Environmental and Social Impacts of Industrialization in Northern Russia (ENSINOR)

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Photo: Bryan and Cherry Alexander
Tundra ecosystems are often considered vulnerable or 'fragile' in the face of large-scale hydrocarbon development, in part because even relatively small-scale, low-intensity impacts can accumulate in space and time.

- Scaling up to include human residents, combined arctic social-ecological systems are believed similarly susceptible to industrial impacts, as well as climate change.
- In contrast to North America, virtually all terrestrial and aquatic components of oil and gas fields in Russia’s Yamal-Nenets and Nenets Okrugs are seasonally exploited by migratory herders, hunters, fishers and domesticated reindeer (Rangifer tarandus).
- The amount of area directly disturbed in Russia is typically greater than in North America, in some cases by an order of magnitude.
- The key issue in Russia is coexistence since the shared territories for hydrocarbon development and indigenous peoples overlap so completely.
Oil & gas fields in the Barents Region and Yamal

World class deposits: most of them not yet tapped or in full production
Primary Russian oil & gas pipelines supplying Europe

The new Baltic ‘Nord Stream’ gas pipeline will be supplied in large part with gas from the Yamal Peninsula, West Siberia. It is currently delayed pending permission from e.g. Finland.
For Finland, 70% of its imported oil and 15% of its total electricity are supplied by Russia.

Environmental & Social Impacts of Industrialization in Northern Russia (ENSINOR project). Funded by Academy of Finland (2004-07) active in both NAO & YNAO.
Onshore deposits in the vicinity of the Varandei terminal, NAO

First ice-class tanker was loaded in June 2008 and sailed for Canada.
The ENSINOR project was designed to consider primarily oil & gas activities because these were what herders themselves cited as the most important factors affecting them. However, spring and summer air temperatures in NAO and YNAO have warmed over the past 25 to 30 years some 2 to 3°C. This has major implications for both oil & gas infrastructure and the future of reindeer herding since it means that people and reindeer are potentially exposed to multiple stressors.

Data from Chapman & Walsh, UAF
The first year of the project was devoted mainly to consultation, permissions, and field reconnaissance. Study areas were jointly selected in cooperation with the different stakeholders, including reindeer herders, during spring/summer 2004.

Dmitri Khorolya, President, Association of World Reindeer Herders (WRH)

A. Azarnov, Minister of Natural Resources

PhD students Timo Kumpula & Anu Pajunen discuss migrations with Roman Okotetto

Dr. Nina Meschtyb discusses migration with Taichi Khudi at Bovanenkovo

Sergei N. Khariuchi, RAIPON
Map of the Yamal Peninsula
gas and oil deposits showing the degree of overlap with modern reindeer herding territories (sovkhозы)

Land cover on the peninsula consists primarily of arctic tundra. Treeline is at the Arctic Circle, near Salekhard. For nomadic Nenets, the longest annual migrations are ≈1400 km from the winter ranges south of Ob River, north to the Kara Sea, and back.
Bovanenkovo Gas Field overlaps directly with two northern brigades of the Yarsalinski sovkhoz. 300,000 reindeer on Yamal now, 630,000 in entire YNAO.
Bovanenkovo gas field

Brigade #4 migration route summer 2005

Migration through Bovanenkovo infrastructure, July 2005

Brigade #2 migration route summer 2005
Visible impacts of Bovanenkovo gas field on summer pastures as of 2005

- Brigade 4: 225 km² affected out of total 1019 km² summer pasture (22%)
- Brigade 8: 200 km² affected out of total 796 km² summer pasture (25%)
Transport corridor under development between the main gas field at Bovanenkovo and the coastal port of Kharasavei. Impacts along the route include the damming of rivers and streams for bridge construction during the spawning season, which Nenets report negatively affects fish populations.
Among the negative effects of development, there can be direct impacts on the plant-soil cover over substantial areas. Sand and gravel quarries, for example, sometimes cover several hectares.
Single passage of ‘vezdekhod’ on mesic tundra

Visible changes in land cover over time include a widespread shift from shrub- to graminoid-dominated tundra. Examples of impacts include off-road vehicle traffic and thermal erosion of ice-rich permafrost.

Ice-rich permafrost at Bovanenkovo Gas Field

Multi-pass tracks on wet tundra
Within and near oil & gas fields reindeer herders daily encounter a wide range of environmental impacts.

Abandoned drill rigs are strewn with trash (e.g. rusted metal, broken glass) and often toxic drill muds.
There can also be indirect impacts, including rapid transformation of the hydrological, chemical and nutrient regimes in otherwise intact vegetation. For example, alkaline dust affects moist acidic tundra (pH ≈4.0) along roads in Northwest Siberia. Road dust with pH ≈8.0 can travel hundreds of meters, affecting vegetation. Roads have the potential to improve access for poachers.

Truck traffic near Laborovaya, Baidaratski sovkhoz, Yamal

Toolik area from satellite
Yamal-Taz region, West Siberia. Gas deposits in yellow, oil deposits in red.

New road and railway corridors continue to improve access to the region, although the main gas field at Bovanenkovo is still accessible only by helicopter. Construction is difficult and costly due to extensive deposits of ice-rich permafrost and terrain that is potentially unstable with or without a warming climate.
Very high-resolution satellite imagery is readily interpreted with local Nenets.