



## **The assessment of anthropogenic impact on the environment in East Fennoscandia based on the Normalized Difference Vegetation Index data**

Daria Miulgauzen (1) and Lubov Pankratova (2)

(1) Institute of Earth Sciences, Saint Petersburg State University, Saint Petersburg, Russian Federation (dariadauria@yandex.ru), (2) Institute of Earth Sciences, Saint Petersburg State University, Saint Petersburg, Russian Federation (l.pankratova@spbu.ru)

Being a part of Eurasian “cold sector”, ecosystems of East Fennoscandia may fit in the category of the most vulnerable to any external impact, including anthropogenic one. The productivity of plant communities can serve as an indicator representing the state of ecosystems, especially in disturbed areas. The present research is aimed at the environmental impact assessment caused by the Pechenganikel Mining and Metallurgical Plant based on the plant communities’ productivity data on the example of ecosystems of East Fennoscandia.

Vegetation productivity was assessed on the basis of the Normalized Difference Vegetation Index (NDVI) which is often used for screenings to quantify plant canopy. The essence of the method is that of the difference between the spectral reflectance of vegetation in red and near-infrared regions. The index was calculated on the satellite images of Landsat 8 in IDRISI Kilimanjaro (Clark Labs) according to the equation:

$$NDVI = \frac{NIR - RED}{NIR + RED};$$

NIR - spectral reflectance measurements in near-infrared region,

RED - spectral reflectance measurements in red region.

To compare the index calculations with the information on the state of plant communities, the field studies were carried out in the area of 380 km<sup>2</sup> in the vicinity of the Pechenganikel Mining and Metallurgical Plant (Kola Peninsula, Nickel urban-type settlement). As a result, there was created a map in MapInfo Professional 12.5 (Pitney Bowes Software) that represents the vegetation damage at a scale of 1:100,000.

The field research has revealed the morphogenetic discrepancy between the soil-plant cover of the area in question and the one of “zonal” ecosystems. Plant communities have been widely modified or destroyed because of air pollution and there are numerous disturbances in the soil profile structure. In terms of vegetation productivity, the analysis of the NDVI figures has shown that the closer the pollution source (Pechenganikel Plant) is, the more significant the productivity decrease is. In addition, the published data on the content of heavy metals (Ni, Cu), which are the main components of the Plant’s emissions, found in plants (berries and mushrooms) in the area in question (*Environmental condition of Kuetsyarvi lake and its surroundings. Michurin A. N., Tatarinskiy V. N. (Ed.). St. Petersburg., 2003. 144 pp. (in Russian)*), field data on vegetation cover, soils and topography, as well as calculations of the NDVI helped to identify the zones with different damage intensity, to define their shape and local interpenetration. Southwestern winds prevailing in the area were determined to contribute to spreading of pollution in the area and to widening of the zones with low NDVI to the south-east from the source.

Thus, the research findings have proved the fact that anthropogenic impact of the Pechenganikel Mining and Metallurgical Plant induced ecosystem degradation in East Fennoscandia. The NDVI enabled to shift the research from the “spot” field data to the level of areal generalizations; therefore, it should be applied in further studies dedicated to the problem of sustainable development.