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ANALYSIS OF LANDSAT NDVI TIME SERIES FOR DETECTING DEGRADATION OF VEGETATION

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Calculation of vegetation indices, especially Normalized Difference Vegetation Index (NDVI), has become one of the most successful, popular and traditional attempts in biogeographical research methods, because NDVI has certain advantages over other vegetation indices or band combinations. The results of calculations of vegetation indices for studies of land cover types are being repeatedly reported in various papers [1], [2], [3], [4]. Thus, NDVI is less depending on soil properties of the research area as well as to the daytime illumination comparing to simple red-infrared bands combination [5]. NDVI is well adjusted specially for the analysis of vegetation properties, which can be indirectly interpreted from the objects colors, as shown on the raster image. However, the correlation of the results received from the satellite spectral signals may not necessarily precisely correlate with real data on biomass and vegetation quality which is caused by the local climatic settings and biogeochemical background of the research area.

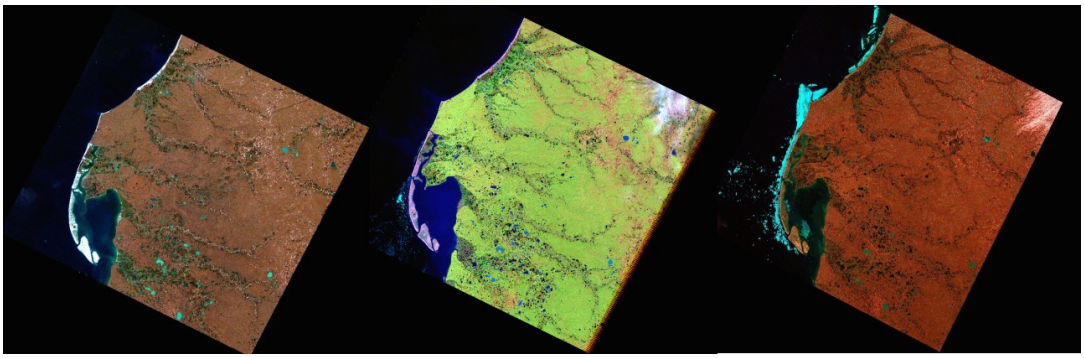


Fig. 1. Initial remote sensing data, left to right: Landsat TM 1988, bands 7-3-1; Landsat TM 2011, pseudo natural colors composite; Landsat ETM + 2001 bands 6-3-1.

As a result, the accuracy and certainty of the modeled NDVI data may differ from the real biophysical characteristics of vegetation canopy in various geographic regions. Nevertheless, in the Arctic region, the application of NDVI shows high overall correlation with real biophysical properties of vegetation [6]. Therefore, using NDVI for monitoring land cover types in Yamal Peninsula is highly useful for studies of land cover changes.

Producing vegetation indices has been done in this research using mathematic calculation of the channels: (NIR-VIS) / (NIR+VIS), or a ratio for channels: (Band4-Band3) / (Band4 +Band3). NDVI values lie in the range of 0 – 1 and never become negative or extend over 1, because NDVI is a linear algebraic function of these bands [7]. The resulting image shows vegetation types in enhanced colors and sharpness, which can help to highlight most rapid changes while comparing two or more images taken in different time periods. Monitoring spatial distribution, presence and health conditions of the vegetation is traditionally being performed using calculation of the NDVI (Normalized Difference Vegetation Index). To model the NDVI I used Map Calculation tool in command line of the Raster Operations menu in ILWIS GIS, which enables to perform spatial analysis and modeling by combination of queries, arithmetic expressions and overlays of selected raster images. The calculation of the NDVI index is read into the ILWIS spatial analysis menu using following equation: NDVI = (Band4 – Band3) / (Band4 + Band3), where Band 4 is DN values of spectral reflectance in NIR (near infra-red) and Band 3 is DN values of spectral reflectance in VIS. The NDVI was calculated automatically using arguments of images: VegIndex = NDVI (Band3, Band4). Two Landsat bands have been used: Band4, containing red reflectance and Band3 with infra-red reflectance: VegIndex=NDVI(TM_3,TM_4). Other Landsat scenes were classified individually using the same method scheme in ILWIS GIS.

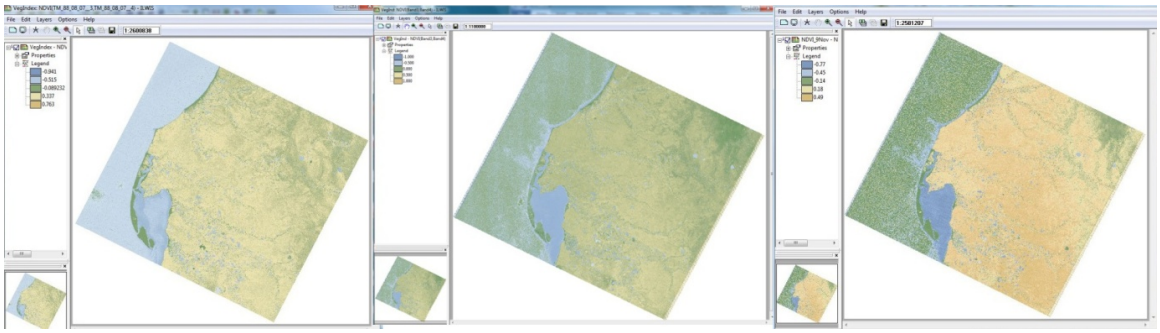


Fig. 2. Results of NDVI Calculation. From left to right: Landsat TM, 1988, 2001 and 2011.

The resulting images shows distribution of the vegetation over the Bovanenkovo region within three (3) years: 1988, 2001 and 2011 (Fig.2). The results for the year 2001 show that vegetation has very moderate overall index, reaching value 0,500 as a maximal. The maximal NDVI values in year 2011 are 0.49, while in 1988 it was 0.76, which shows the decrease in the biomass values during the past two decades. The satellite-based monitoring of the northern ecosystems is important tool for detection of the environmental changes. This research presented ILWIS GIS based image processing of Landsat time series covering Yamal area. The results show decrease in overall NDVI values for the study area since 1988 to 2011, which can be caused by the environmental change and anthropogenic factors. The calculated NDVI indicated biomass and can be also used as indicator of “greenness” of the vegetation.

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A COMPARISON OF IDF PRECIPITATION CURVES TO PERIODIC ANOMALIES IN THE CENTRAL MISSOURI RIVER VALLEY

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Over the last few decades, atmospheric research has worked on assimilating regional rainfall statistics in an effort to improve: the monitoring of precipitation, the understanding of climate trends and variability, and the anticipation of anomalously dry and wet periods. The long-term goal of this work is to enhance the understanding of rainfall gauge position in relation to the long-range prediction of regional precipitation and subsequent crop forecasting issues. Among the nine rain gauges currently positioned throughout Goodwater Creek (a 72.5 sq. kilometer basin to the northeast of Columbia, Missouri); four gauges have been active from 1976 to the present; two of which have been active since 1969. The primary statistical analysis will be to examine return periods for heavy rainfall across the central Missouri River Valley basin over the last 45 years and evaluating the inter-annual variability of precipitation anomalies. This will be complemented by the analysis of intensity-duration-frequency (IDF) curves from the specified rain gauges over the time period(s) of interest. One concern is whether the analog data between 1969 and 1995 are reliable which will be addressed through a comparison of synoptic flow regimes associated with precipitation anomalies using North American Regional Reanalysis archives. The secondary aspect involves assessing relationships between climatic trends and possible connections to higher atmospheric water vapor content; often linked to heavier rainfall. The aspiration for these results is to improve the effectiveness of agricultural practices.

ИЗУЧЕНИЕ БИОЛОГИЧЕСКИХ СВОЙСТВ ТЕХНОГЕННО НАРУШЕННЫХ ПОЧВ КУЗБАССА С ИСПОЛЬЗОВАНИЕМ ТОРФЯНЫХ ПРЕПАРАТОВ

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Нарушенные после горнодобывающих работ территории представляют собой техногенную пустыню, с практически полным уничтожением почвенного и растительного покрова. В связи с этим, актуальность данной работы заключается в решении одной из