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Assessment of the environmental effects of mining using SPOT-Vegetation NDVI

C. Tote (1), E. Swinnen (1), M. Goossens (2), I. Reusen (1), and S. Delalieux (1)

(1) Flemish Institute for Technological Research (VITO), Centre for Remote Sensing and Earth Observation Processes, Mol, Belgium (carolien.tote@vito.be), (2) Geosense, Den Ham, the Netherlands

Within the ImpactMin project, funded by the Framework Programme 7 of the European Commission, new methods for the environmental impact monitoring of mining operations are being developed. The objective of this study is to analyze the impact of mining on soil properties through assessment of the vegetation status using time series analysis of low resolution Normalized Difference Vegetation Index (NDVI) images derived from SPOT-Vegetation. The study focuses on the surroundings of mining areas in the Orenburg region in the Russian Urals. Karabash has been a centre for mining and metal production for well over 3000 years, and environmental impact of (historical) mining in the area is extremely severe. The area was characterized as an 'ecological disaster zone', based on chemical analysis of soil samples in the area [1]. The mining activities were intensified in the early to mid-20th century, but the old smelter was modernized in the 1990s. A time series of 10-daily NDVI images from SPOT-Vegetation (S10 April/1998–December/2010 at 1km^2 resolution, http://www.vgt.vito.be/) is analyzed. Different land cover types clearly show different phenology. To remove seasonal vegetation changes and thus to facilitate the interpretation through the historical record, a Standardized Difference Vegetation Index (SDVI) was calculated for each pixel and for each record of the time series. The first results of trend analyses indicate a strong recovery of open forests in the Karabash region in the last decade. To what extent this can be related to reduced mining impact or climate factors, still needs to be assessed. Further research will also focus on the spatial heterogeneity of phenological parameters, in relation to distance to and wind direction of the smelters and soil properties.

[1] V. Nestersnko, "Urban associations of elements- environmental pollutants in Karabash city (Chelyabinsk oblast) as a reflection of ore-chemical descriptions of mineral raw material", Proceedings of the Chelyabinsk Scientific Center, vol. 3, pp. 58-62, 2006.