Second Yamal Land-Cover and Land-Use Change Workshop
Arctic Centre, Rovaniemi, Finland
8-10 March 2010

Welcome, goals of the workshop, and overview of the project

Skip Walker

Welcome!

Important that we meet as a whole project to:

- Meet, discuss and socialize between all members in different countries, different universities, and different agencies;
- (Especially important to take advantage of the opportunity to meet with collaborators in NASA)
- Review the overall goals of the project;
- See the progress of each of the individual parts of the project;
- Adjust the project goals in light of new discoveries, changing funding situation, and changing personnel;
- Discuss the future field seasons;
- Plan new publications and research.

Introductions:

Goals of the Workshop

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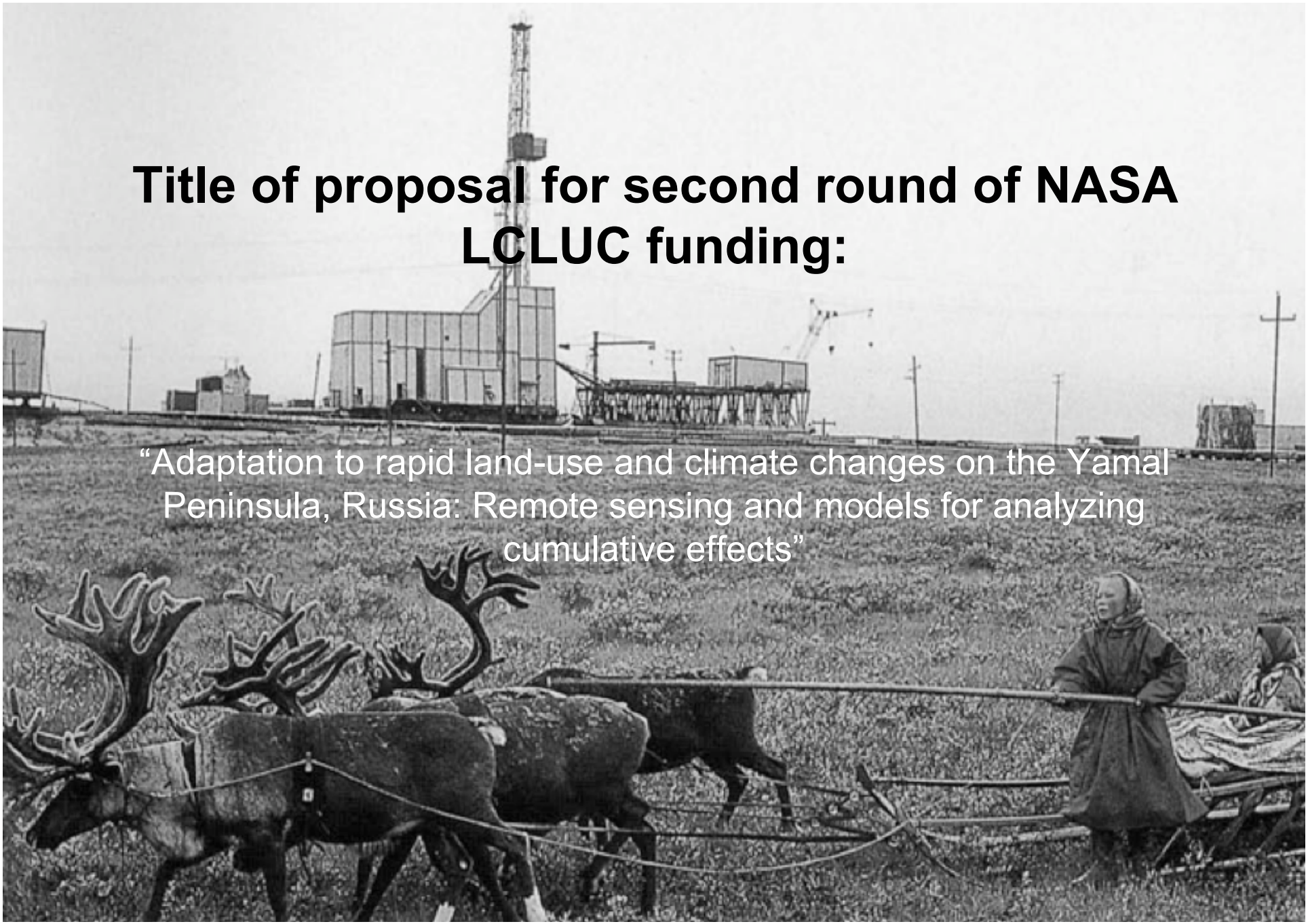
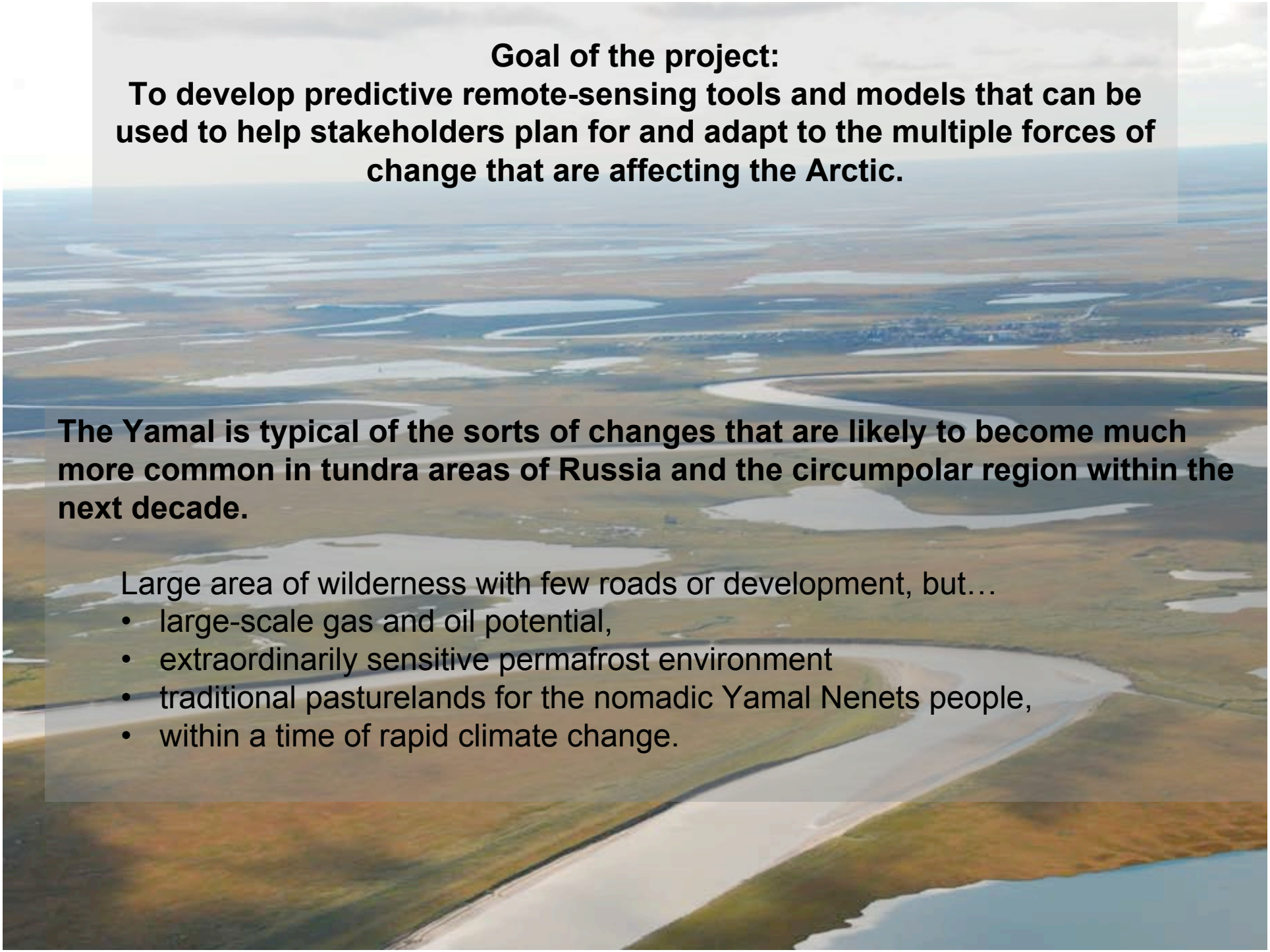


Title of proposal for second round of NASA LCLUC funding:

"Adaptation to rapid land-use and climate changes on the Yamal Peninsula, Russia: Remote sensing and models for analyzing cumulative effects"



Goal of the project:
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.

The Yamal is typical of the sorts of changes that are likely to become much more common in tundra areas of Russia and the circumpolar region within the next decade.

Large area of wilderness with few roads or development, but…

- large-scale gas and oil potential,
- extraordinarily sensitive permafrost environment
- traditional pasturelands for the nomadic Yamal Nenets people,
- within a time of rapid climate change.

Component 1: Changes due to climate/ sea-ice/ vegetation interactions

We will examine how the dramatic change in Arctic sea ice witnessed in recent years is affecting land temperatures and vegetation across the Yamal Peninsula. We will use a combination of ground-based studies, remote sensing and models:

(a) Ground based observations will be conducted in the coldest northern part of the peninsula at Belyy Island. [Note: There were sufficient funds remaining from the first round of funding to cover the Belyy field work. So we are now proposing to go to Franz Josef in 2010, to complete the Eurasian transect through all 5 bioclimate subzones.] The field work will also focus further south on vegetation succession associated with the abundant landslides, which have been identified as a major factor affecting the regional patterns of NDVI.

(b) We will use remote-sensing data for an analysis of the spatial and temporal patterns of and sea-ice, land-surface temperatures, and vegetation greenness as indicated by the Normalized Difference Vegetation Index. These patterns will be linked to ground-based measurements of NDVI, leaf-area index, biomass, and trends in climate patterns including snow-melt and wind regimes and broad-scale circulation patterns.

(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.

Questions for Component 1

(1) How do ground-based measurements of zonal vegetation vary with climate, soil type, and disturbance along the Yamal bioclimate gradient?

(2) How do satellite-based measurements of sea-ice concentrations, land-surface temperatures, and vegetation greenness in the Kara Sea-Yamal region vary spatially and temporally along the Yamal bioclimate gradient?

(3) Has there been detectable changes in the timing (seasonality) of greening on the Yamal Peninsula?

(4) How do these changes compare with other regions of the Arctic?

(5) How do these changes correspond to trends in climate patterns?

Component 2: Socio-ecological Studies

Petroleum-related infrastructure is the largest single change factor affecting the Yamal. Expanding networks of roads and pipelines are interacting with the growing populations of Nentsy and their reindeer.

(a) We will document and analyze the changes due to resource development using high-resolution (60-70-cm pixel) Quickbird satellite imagery. We will also use the Quickbird imagery to examine how roads have affected the adjacent tundra in the Prudhoe Bay region of Alaska, where there is a good historic record of infrastructure growth. We will also determine if the moderate-resolution (15-m pixels) mid-decadal global land survey (GLS-2000) can be used to inventory the footprint of the industrial development on the entire Yamal Peninsula and the oil fields in northern Alaska.

(b) We will conduct interviews with the nomadic Nentsy to provide a detailed picture of how the reindeer are using the rangelands. A preliminary study will be directed at how reindeer are using the vegetation that develops on the abundant landslides in the region.

(c) An international workshop on the cumulative effects of rapid land-use and climate change is proposed that will draw on a variety of related experiences in the Russia, Canada, Norway and the U.S. to help move the international community toward more far-sighted tools and models to approach the topic of cumulative effects of arctic petroleum development and climate change.

Questions for Component 2

(1) What is the total extent of industrial development on the Yamal Peninsula?

(2) What is the extent of the planned direct impact compared to the unplanned (indirect) impacts?

(3) What has been the historical progression of development?

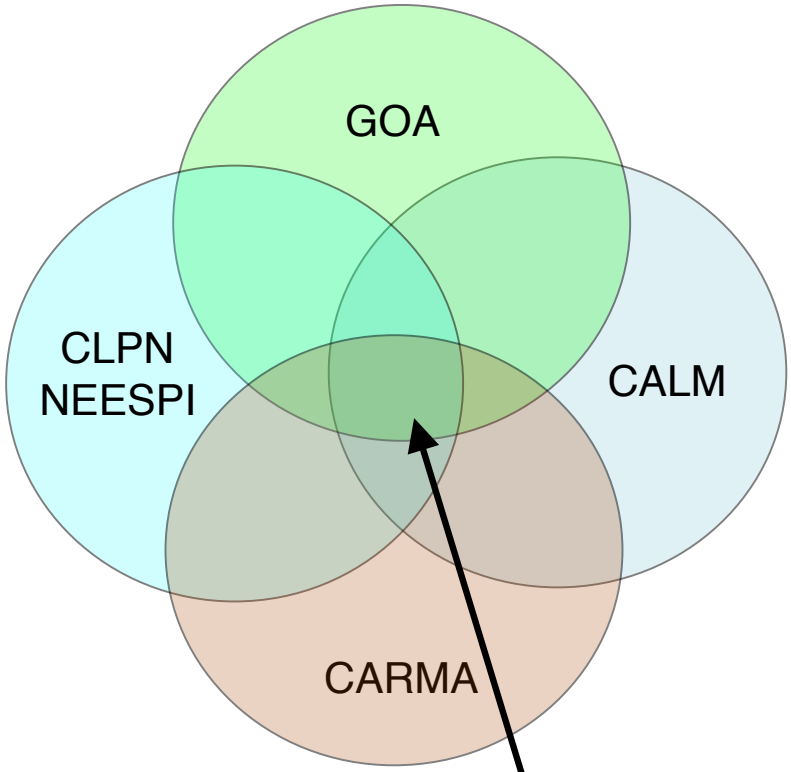
(4) How do the expanding networks of roads and pipelines affect the reindeer pasturelands?

(5) How do the impacts on the Yamal compare with those in northern Alaska?

Linkages with other IPY projects

- Connected with four IPY projects:.
  - GOA: Greening of the Arctic
  - CALM: Circumpolar Active-Layer Monitoring
  - CARMA: Circumpolar Arctic *Rangifer* Monitoring and Assessment and the
  - CLPN: Cold Land Process in NEESPI (CLPN).
    (NEESPI: Northern Eurasia Earth Science Partnership Initiative)

- One of four Greening of the Arctic projects:
  - Yamal LCLUC Project - NASA
  - North American Arctic Transect - NSF
  - Arctic Geobotanical Atlas – NSF
  - Spatial and temporal patterns of circumpolar greening – NSF



The Yamal NASA-LCLUC project

Collaborating groups:

USA

University of Alaska Fairbanks

Donald (Skip) Walker (PI, vegetation science and mapping)

Vladimir Romanovsky (Co-PI, Permafrost)

Uma Bhatt (Co-PI, circumpolar climate, sea-ice, vegetation interactions)

Gary Kofinas (Co-PI, socio-ecological dimensions)

Martha Raynolds (Post-doc, circumpolar vegetation remote sensing, GIS)

Hilmar Maier (GIS, remote sensing, mapping)

University of Virginia:

Howard Epstein (Co-PI, modeling and ecosystem analysis)

Gerald (JJ) Frost (Ph.D. student, Kharp alder studies, vegetation analysis

Qin Yu (Ph.D. student, ArcVeg Model)

NASA Goddard

Joey Comiso (Arctic Sea Ice and land temperatures)

Jorge Pinzon (Arctic NDVI, GIMMS 3g data set)

Compton (Jim) Tucker

Finland

Arctic Centre, Rovaniemi

Bruce Forbes (Finnish lead PI, socio-ecological dimensions, vegetation, ENSINOR coordination)

Florian Stammler (Nenets)

Timo Kumpula (Oil development impacts)

Russia

Earth Cryosphere Institute, Tyumen and Moscow

Dmitri Drosdov (ECI Director, Landschaft databases)

Marina Liebman (Permafrost, Russian lead PI)

Nataliya Moskalenko (Vegetation)

Nataliya Ukraientsevza (Shrub relationships at Vaskiny Dachi)

Pavel Orekhov (Animals and logistic coordination)

George Matyshak (Soils)

Anatoly Gubarkov (Ph.D student, Yamal oil and gas development)

Artuom Khumotov (Ph.D. student, active layer-landscape relationships)

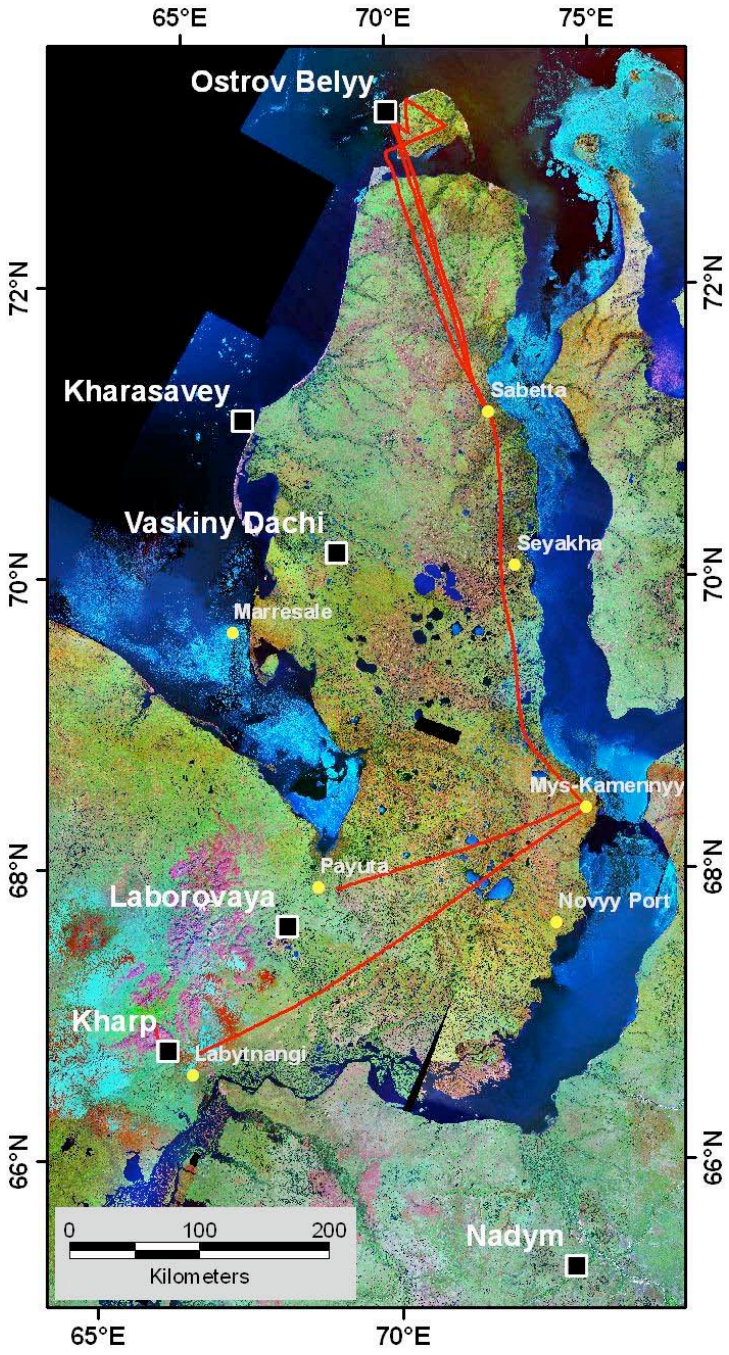
Komarov Botanical Institute, St. Petersburg

Olga Khitun (Yamal flora)

China:

Institute of Atmospheric Physics, Beijing

Gensu (Jiong) Jia (Remote sensing)



Study locations

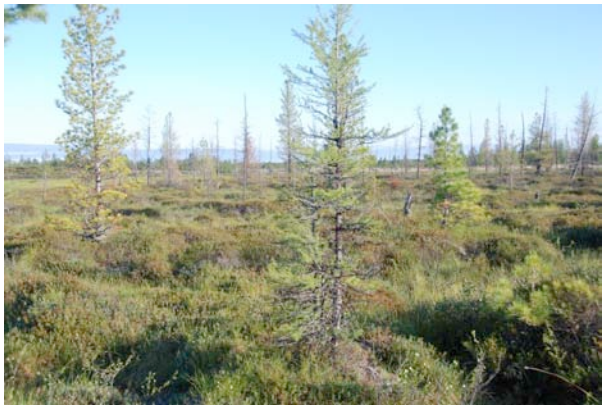
- Forest-tundra transition: Nadym and Kharp
- Subzone E: Laborovaya
- Subzone D: Vaskiny Dachi
- Subzone C: Kharasavey
- Subzone B: Ostrov Belyy

Nadym
Forest-tundra transition

Site 1: Lichen woodland
(***Pinus sylvestris, Larix sibirica, Betula pubescens, Cladonia stellaris, Pleurozium schreberi***)

Site 2: Hummocky peat plateau
(**hummocks:** ***Ledum palustre, Rubus chamaemorus;*** **between hummock:** ***Cladonia stellaris, Sphagnum majus***)

Scattered trees in peatlands
(***P. sibirica, P. sylvestris, L. sibirica***)



Sandy deeply thawed soils in forests

Thick peat and shallow thaw in tundra areas

Wetlands and palsas

Kharp

Mountain forest-tundra transition

Polar Ural foothills

Bedrock and glacial till

Expanding alder shrublands

Larch woodlands and tundra
(*Larix sibirica*)

Patterned ground
(non-sorted circles)

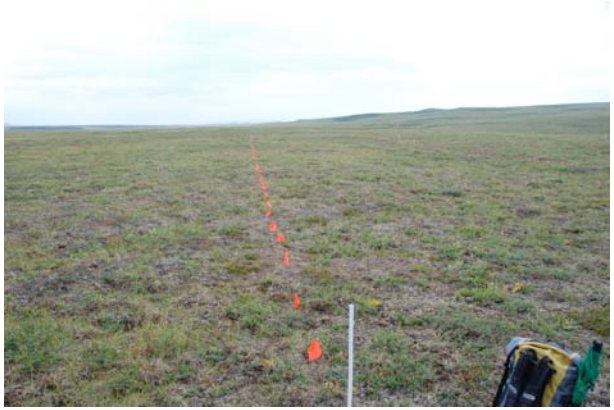
Old burn

Laborovaya

Arctic tundra, bioclimate subzone E (southern hypoarctic tundra)

Site 1, Loamy
(***Betula nana, Salix phylicifolia, Vaccinium uliginosum. V. vitis idaea, Carex bigelowii, Dicranum*** **spp.)**

Site 2: Sandy
(***Betula nana, Carex bigelowii,*** **Vaccinium uliginosum, Cladonia spp.,** ***Sphaerophorus globosus, Flavocetraria nivalis, Polytrichum strictum, Dicranum elongatum***)



Zonal site, Polar Ural foothills

Loamy soil

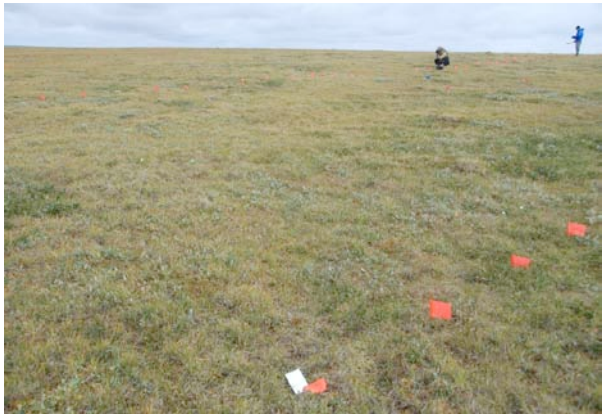
Sandy soil

Alders and willows on warm microsites

Vaskiny Dachi

Arctic tundra, bioclimate subzone D (northern hypoarctic tundra)

Site 1: Loamy, grazed
(***Carex bigelowii, Betula nana, Salix polaris, Aulacomnium turgidum, Hylocomium splendens***)



Site 3: Sandy, alluvial terrace
(***Ledum decumbens, Salix nummularia, Carex bigelowii, Sphaerophorus globosus, Gymnomitrion coralloides, Polytrichum strictum,***
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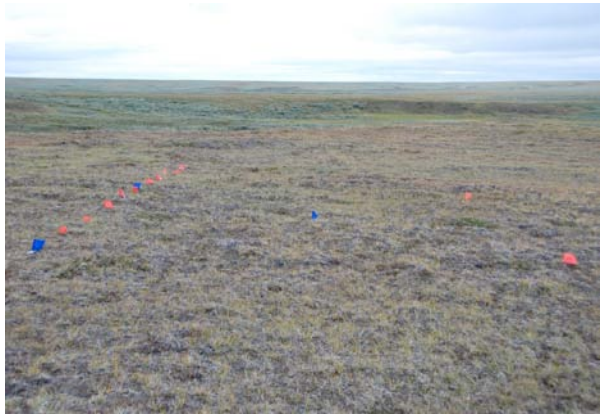
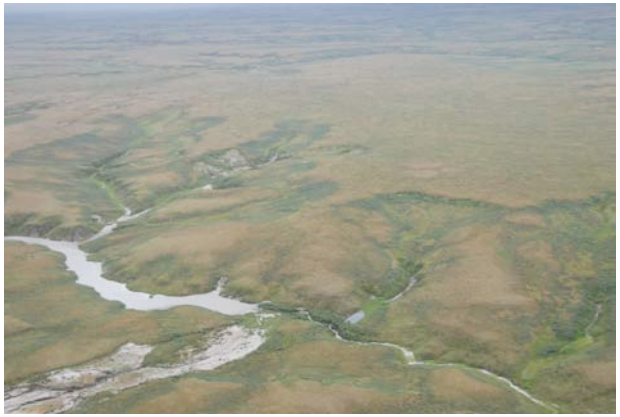


Cryogenic landslides near VD
Eroded marine terraces



Loamy site soil

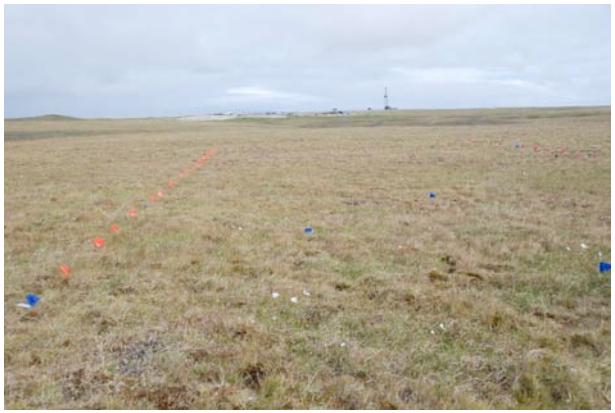
Sandy site soil

Willows on old landslides
(***Salix glauca, S. lanata***)

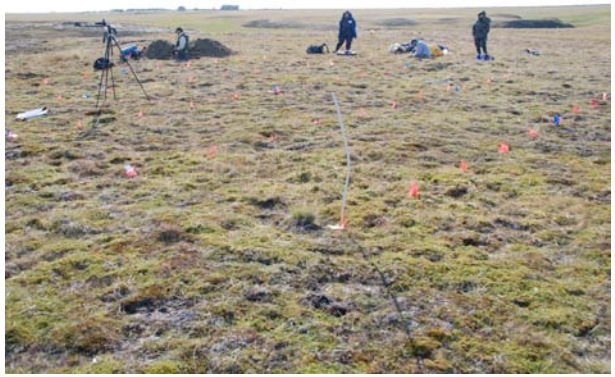
Kharasavey

Arctic tundra, bioclimate subzone C (Arctic tundra)

Site 1: Loamy tundra
(***Carex bigelowii, Calamagrostis holmii, Salix polaris, Hylocomium splendens, Aulacomnium turgidum, Dicranum* spp.**)



Site 2b: Sandy tundra
(***Salix nummularia, Luzula confusa, Dicranum elongatum, Spaerophorus globosus, Gynomitrion coralloides***)



Kharasavey tundra from the air

Loamy tundra soil

Sandy tundra soil

Eroded marine terraces

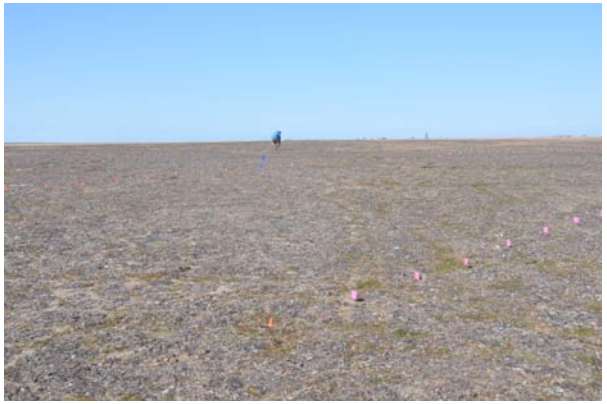
Ostrov Belyy (White Island)

Arctic tundra, bioclimate subzone B (High Arctic tundra)

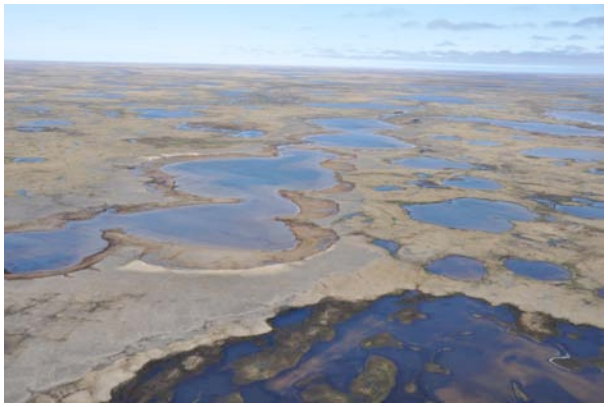
Loamy tundra complexes in the northwest

Site 1: Moist loamy tundra
(***Carex bigelowii, Calamagrostis holmii, Salix polaris, Hylocomium splendens***)

Site 2: Dry sandy tundra
(***Gymnomitrion coralloides, Salix nummularia, Sphaerophorus globosus, Racomitrion lanuginosum***)



Sandy wetland complexes in south



Non-sorted circles on loamy soil

Small nonsorted polygons on sandy soil

Goals of the workshop

1. Summarize information collected along the Yamal transect during the first 3 years of the project.
2. Present socio-ecological progress.
3. Present remote sensing and modeling studies relevant to the project.
4. Address some of the pressing remote-sensing issues.
5. Strengthen collaboration between the various components of the project.
6. Plan future publications.
7. Plan for the 2010 and 2011 field seasons.