Considerations for large-scale experiments in arctic terrestrial ecosystems

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1. Land cover change and parameterization of ecosystem models

2. Resampling historic sites to assess change in ecosystem structure and function

3. Barrow Biocomplexity Experiment

4. AON-TEX Impacts of warming and scaling of ecosystem properties and processes

5. Barrow Area Information Database – a cyberinfrastructure and web mapping application

Widespread monitoring of change important
Wet land cover types appear to be changing faster than dry land cover types.

Soil/site moisture important.

Models important but do not need to be complex.
Species are important.

Controlled growth experiments.

Capturing the complexity of spatio-temporal dynamics and ecosystem variability important.

QuickBird Satellite Imagery

Air-borne LiDAR DEM

Supervised Classification

Land Cover Type
- Seasonally Flooded Graminoid Tundra
- Wet Graminoid Tundra
- Moist Graminoid Tundra
- Dry-Moist Graminoid Tundra
- Dry-Moist Dwarf Shrub Graminoid Tundra
- Bare Ground
- Water
- Aquatic Graminoid Tundra
QuickBird Satellite Imagery  
Air-borne LiDAR DEM  
Supervised Classification

Pixel size is important

Eroding Coastline – Elson Lagoon

Natural analogs of change... with models – useful for hypothesis generation and testing in experiments
Teasing apart impacts of climate change from successional change and disturbance difficult

Herbivory important over decadal time scales

40-70 yrs herbivore exclusion results in substantial change
Change in land cover related to herbivory?

Herbivory important over inter-annual time scales

Experiments are opportunity for mech. understanding, tech development, training

NSF Biocomplexity Flooding and Draining Experiment

Publications
- Goosen et al. In Press
- Nakamoto In Review
- Olivas et al. In Press
- Shiklomanov et al. In Press
- Olivas et al. Submitted
- Gallegos et al. Submitted
Regionally representative Gaining Differences between treatments Gaining regional representation and similarity between treatments difficult

Aligning footprints of sampling equipment is tough!
Footprints change in different ways

Maintaining consistent treatment effects challenging

Supports analysis using continuous analytical approaches
Santonu Goswami
PhD ESE

Technology development

Goswami et al. In Press

Interdisciplinary training opportunities
Up/down-scaling of remote sensing remains a key challenge...

...an interactive mapping application, database, project browser, portal for research activities with pointers to data and other information

Arctic Research Logistics Support Service

Enormous research legacy in northern Alaska

www.baidims.org
People are important!!!

Thank you
What is important?

- Long term monitoring, use of natural analogs, modeling and experiments are all important and needed.
- Different land cover types are changing in different ways (résistance) and these have different ecosystem properties and processes.
- Species and herbivory are important.
- For gridded datasets cell/pixel size important for capturing spatio-temporal patterns and dynamics of change.
- Large-scale experiments important for tech development, training, understanding mechanisms.
- Difficult to design unreplicated large scale experiment and maintain consistent treatment effects.
- Development and scaling of algorithms applied to remote sensing is a key challenge where experiments could help.
- Large relatively untapped legacy of research history in northern Alaska.
- Large scale experiments present enormous interdisciplinary training and education opportunities.