acquisition, such as satellite and aerial remote sensing, and innovative methods of data processing and interpretation (spatial statistics, including multidimensional spatial regression) can significantly facilitate the study of environmental components in post-mining areas, the analysis of their changes over time, as well as the forecasting of processes that may affect the elements of the former mining landscape. The aim of this dissertation were to identify of long-term changes in the state of natural environment of post-mining area and to develop of regression models (Ordinary Least Squares and Geographically Weighted Regression models), describing the relationships between the condition of plant cover and soils, determined on the analysis of time series of spectral indices (dependent variables) and geological, mining and topographic factors (explanatory, independent variables). Moreover, an index of environment condition for the post-mining area was developed based on the global regression models and a set of existing spectral indices. The study area in this research was a closed lignite mine "Friendship of Nations - Babina Shaft", where mining works were carried out by open-cast and underground extraction methods. The condition of plant cover and soils in the period of 1989-2019 was characterized on the basis of environmental indices developed using multispectral satellite imagery (Landsat TM/ETM +/OLI and Sentinel-2 missions). The results obtained in this study allow to understand and determine whether, and to what extent, the former mining activities, complex geological structure and topographic conditions have an impact on the condition of the vegetation cover and soils. The developed regression models can also be used to predict the values of remote sensing indices, or the index of the state of the post-mining area environment in places where their determination was not possible, or to determine changes of these indices over time.

Key words: remote sensing indices, spatial regression models, Babina mine, vegetation and soils condition, secondary impacts of mining, glaciotectonic area, post-mining

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