

Abstract

The main purpose of this thesis is to use Image Spectroscopy as a tool to monitor the environmental conditions in a region affected by anthropogenic activities via estimating both geochemical and biochemical parameters on a regional scale. The research has been carried on the Sokolov lignite mine, NW Bohemia, a region affected by long-term extensive mining. The thesis is divided into two thematic parts. First part is devoted to applications of Image Spectroscopy into Acid Mine Drainage mapping and its related issues (chapters 2 and 3).

In *chapter 2* the equivalent mineral end-members were successfully derived from the ASTER image data (Advanced Space-borne Thermal Emission and Reflection Radiometer satellite data). In *the chapter 3* the pH was estimated on the basis of mineral and image spectroscopy. The Multi Range Spectral Feature Fitting (MRSFF) technique was utilized for mineral mapping and the multiple regression model using the fit images, the results of MRSFF, as inputs was constructed to estimate the surface pH and statistical significant accuracy was attained.

In the second thematic part (*chapters 4-6*) Image Spectroscopy is applied into monitoring of vegetation stress. A new statistical method was developed to assess the physiological status of macroscopically undamaged foliage of Norway spruce (*chapter 4*). As the chlorophyll content alone may not correspond sufficiently well to the physiological/health status, the suggested method utilized three indicators (Cab, REP, expSIPI). In the following study (*chapter 5*) the same method is employed and validated while using additional temporal HS image data set (08/2010). Both biochemical analysis of the sampled foliage and classification of 2009 and 2010 hyperspectral images identified the same sites affected by vegetation stress.

Lastly, the potential of diverse foliar biochemical parameters used as stress indicators is assessed to suggest the most sensitive once having the biggest potential for future HS Remote Sensing forest monitoring. The correlations between two toxic element contents in needles (aluminum (Al) and arsenic (As)) and the contents of soluble phenolic compounds and total carotenoid to chlorophyll (Car/Cab) ratio suggest that these latter two biochemical parameters can serve as suitable non-specific stress markers, thus should be further considered for vegetation stress monitoring while employing the methods of Image Spectroscopy (*chapter 6*).