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**Adaptation to Rapid Land-Use and Climate Changes on the Yamal Peninsula, Russia:
Remote Sensing and Models for Analyzing Cumulative Effects**

We propose to develop predictive remote-sensing tools and models that can be used to help stakeholders plan for and adapt to the multiple forces of change that are affecting the Arctic. We focus on the Yamal region in northwest Siberia where a combination of gas development, reindeer herding, climate change, and extraordinarily sensitive permafrost landscapes are affecting the land and people. Our proposal has two components that analyze changes to the biophysical and social-ecological systems and several subcomponents: Component 1. Biophysical studies: climate/ sea-ice/ vegetation interactions. (a) Ground based observations will be conducted in the coldest northern part of the peninsula at Belyy Island and will complete a 700-km bioclimatic transect across the Yamal Peninsula. (b) Studies using remote sensing will analyze the spatial and temporal patterns of and sea-ice, land-surface temperatures, and vegetation greenness as indicated by the NDVI. (c) We will refine an arctic tundra vegetation change model (ArcVeg) to simultaneously examine the effects of climate change, reindeer foraging, and denudation by industrial development along the Arctic bioclimate gradient. Component 2. Social-ecological studies. (a) We will use determine the extent of the infrastructure and related disturbances using Quickbird imagery and the mid-decadal global land survey (GLS-2000). (b) We will conduct interviews with the nomadic Nentsy to provide a detailed picture of how the reindeer are using the rangelands. (c) An international workshop will address the topic of Arctic cumulative effects.