Effects of climate, grazing, and gas development on tundra ecosystems of the Yamal Peninsula, northwestern Siberia

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Remote sensing of land cover and vegetation change in the gas-developed Nadym region

Landsat imagery from 1988 and 2007 were collected and preprocessed before deriving NDVI, albedo and Normalized Difference Water Index (NDWI). To minimize any seasonality effect, we normalized the data with the mean difference between images. Then we can calculate the changes in NDVI, albedo and NDWI by subtracting 1988 data from normalized 2007 data. Natural recovery of vegetation occurs around old roads and is detected with an increased NDVI of ~0.25. Development disturbances such as new buildings and new roads can cause NDVI to decrease significantly (~0.58), while albedo can increase by approximately 0.1. The final difference map shows that NDVI in both forest and tundra sites has declined with a greater decline in the tundra site (~0.064) than in the forest site (~0.036), suggesting that tundra vegetation may be more vulnerable than forests to land use change.

Vegetation dynamics in northwest Siberian forest-tundra

Tall shrub and tree proliferation in tundra-dominated regions represents a fundamental change to ecosystem structure and function due to climate warming, natural or anthropogenic disturbances including surface mining, roads and buildings. This change often occurs in otherwise relatively stable (Physiologically) cold permafrost-tundra (Kharp and Tazovskiy). To examine spatial patterns within disturbed areas, we collected satellite Quickbird imagery (acquired 2006/9/6) and aerial Corona imagery (acquired 1968/8/21) within our Landsat study region. Corona images were co-registered and georeferenced with Quickbird imagery. The Quickbird image shows new roads, and along the roads, there are regions with vegetation change with respect to nearby disturbances such as roads.

High resolution remote sensing imagery can be used to detect fine-scale spatial patterns within disturbed areas. We collected satellite Quickbird imagery (acquired 2006/9/6) and aerial Corona imagery (acquired 1968/8/21) within our Landsat study region. The Corona images were co-registered and georeferenced with Quickbird imagery. The Quickbird image shows new roads, and along the roads, there are regions with conspicuous vegetation decline. We are continuing to analyze the spatial patterns of vegetation change with respect to nearby disturbances such as roads.

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