Working Group Lead: Natalie Boelman

Wildlife & Ecosystem Services

Bohrer, Gil -- Ohio State University
Brinkman, Todd -- University of Alaska, Fairbanks
Chen, Wenjun -- Canada Centre for Mapping and Earth Observation
Clark, Karin -- GNWT, ENR, Wildlife
Cold, Helen -- University of Alaska, Fairbanks
Cosgrove, Christopher -- Oregon State University
Fienup-Riordan, Ann -- Calista Education and Culture, Inc.
Frost, Gerald (JJ) -- Alaska Biological Research, Inc
Gill, Michael (Mike) -- Polar Knowledge Canada
Goetz, Scott -- Northern Arizona University
Griffith, Peter -- NASA GSFC / SSAI
Gurarie, Eliezer -- University of Maryland
Hebblewhite, Mark -- University of Montana
Kimball, John -- University of Montana
Kirchner, Peter -- National Park Service
Scott LaPoint -- Lamont-Doherty Earth Observatory, Columbia Univ.
Macander, Matthew -- Alaska Biological Research, Inc. McCaffery, Brian -- Fish and Wildlife Service
Meddens, Arjan -- University of Idaho
Miller, Charles (Chip) -- NASA JPL
Nolin, Anne -- Oregon State University
Oliver, Ruth -- Columbia University
Prugh, Laura -- University Of Washington
Reynolds, Joel -- U.S. Fish and Wildlife Service
Sowl, Kristine -- USFWS Yukon Delta National Wildlife Refuge
Vierling, Lee -- University of Idaho

Institutional Collaborations

Science Objectives

Objective #1. To **understand** how spatial and temporal dynamics in environmental and ecological conditions within the ABoVE Study Domain influence:

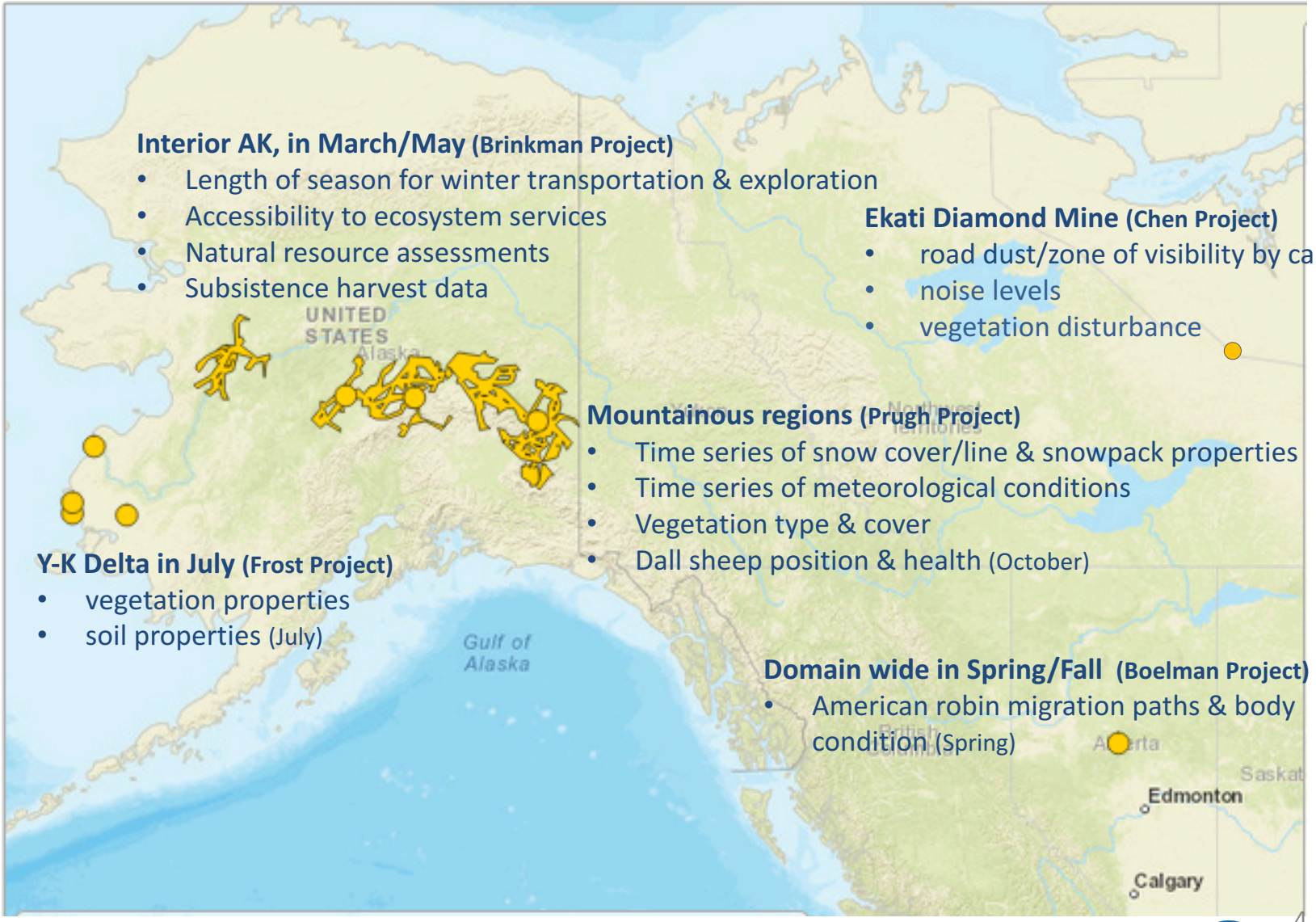
(a) movement, habitat selection and population viability of a suite of highly mobile terrestrial animal species, and;

(b) accessibility of natural resources to local subsistence communities.

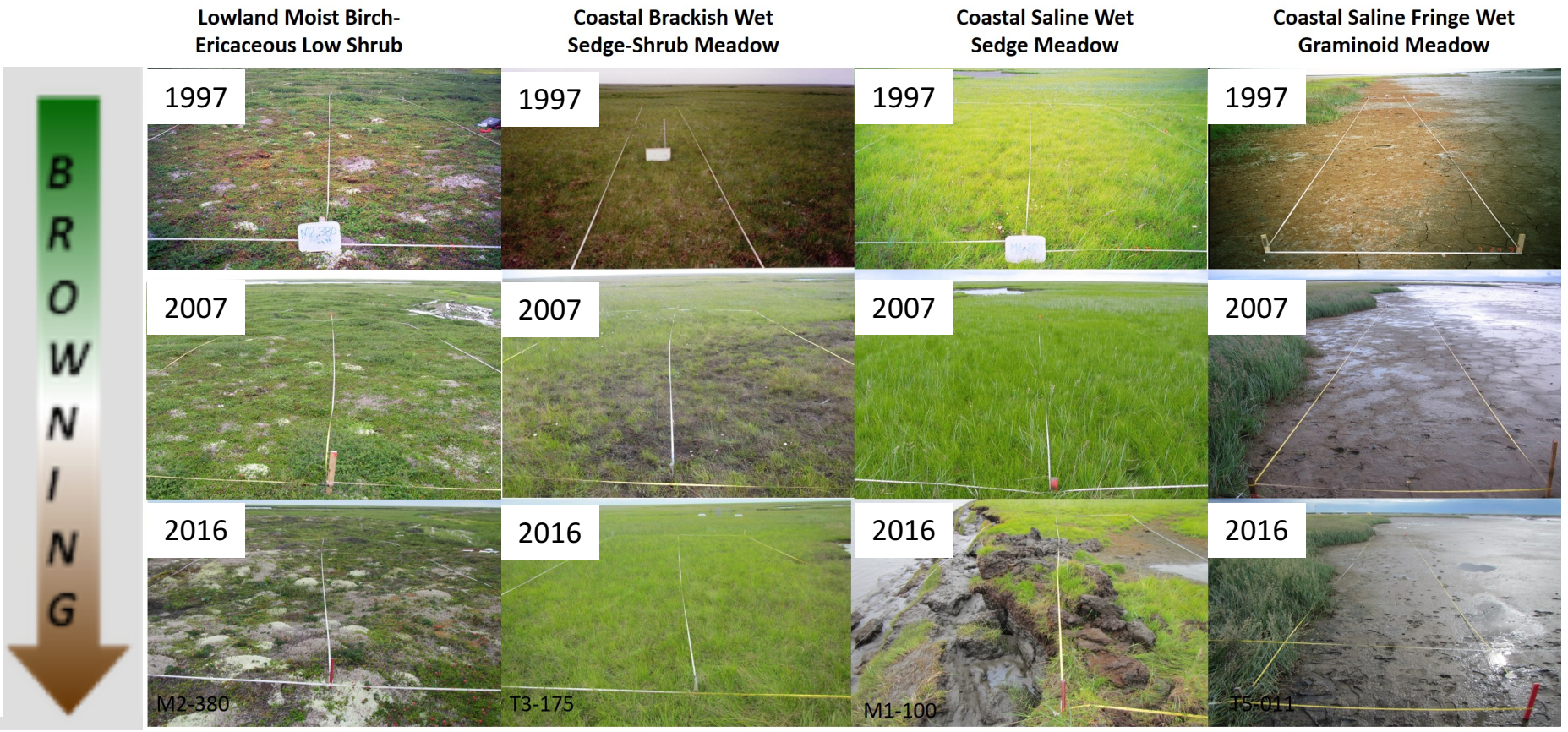
Objective #2. To **provide local stakeholders** - including natural resource agencies, wildlife managers, First Nations, Alaskan natives, and other stakeholders - **with knowledge, products, and tools** that will aid them in making informed management and adaptation decisions.

Field Studies

** only shows where we are collecting field data ourselves **

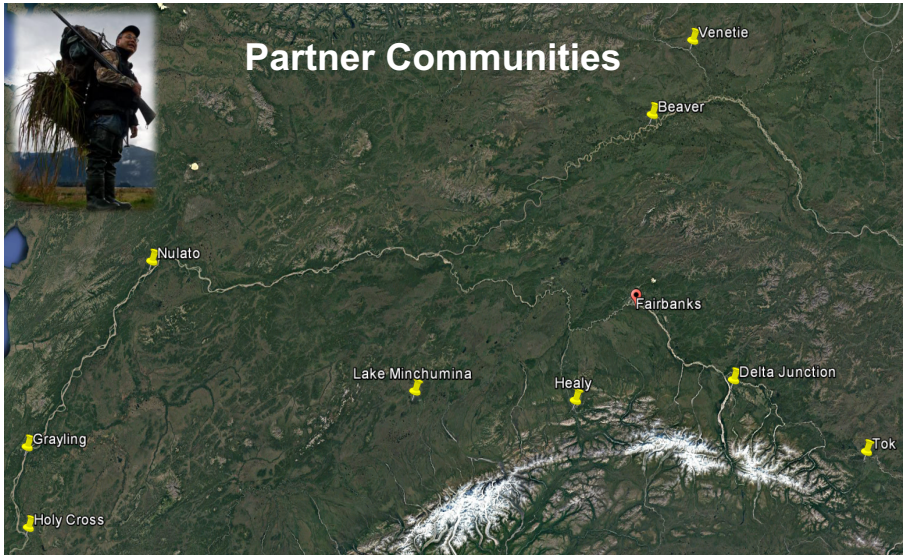


Frost project

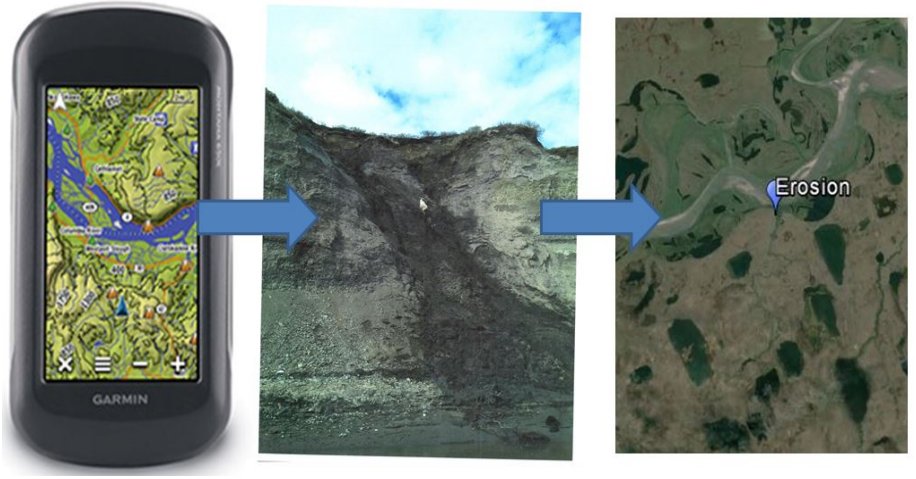


- coastal browning driven by:
  - Bering Sea climate drivers
  - landscape-scale disturbances
    (ie. flooding, salinization & PF thaw)
- reduced nesting habitat for upland shorebirds

Brinkman project



Locate & document disturbances influencing rural travel and access to local resources



Wildfire & Access

Travel hindered by fallen trees & thermokarsting following wildfires

Brinkman project

Permafrost Thaw → Bank Erosion → River Channel Change

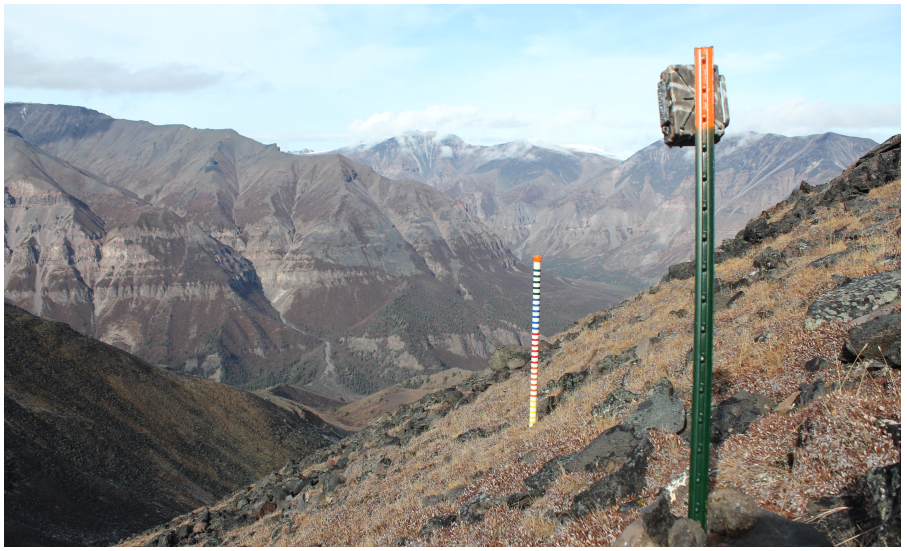
Challenges to river navigability

Drying trend in streams obstructing travel

Challenging ice & snow travel conditions
Heightened ice safety issues

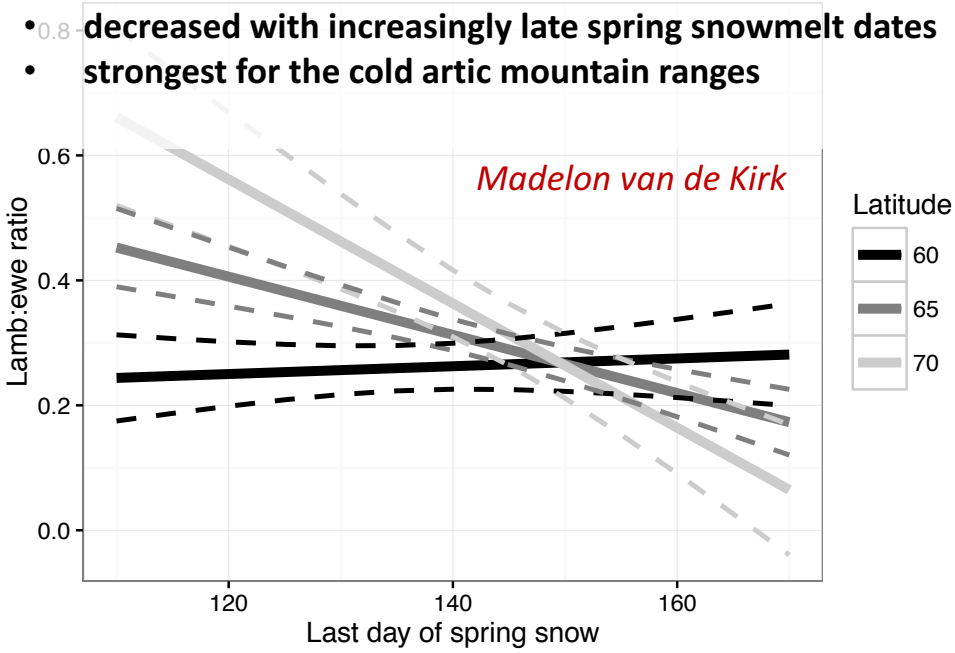
Prugh project

- Lamb:Ewe ratio increased with higher snowline elevations on May 15th

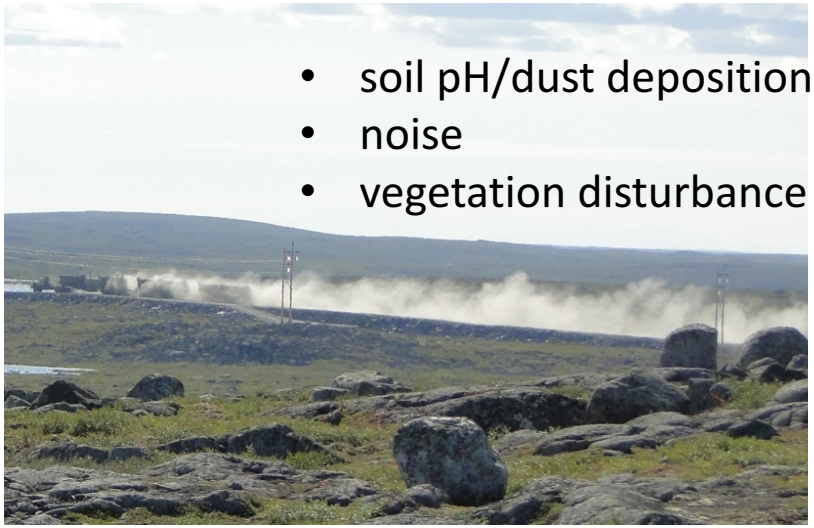


Time series of alpine snow depth from daily photos of snow stakes — *Chris Cosgrove & Anne Nolin*

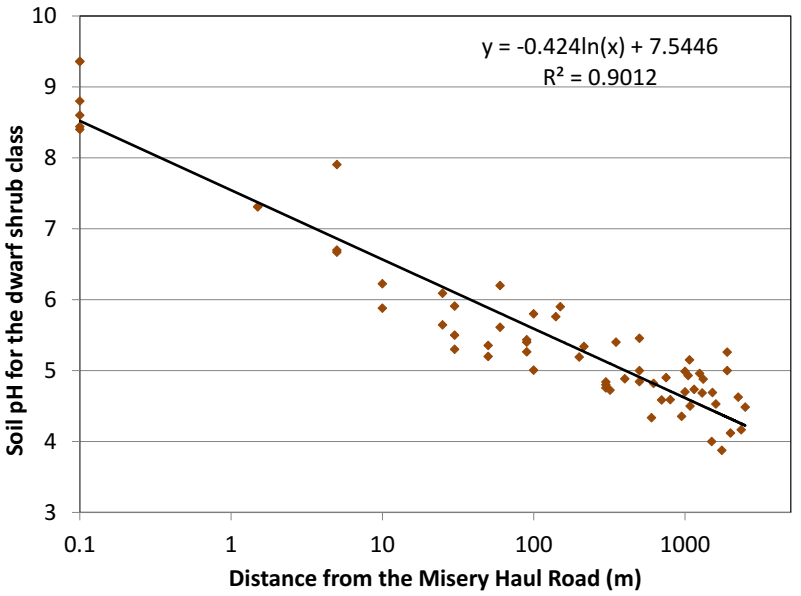
- decreased with increasingly late spring snowmelt dates
- strongest for the cold artic mountain ranges



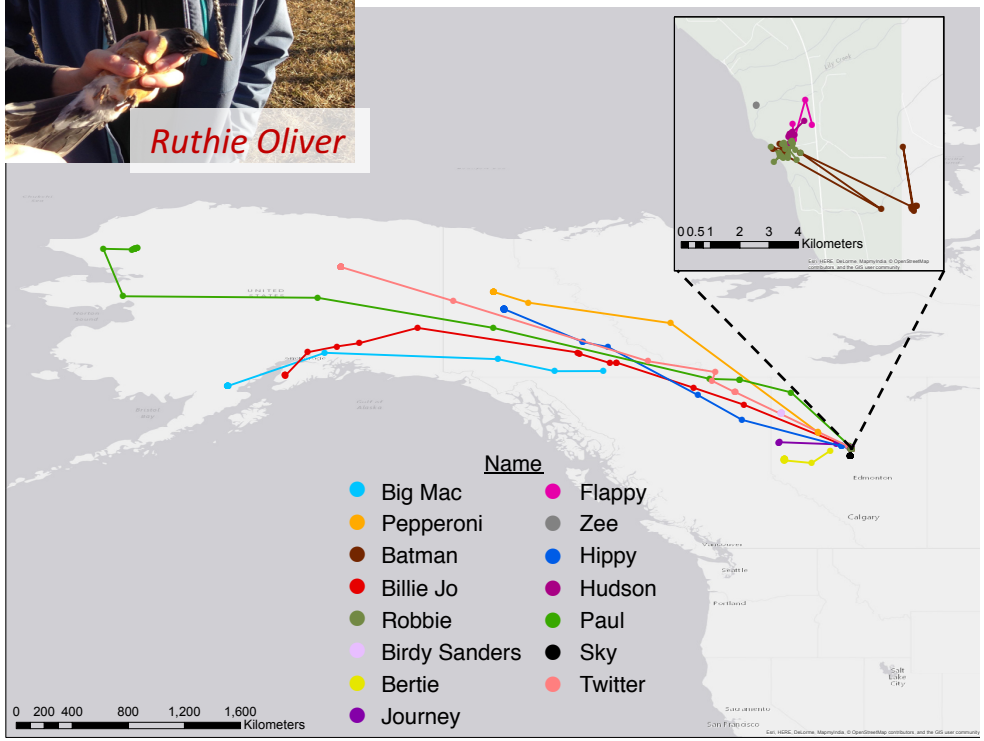
Chen project

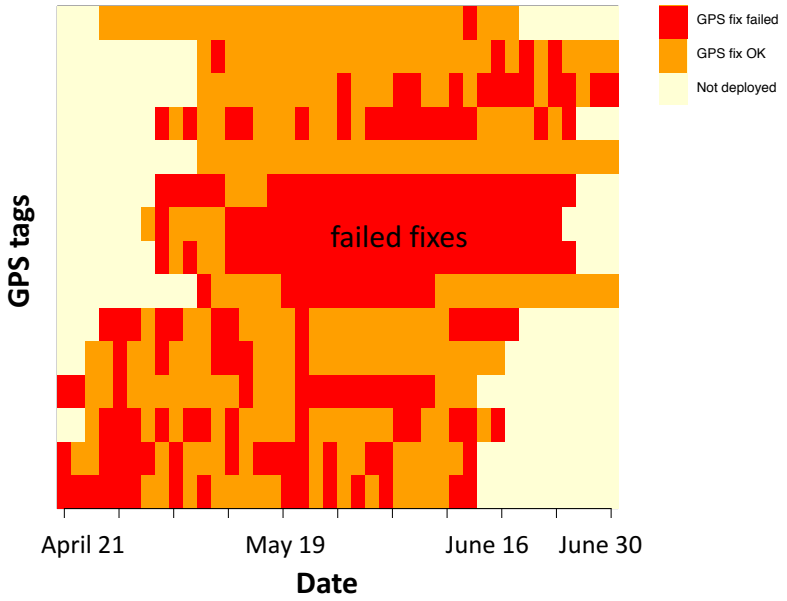


- soil pH/dust deposition
- noise
- vegetation disturbance



Boelman project

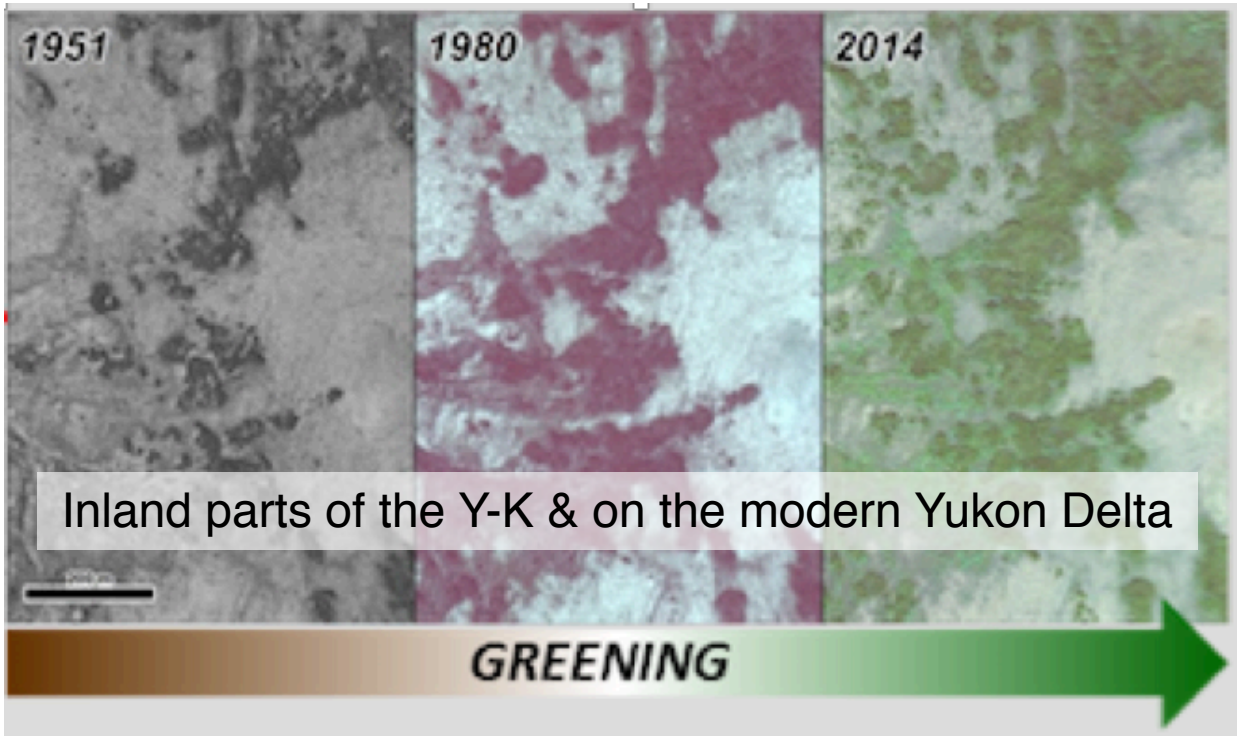




2017: use different tag firmware

Airborne Remote Sensing

Frost project



Ties to 2017 airborne campaign

LVIS & AVIRIS =

Can offer cal/val data:

- ASD field spectra
- Vegetation composition

Boelman project

Existing airborne data

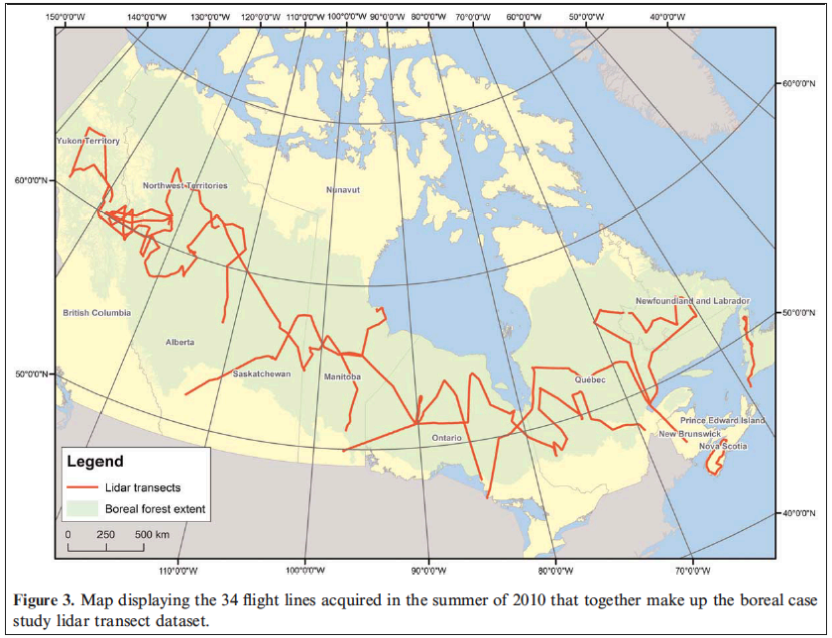
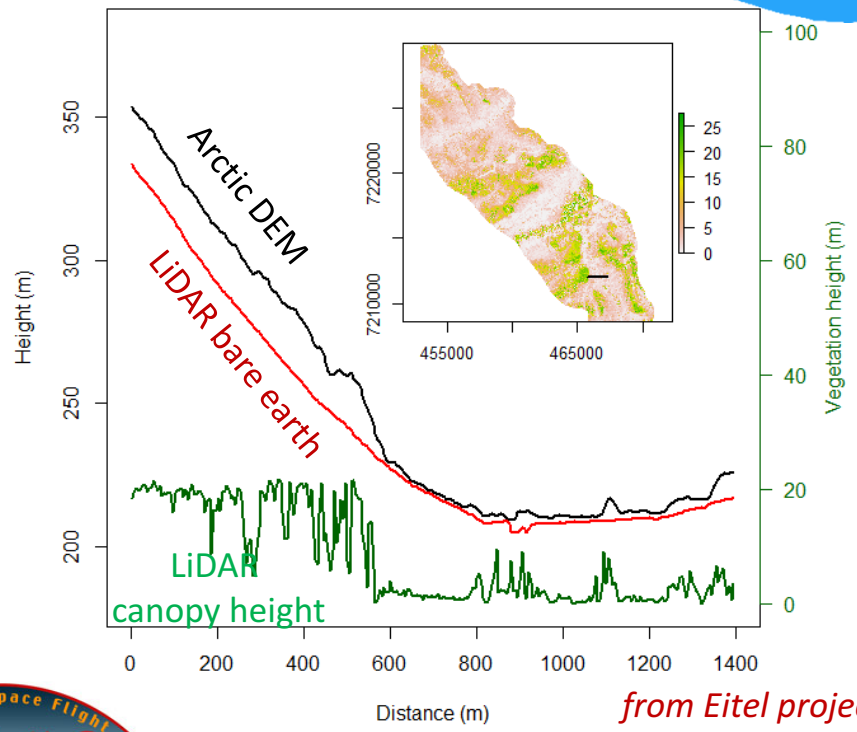


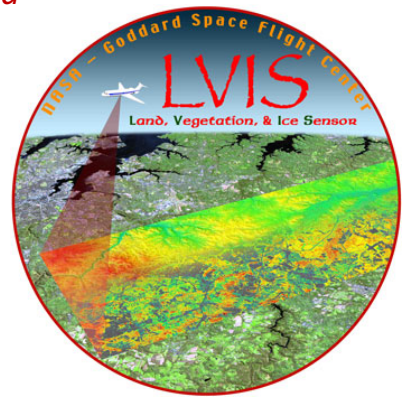
Figure 3. Map displaying the 34 flight lines acquired in the summer of 2010 that together make up the boreal case study lidar transect dataset.

Mike Wulder, Natural Resources Canada



from Eitel project: Arjan Meddens

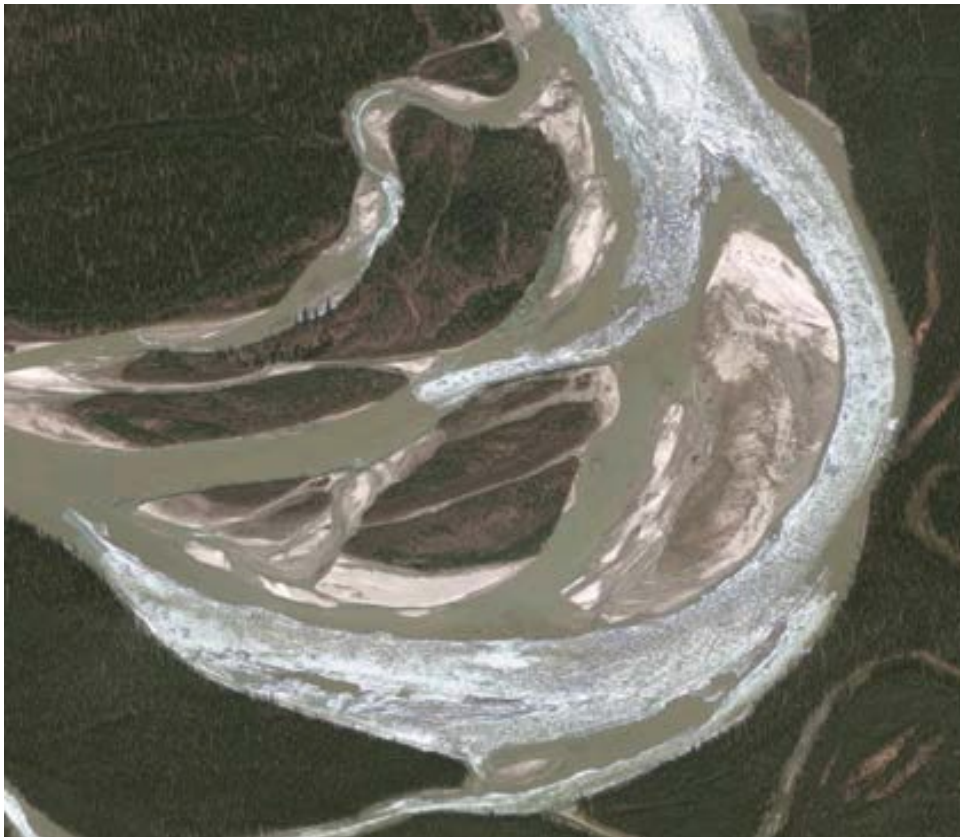
Ties to 2017 airborne campaign



=

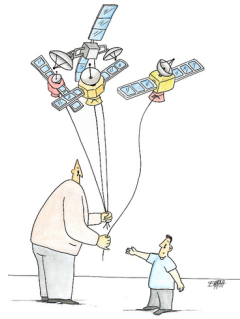
Brinkman project

Ties to 2017 airborne campaign:
High resolution imagery of river corridors in all seasons =



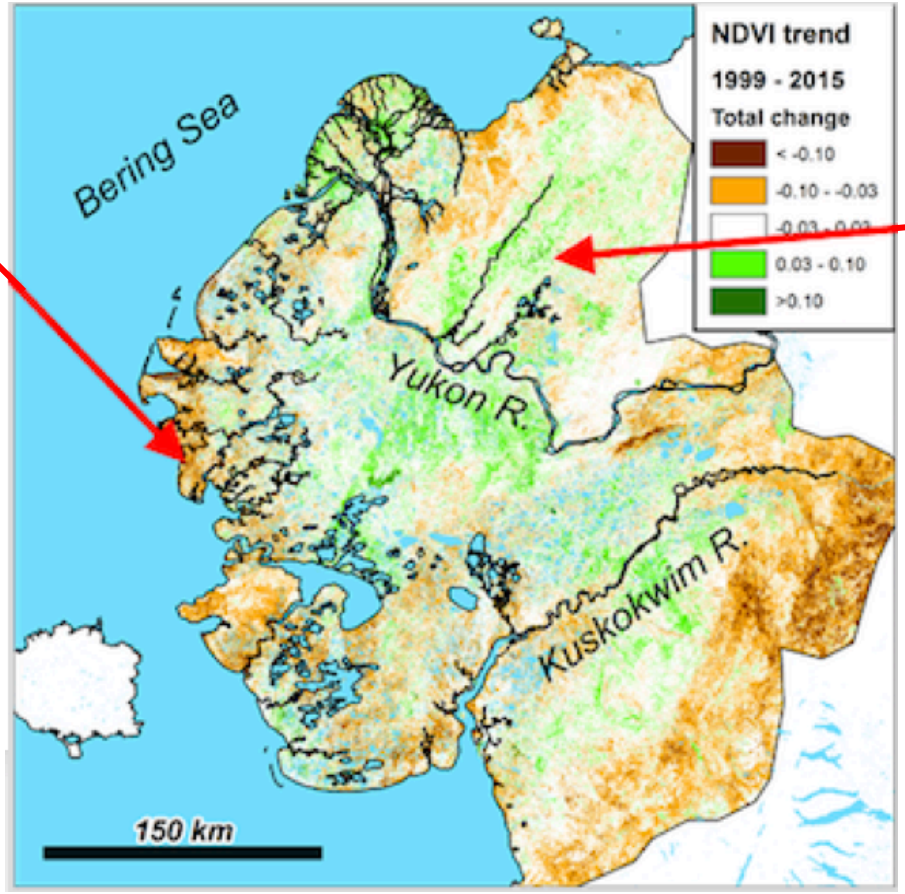
Aerial photo of Spring ice conditions
Tanana River in Interior Alaska

Spaceborne Remote Sensing



Frost project

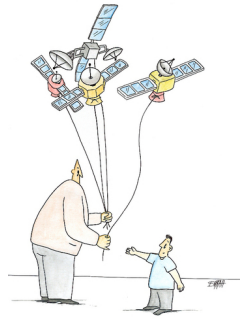
BROWNING
in coastal tundra



GREENING
in interior uplands &
modern Yukon Delta

- **Landsat MaxNDVI times-series (1999-2015)**
- **Consistent with AVHRR NDVI record**

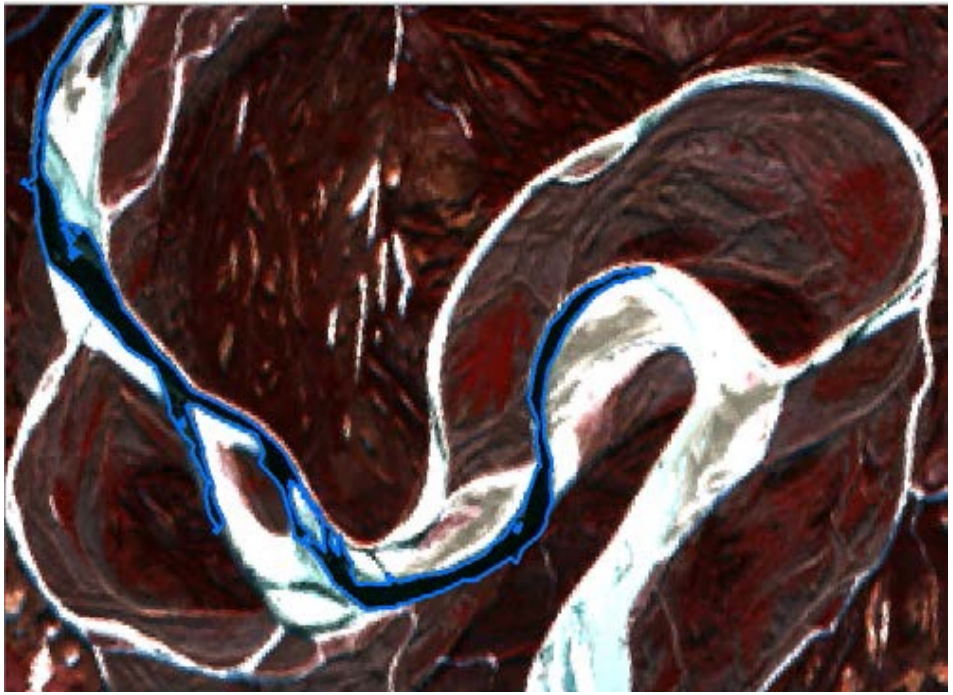
Brinkman project



Identification of disturbance signatures

↓

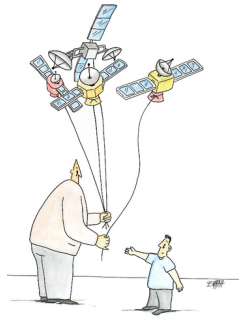
maps of travel accesability during shoulder seasons



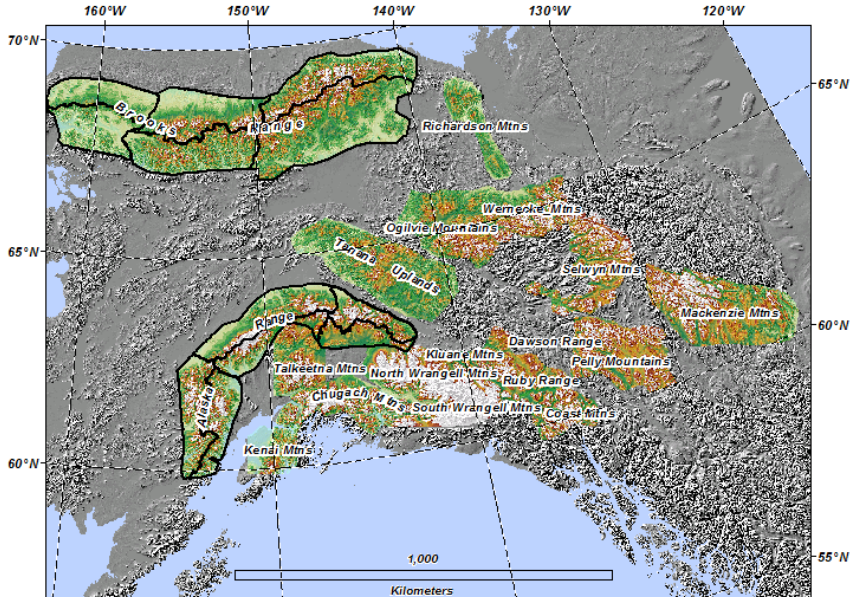
Landsat8 OLI, Nov 1 2014

i.e. open water impedes travel
blue outlined polygon

Prugh project



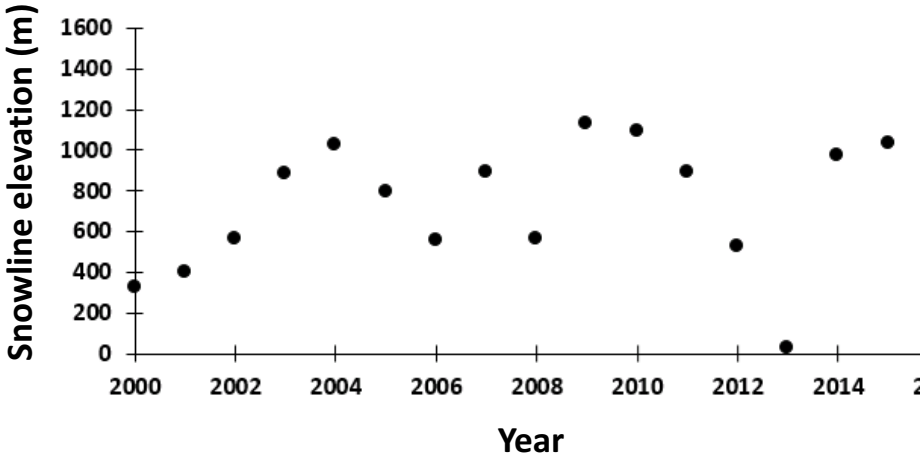
Dave Verbyla



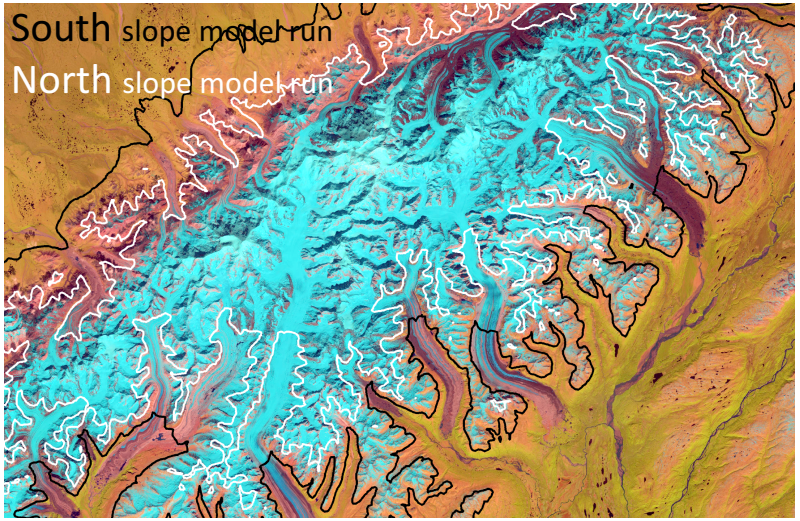
- **delineated 28 mountain areas**
- **partitioned some ranges based on:**
  - **major climatic gradients**
  - **north vs. south facing slopes**
- **use MODSCAG daily snow cover fraction per pixel**

Estimates May 15 Snow Elevation

(linear or polynomial regression models)

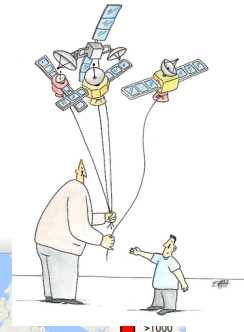


Aspect & climatic gradients matters!

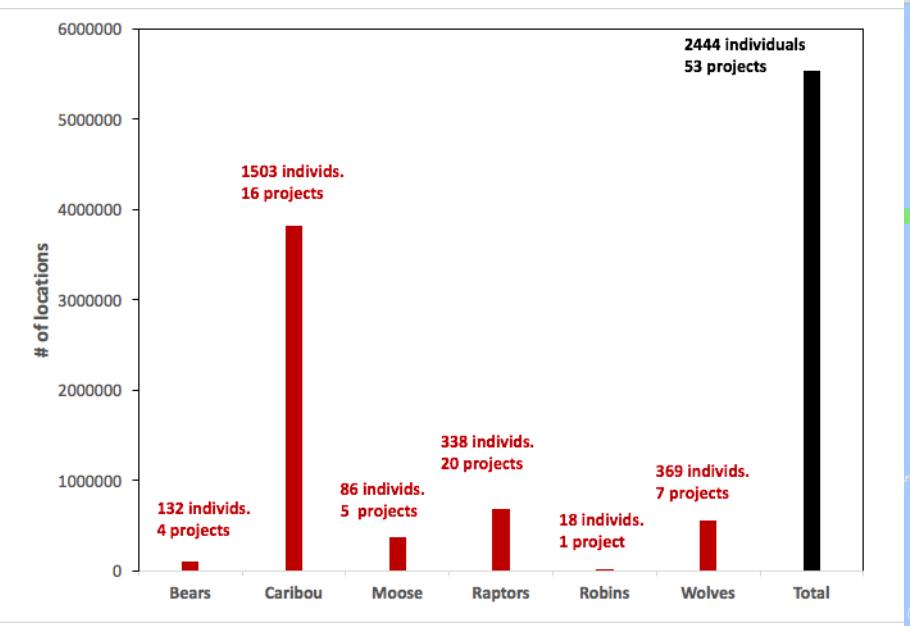


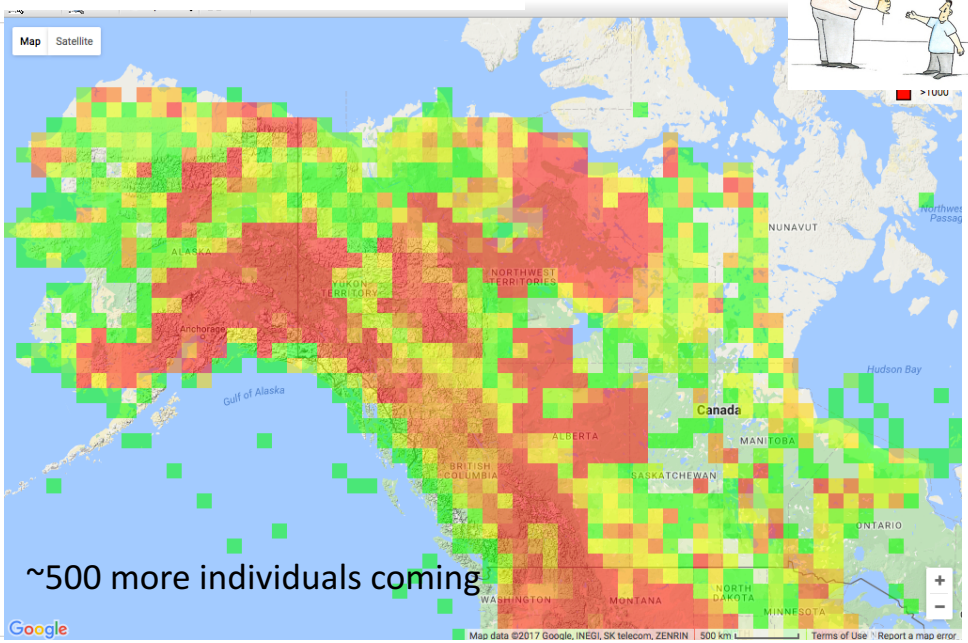
Alaska Range 30-May-2015

Boelman project



- **Movebank:** Compiling archive of arctic animal movement data *Sarah Davidson*





animals on the move

Modeling

MODEL TYPES

Resource Selection Functions (RSF)
with Generalized Functional Responses (GFR) extension

SnowModel

MicroMet Model

Snowline Elevation

Population Viability Analyses

Harvest Models

Structural Equation & Agent-based Modeling

PRODUCTS

Maps of probability of wildlife habitat use
for several groups of animals (present day)

Maps of multiple snow property variables
high spatial/temporal res., Wrangell St-Elias & Lake Clark only

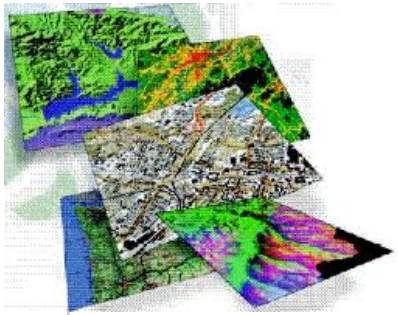
Maps of met variables
high spatial res, Wrangell St-Elias & Lake Clark only

Maps showing elevation of spring snowline
in mountainous regions on May 15 (2000-2015)

Trajectories of Dall sheep populations
throughout their present day range

Key factors that affect Dall sheep harvest levels

Maps of changes in human access & rural travel
in Interior Alaska, spatially & temporally explicit



Summary: Geospatial Data Products

Boelman	**Animal movement data** (including metadata) over the ABoVE Study Domain for all groups of study animals (caribou, wolf, moose, golden eagle, robin, bear) using Movebank. Will include data from mid-1990s to present day, wherever possible.
Boelman	**Environmental data** from various remote sensing and derived sources will be interpolated to a raster around the animal habitats or points along the animal tracks using Env-DATA tools.
Boelman	**Vegetation structural change over time** based on Landsat time-series (using Landtrendr) which will include data from mid-1990s to present
Boelman	**Maps of probability of habitat use** over the ABoVE Study Domain for all groups of study animals (caribou, wolf, moose, golden eagle, robin, bear)
Brinkman	**Subsistence travel network** around studied communities along with predicted travel network around ABoVE domain communities
Brinkman	**Inventory of environmental disturbances** influencing access for areas around studied communities. For 1980s, current, and future scenarios.
Frost	**Linear trend RS veg maps** ($p < 0.05$) for AVHRR (1982–2015), Landsat (circa 1985–2015), and MODIS (2000–2015) peak- and time-integrated NDVI for YK Delta. Results stratified by ecotype; e.g. coastal salt marshes and other important bird habitats
Frost	**Disturbance mapping** for central coast focus area (salt-killed vegetation, thermokarst); period-of-record circa 1945–2015
Frost	**Disturbance- and landscape-change mapping** for Yukon Delta area near Emmonak (channel migration, thermokarst, shrub expansion); period-of-record circa 1945–2015
Frost	**Downscaled ERA-Interim reanalysis for suite of climate variables** (gridded products)
Frost	**Disturbance mapping to meet stakeholder needs** in vicinity of Chevak and Emmonak villages (including ELOKA contribution)
Prugh	**Dall sheep products**: geo-location (1997-present), harvest, survey (both 1950s to present)
Prugh	**Snow datasets**: snow cover fraction and snow extent for 15-May and 1-July (500m, 2000-present); Snow depth, snowpack stratigraphy, and snow water equivalent transect data (Wrangells, 100m, 2017-2018), SnowModel output (Wrangells, 100m, 2000-present)
Prugh	**Max NDVI** (Dall sheep range-wide, 250m, 2000-present)
Prugh	**Alpine shrub extent (**Range-wide, 30m, 1980s and present)
Prugh	**MicroMet output** (Wrangells, 100m, 2000-present)

Highest priority:
Snow vs. Wildlife & Ecosystem Services

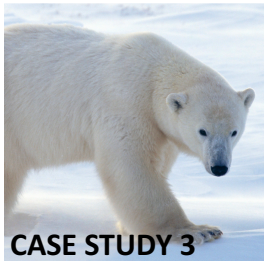
1. **To highlight the importance of spatial-temporal dynamics in snow properties on wildlife movement & human access to provisional ecosystem services**

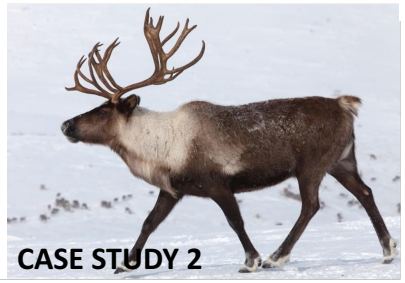
Snow vs. Wildlife & Ecosystem Services

Towards characterizing wildlife relevant "snowscapes"

(for Frontiers in Ecology?)

- highlight importance
- review what's available
- identify what is missing/needed





- identify how best to satisfy needs