Summary

In the course of hard coal mining activities the mining company is bound by law to observe the ecological impacts of their business in detail. Up to now the ecological monitoring is done terrestrially on small sample areas which are chosen according to the valid mining plannings and the hydrological models. The fast enhancement of hyperspectral sensor technology promises that data exploitation methods based on this technology are able to detect status and changes in the health conditions of the ecological environment fast and easily.

This thesis examines the possibilities to use the data of the airborne hyperspectral remote sensing sensor *HyMap*^{TM} to support the ecological monitoring by the example of perennial plants. On the test site in the Northern Ruhr District, Germany, such crops are mainly forest stands.

For the thematic data exploitation and especially for the development of new algorithms it is necessary to have good knowledge of the relevant conditions of the test site. Hence, in the framework of the airborne hyperspectral Data flights, an extensive Ground reference campaign has been done. During this field campaign, next to spectral measurements on plant and leaf material using an *ASD Field-Spec Pro FR* portable spectroradiometer, forest stands have been mapped and the chlorophyll content of leaf samples have been measured in the laboratory. Leaf Chlorophyll Content will be used as an indicator for the plant status estimation in the course of this thesis.

Because remote sensing data of two different recording times have been analysed comparatively and are stored in a GIS, some different steps of data pre-processing had to be introduced. These steps are mainly the geometric corrections, which effect of the flight path and course instabilities, and radiometric corrections of the data, where the influences of the atmospherical situation to the radiance is modelled and corrected.

On the basis of two pre-processed *HyMap*^{TM}-Datasets and the ground reference, two essentially different Methods to determine plant status differences have been tested. For the first Method 32 descriptive spectral attributes have been introduced. With these attributes the reflectance spectrum can be mathematically described and analysed. Correlation analysis is used to detect dependencies between these attributes as well among each other as between these and the leaf chlorophyll content. The calculation of leaf chlorophyll content from the spectral signatures is done using several descriptive attributes and the multiple linear regression method.

The second Method uses two approaches of Spectral Mixture Modelling, the linear spectral unmixing and the Mixture tuned matched filtering, to derive plant status parameters. Fundamental to this Method is a new approach for the derivation of spectral endmembers.

After a view on available change detection algorithms, changes are then derived using a modified and to the existing demands adapted change vector analysis. The tested Methods to derive the state of plant health and its change has shown a fundamental potential to achieve a fast and easy to use method for the monitoring of mining activities.