Introduction
Gas and oil exploration is growing rapidly in the Russian Arctic which causes increasing pressures to reindeer herding. The aim of the research is to investigate impacts of petroleum exploration on reindeer pastures and the overall nomadic Nenets economy. Natural changes due to the climatic or other factors are also examined.

The field research has taken place in the Yamal-Nenets Autonomous Okrug (YNAO) (Fig. 2). Nenets continue to practice migratory reindeer husbandry in the area. Pressures are environmental, social and economic. Extensive infrastructure like roads, pipelines, quarries and various garbage hinders the use of traditional migration routes.

Remote sensing is used to study how large are the areas that have been affected by industrial sites. Important questions are: what is the utility of affected areas to reindeer and reindeer herders and what is the general quality of pastures (Fig. 6). Very high-resolution (VHR) remote sensing data produce detailed information about the effects around the drilling sites. Even 5-15 year old all terrain vehicle tracks are visible in the images (Fig. 4).

Remote sensing data
Research was carried out at the different scales (Fig. 1). Fine-scale data include ground truthing and false color camera photographs. The main data used to evaluate the current situation are derived from VHR Quickbird-2 satellite images (2.5 meter multispectral and 0.6m pan-chromatic resolution) (Fig. 1/A4).

ASTER TERRA and Landsat TM images represents coarse and global scale data and are used to cover larger areas. For the detection of the anthropogenic or natural changes the building of time series of satellite images since late 1960’s is in progress. Corona spy satellite images provide the oldest data from 1969. Corona images are black and white with 10 meter resolution. Landsat, SPOT and ASTER images are from the period 1985-2005.

Methods
Infrastructure, roads, quarries and all terrain vehicle tracks are digitized to respective map layers in ArcGIS software. After digitizing, buffers were created around roads, etc. and affected area around different objects were calculated.

ERDAS Imagine was used for image processing. Change detection between the images was produced with change detection module of ERDAS and by visual interpretation (Fig. 8).

Conclusions
- Petroleum industry affects strongly traditional livelihoods.
- Even though the industrial sites are relatively small-scale the pipeline, road and train networks constructions disturb the migration of nomadic herders and reindeer.
- Bovanenkovo gas field, which is still in the construction phase, will expand soon. The effects are expected to be devastating to certain reindeer herding brigades crossing the gas field.
- Reindeer herders have direct observations on changes on tundra over a period of 30-50 years.
- Increasing accessibility to arctic drilling sites will increase the human impacts and can cause severe changes to the regions ecological conditions (increase of thermokarst in construction sites).
- Satellite imagery is essential data source in monitoring the implications
- Anthropogenic impacts + possible climate warming may exacerbate the negative effects.

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