

OVERVIEW OF THE YAMAL LCLUC PROJECT AND OBJECTIVES OF THE MEETING

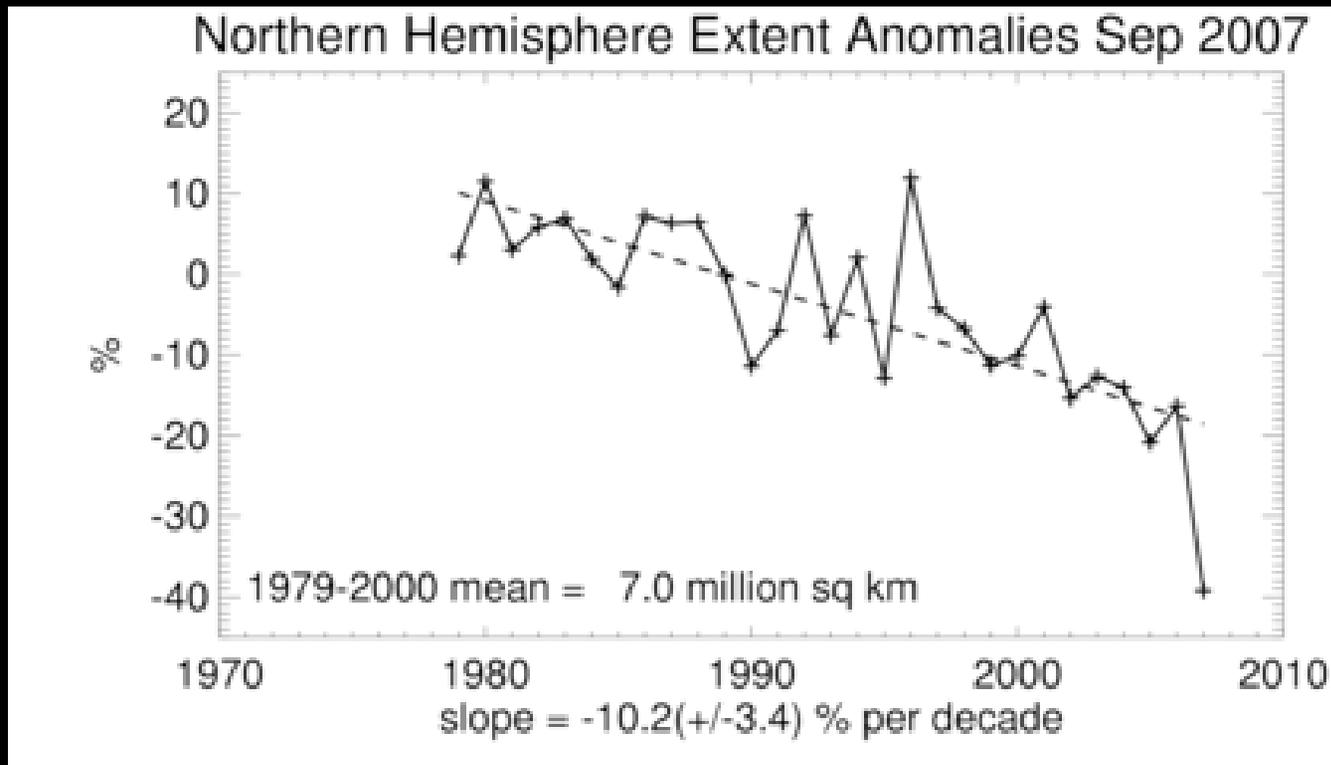
Skip Walker
University of Alaska Fairbanks



Outline

- Welcome
- The Arctic and LCLUC
- Overview of the Greening of the Arctic initiative.
- Overview of NASA-funded GOA project.
- Progress during Years 1 and 2.
- Agenda for the meeting

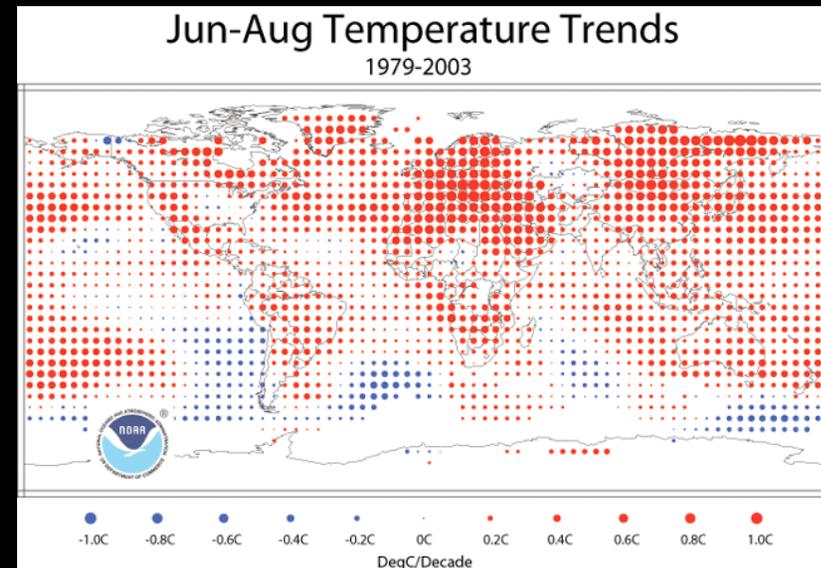
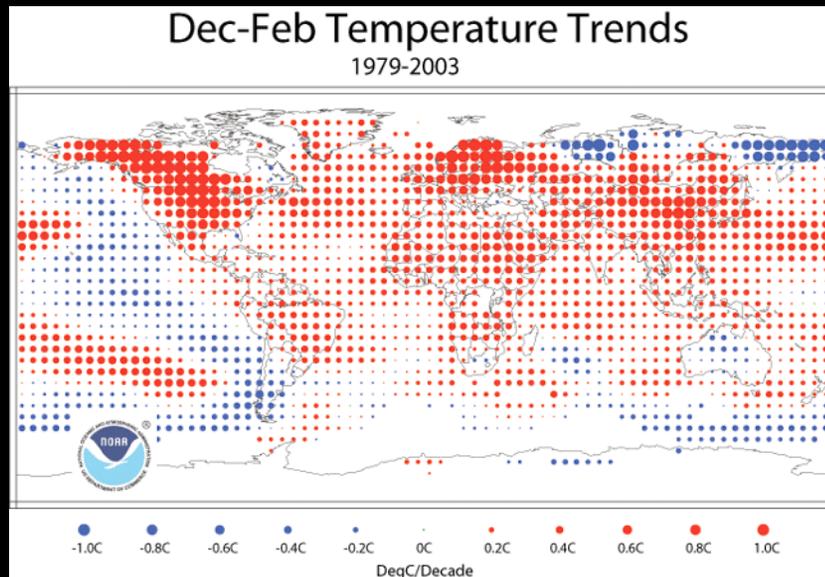
Trend in sea ice



Since 1980, perennial sea ice extent in the Arctic has declined at rate of 10.2% per decade (Comiso et al. 2008, *Geophysical Research Letters* 35: L01703).

Courtesy of National Snow and Ice Data Center,
ftp://sidads.colorado.edu/DATASETS/NOAA/G02135/Sep/N_200709_plot.png

Trend in surface temperatures



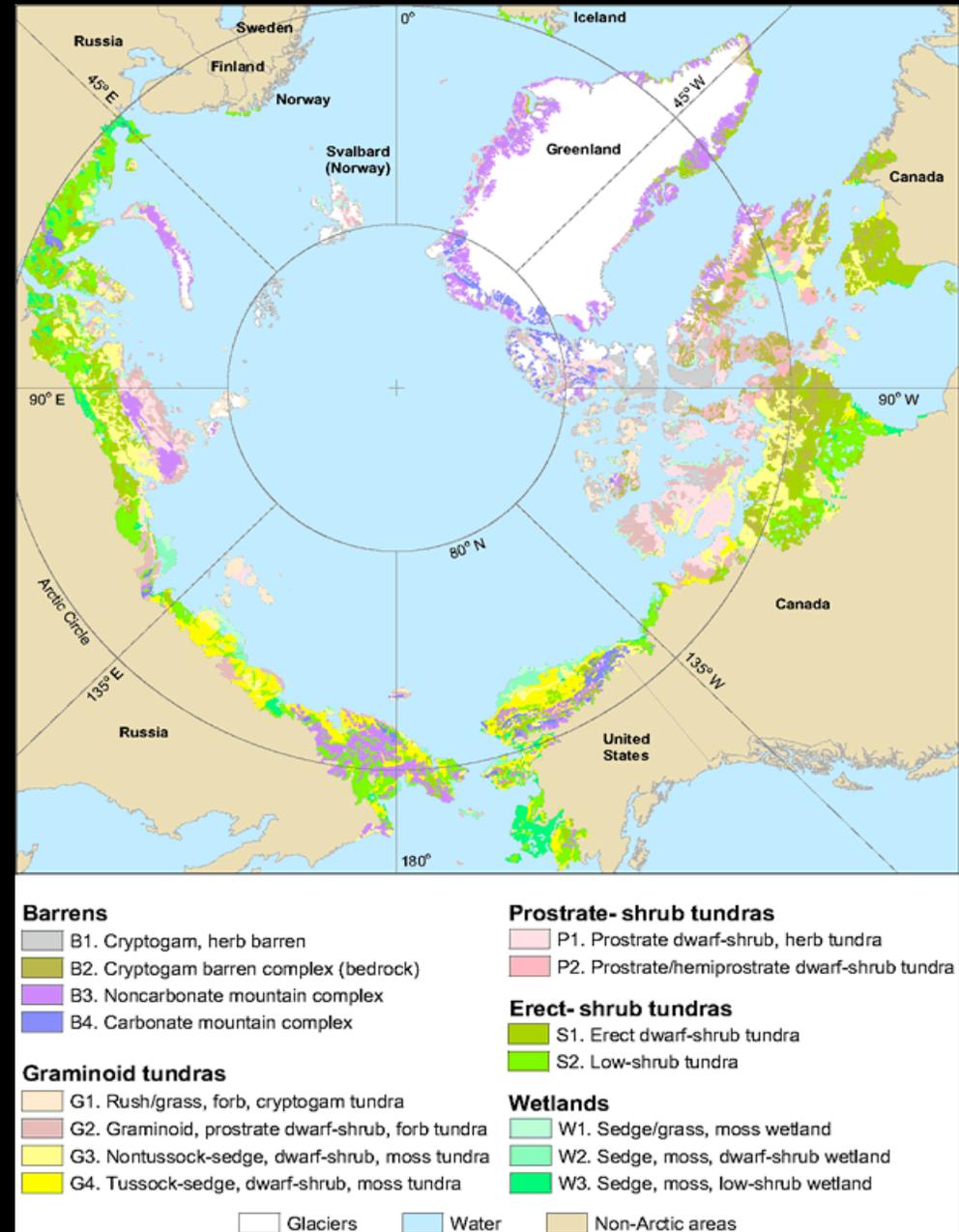
Courtesy of NOAA National Climate Center,
<http://www.ncdc.noaa.gov/oa/climate/research/trends.html>

Land-surface temperatures of North America north of 60° N rose at rate of 0.84 ± 0.18 ° C per decade since 1978 (Comiso 2006).

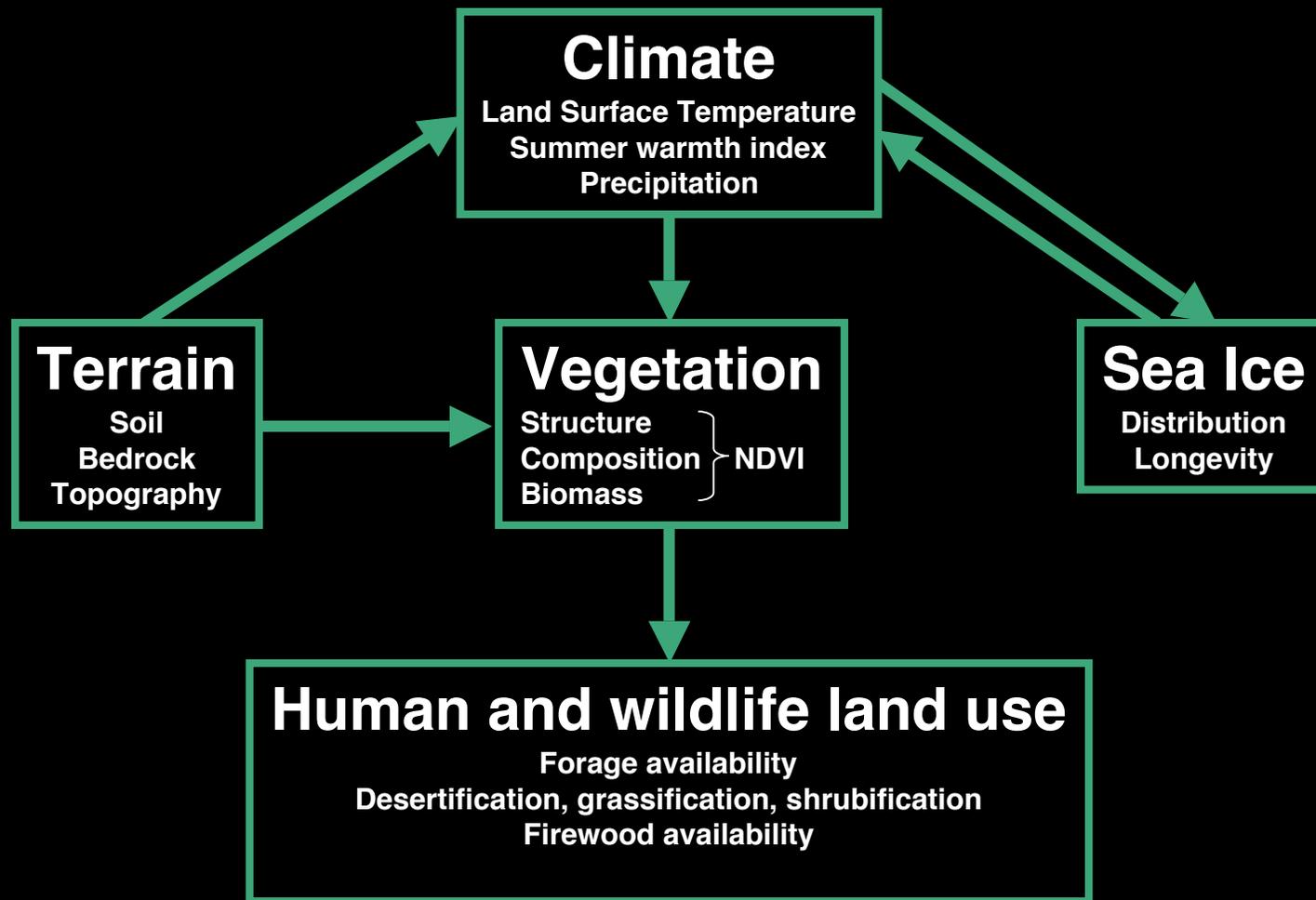
Arctic plant biomass and diversity are strongly related to total amount of available summer warmth, so changes in surface temperatures will likely result in increased biomass over much of the Arctic.

The Arctic tundra is a maritime biome

- Arctic tundra is defined as the area that has an Arctic Climate an Arctic flora, and contains tundra vegetation.
- Southern boundary of the mapped area is tree line.
- Note the close proximity of all parts of the biome to perennially or seasonally frozen seawaters.
- Tundra regions are defined by the cool summer temperatures caused by the proximity of the region to sea ice.

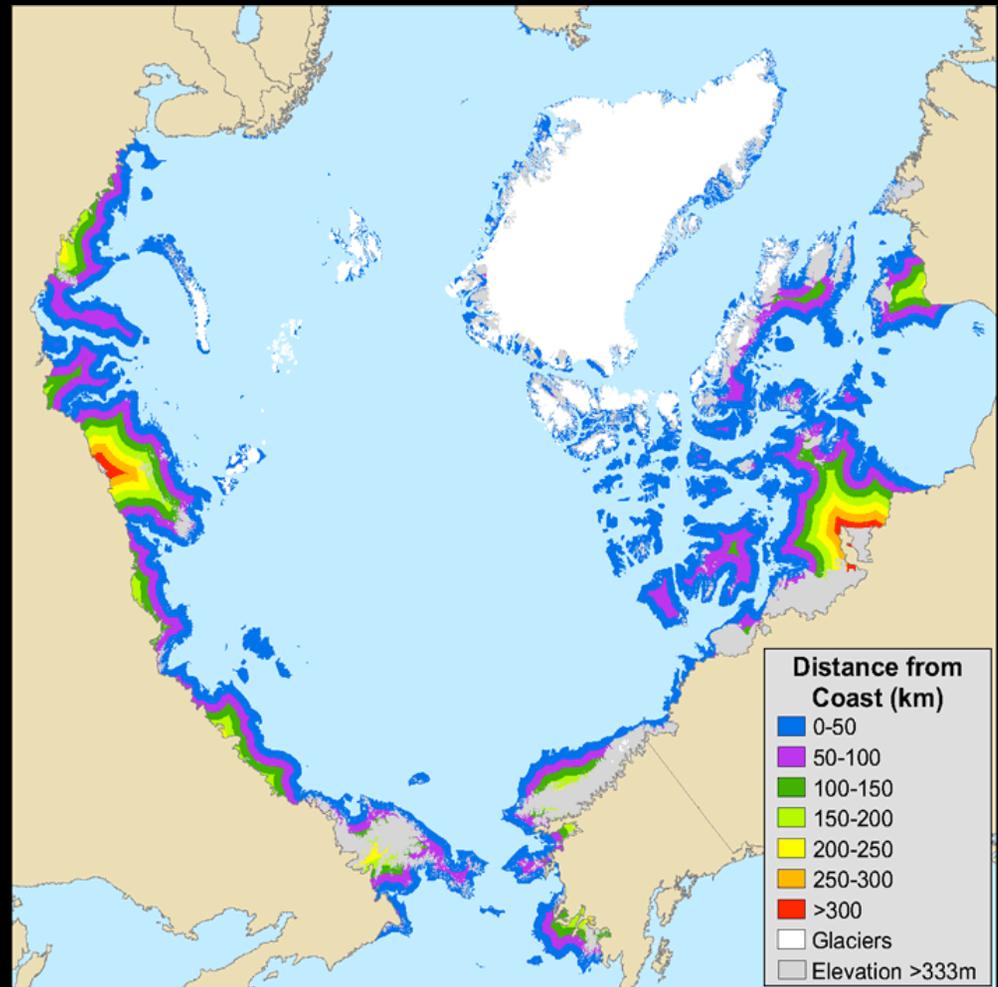


No direct link between sea ice and vegetation, but...

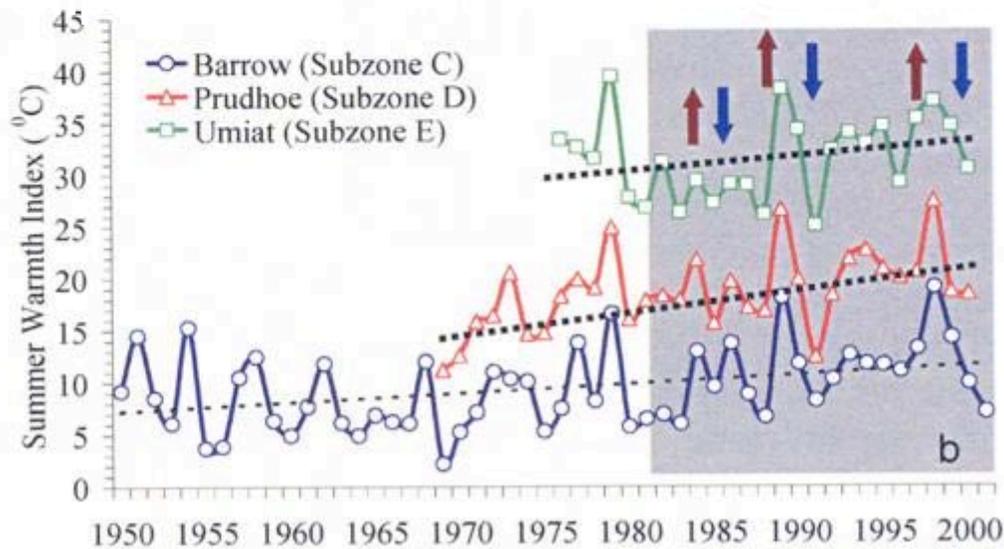
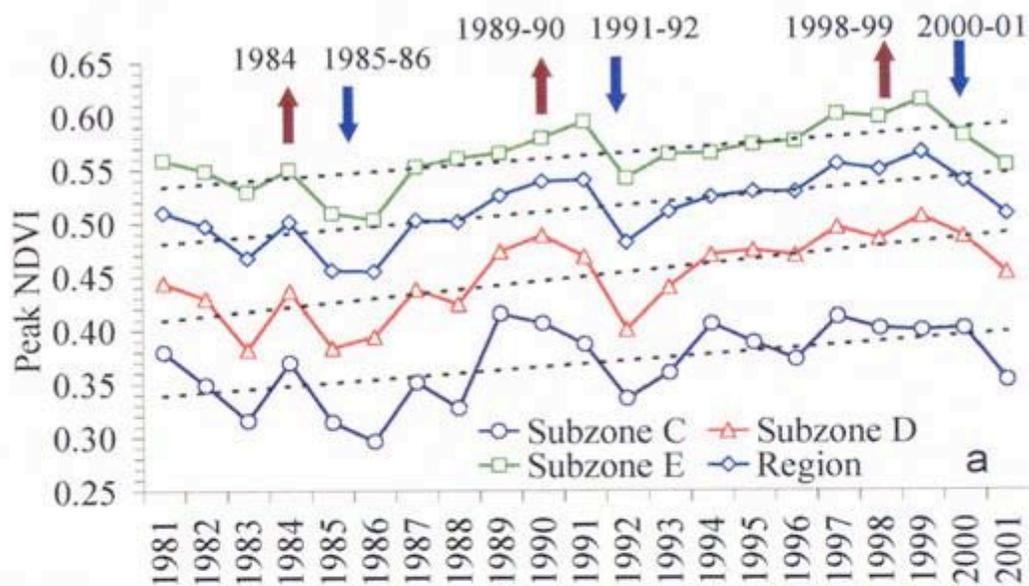


...changes in sea-ice concentrations could strongly affect the tundra.

- 61% of the tundra is within 50 km of sea ice (blue buffer),
- 80% is within 100 km (magenta and blue buffers),
- 100% is within 350 km.
- Changes in the Arctic ocean sea ice will very likely affect terrestrial ecosystems by affecting summer-time land-surface temperatures.



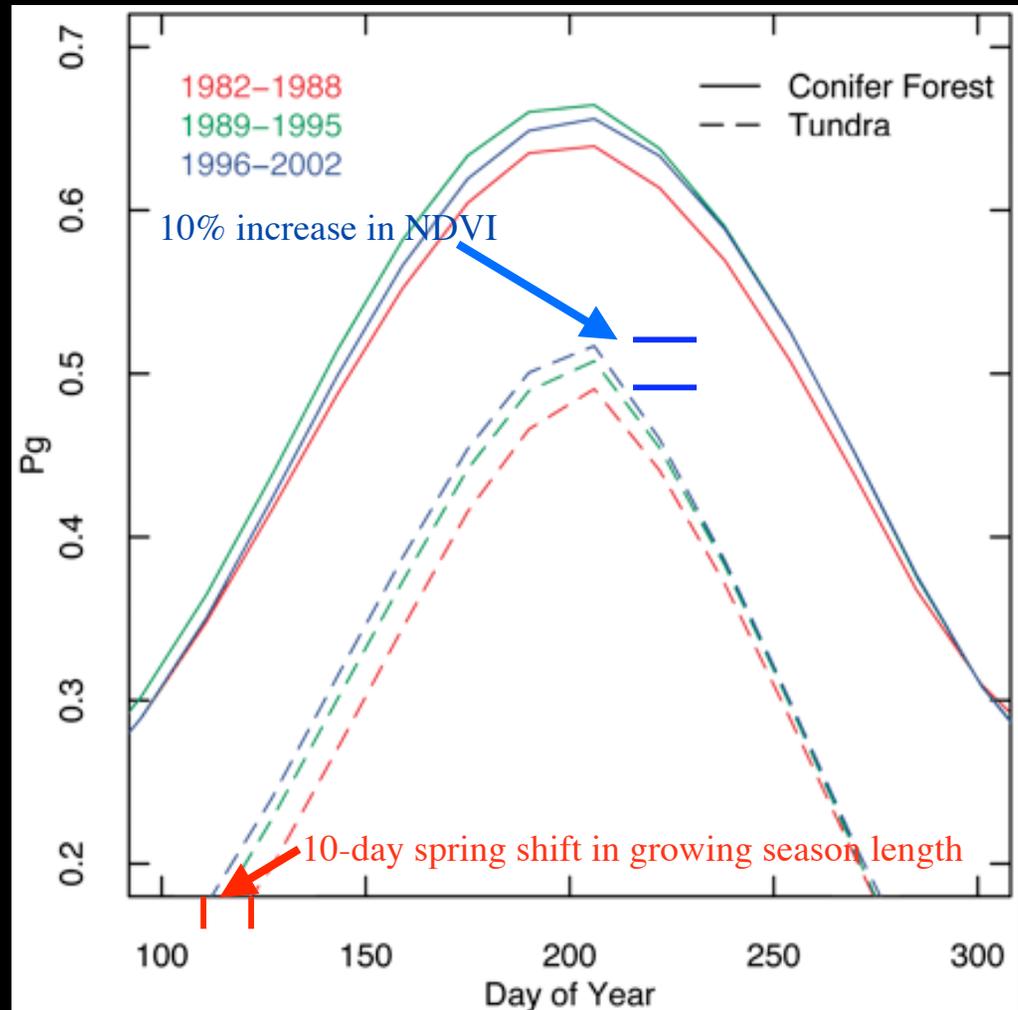
Time series of peak NDVI for northern Alaska (1981-2001)



- $17 \pm 6\%$ increase in peak NDVI from 1981-2001.
- Corresponds to about an 170 g m^{-2} average increase in biomass.
- Changes in NDVI follow yearly changes in temperature and long term increase.
- Currently unknown if similar changes have occurred across the entire Arctic bioclimate gradient.

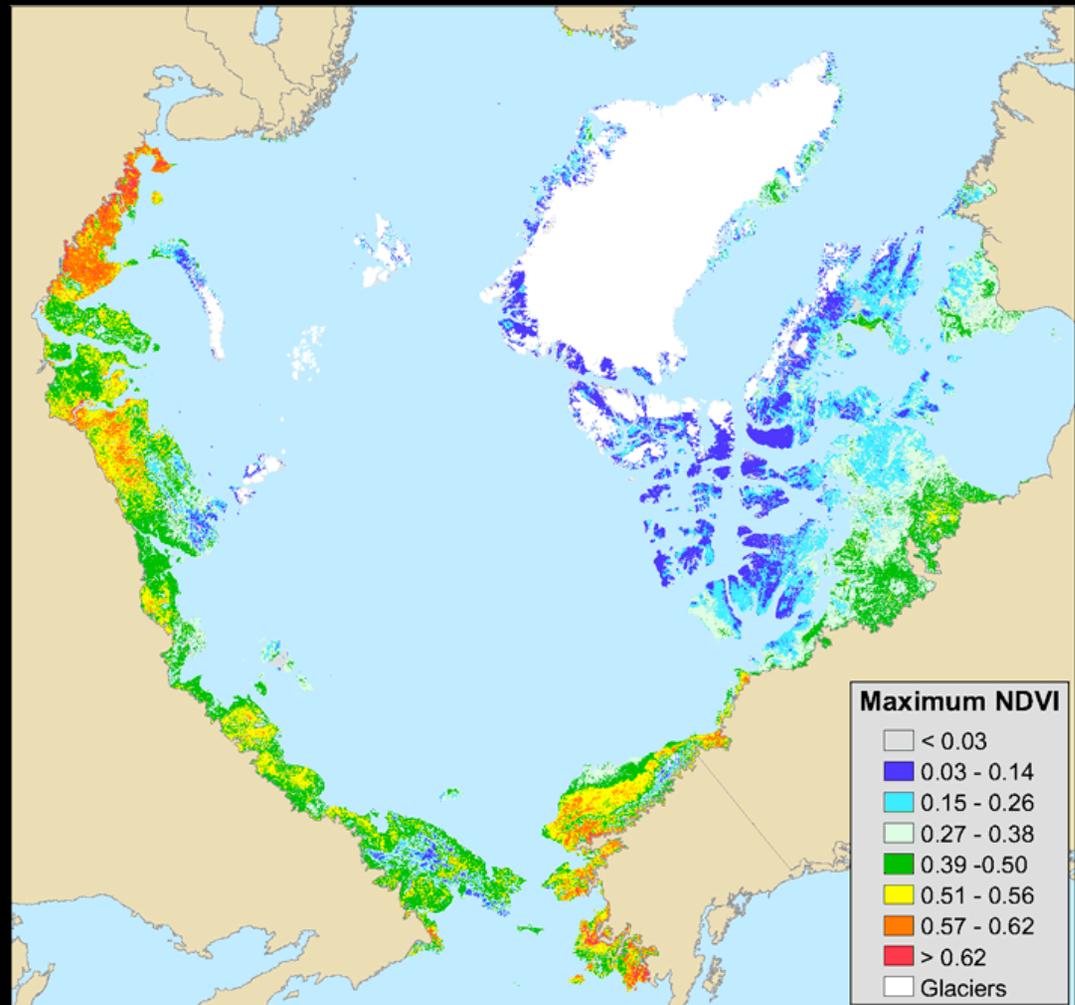
The spring season has started earlier and max NDVI has increased

Tundra regions have shown a continued increase in NDVI and a marked 10-day shift earlier in spring.



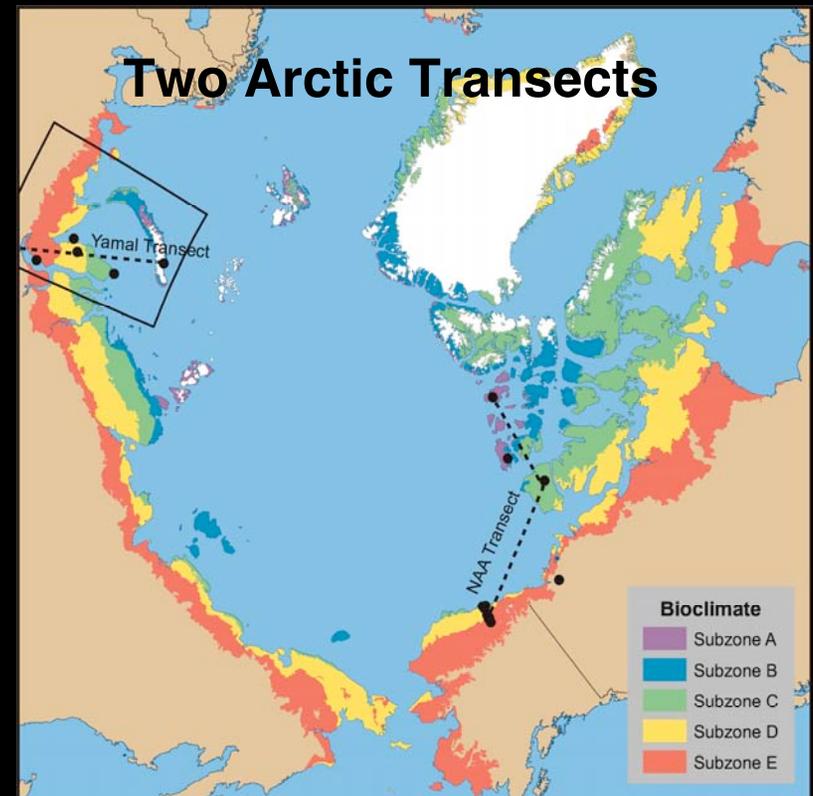
The Greening of the Arctic (GOA) initiative: a study of circumpolar NDVI and biomass patterns

- GOA study extends the Jia et al. analysis to the circumpolar Arctic.
- Our umbrella question is, "How do different patterns of sea-ice distribution affect spatial and temporal patterns of the terrestrial NDVI patterns?"



Four components of the GOA study

- I. Spatial and temporal analysis of Sea Ice – Land-surface-temperature – Terrain – NDVI relationships: Funded by NSF.
- II. Analysis of impacts of shrubification to reindeer and the Nenets people in Russia: GOA transect on the Yamal Peninsula: Funded by NASA
- III. Web-based *Arctic Geobotanical Atlas*: Funded by NSF.
- IV. North American Arctic Transect: Long-term study of biomass change in the Arctic: Proposal denied by NSF but will be resubmitted.



Component III: GOA transect on the Yamal Peninsula, Russia (Funded by NASA)



- Examines the linkages between greening trends, the range and forage for the reindeer of the Nenets people, and the regional sea-ice conditions.
- Field research and modeling in all 5 arctic bioclimate subzones on the Yamal Peninsula.

NASA Land-Cover and Land-Use Change program

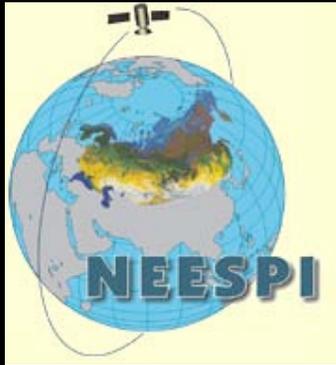
“...through an interdisciplinary approach, is developing and using NASA remote sensing technologies to improve understanding of human interactions with the environment and, thus, provides a scientific foundation for understanding the sustainability, vulnerability and resilience of human land-use and terrestrial ecosystems.”



Land-Cover and Land-Use Change Program



<http://lcluc.umd.edu/>



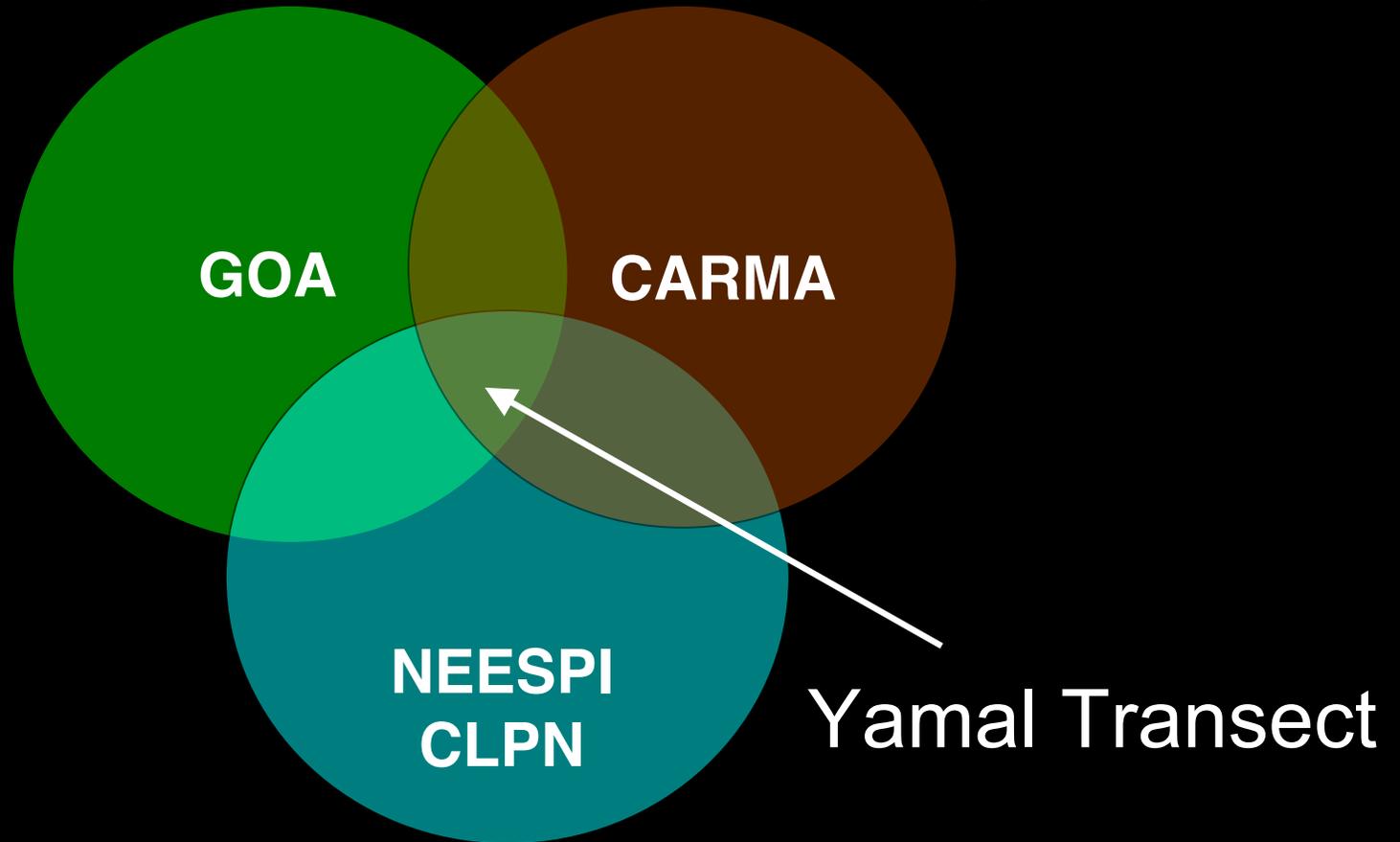
Northern Eurasia Earth Science Partnership Initiative (NEESPI)

“... The original goal established for the NEESPI was to establish a large-scale, interdisciplinary program of funded research aimed at developing a better understanding of the interactions between the ecosystem, atmosphere, and human dynamics in northern Eurasia in support of international science programs with particular relevance to Global climate change research interests and government agency funding priorities.”



<http://neespi.org/>

The Yamal NASA-LCLUC is at the intersection of three IPY projects



Circumpolar Arctic Rangifer Monitoring (CARMA) Program



Courtesy of Bruce Forbes

Environmental and Social Impacts of Industrial Development in Northern Russia (ENSINOR) - Bruce Forbes, Arctic Centre

Integrated social and environmental studies of the Nenets people, using remote sensing imagery in conjunction with the social studies.

Central land-cover/land-use change questions in Northwest Siberia

The Yamal region in northwest Siberia is a “hot spot” for four forces of change:

1. Large-scale oil and gas development,
2. Sensitive landscape,
3. Increasing grazing pressure and use of the land by the Nenets,
4. Climate change.

What will happen to the tundra regions as the global climate warms and industrialization proceeds?

What will happen to the indigenous peoples?

Yamal transect



- Uses many of the same protocols for climate, permafrost, active-layer biomass, and NDVI, monitoring as the North American Arctic Transect.
- Additional study of Nenets people is being conducted by Bruce Forbes group at the Arctic Centre in Finland.

Project components

- *Human dimensions* - effect of land cover/ land-use changes on the Nenets people and their reindeer;
- *Remote-sensing* - climate-sea ice relationships in the Arctic basin, and how these affect the temporal and spatial patterns of vegetation greenness indices;
- *Modeling* - link the remote sensing information and history of land-cover change with predictions of future change; and
- *Field observation* - detailed ground-based studies of vegetation, soil and permafrost are being made along a north-south bioclimate transect of the Yamal Peninsula.

Agenda

Day 1

- Natural systems of Yamal region: 6 talks
- Remote sensing and climate dynamics results: 4 talks (Keynote talk by Joey Comiso)
- 2007 Expedition to the Yamal: 3 talks

Day 2

- Land-cover Land-Use Change on in the Yamal region: 5 talks (Keynote talk by Florian Stammler)
- 2008 Field Season logistics session (Plenary)

Day 3

- Modeling: 3 talks
- Publications and synthesis (Plenary)

Thank you!

Marina and Nataliya for helping to organize this workshop!!!

Academician Vladimir Melnikov and the staff at the Earth Cryosphere lab for facilitating the project.

Edie Barbour and Martha Reynolds, who put the conference volume and the data report together.

Everyone for coming.