



Wildlife & Ecosystem Services Working Group

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Hebblewhite, Mark -- University of Montana

Kimball, John -- University of Montana

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Prugh, Laura -- University Of Washington

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Sowl, Kristine -- U.S. Fish and Wildlife Service

Vierling, Lee -- University of Idaho

Helen Cold --University of Alaska, Fairbanks

Ruthie Oliver -- Columbia University

Kristine Sowl, Yukon Delta National Wildlife Refuge

Institutional Collaborations

Federal or state Management agencies

- USGS
- AK DFG
- USFWS
- NPS
- BLM
- Province of Alberta
- Yukon Territory Gov.
- NWT Territories Gov.
- Natural Resources Canada
- Parks Canada



Alaskan Native groups

- Gwich'in Renewable Resources Board
- Calista Elders Council

Other stakeholder organizations

- ABR, Inc. Environmental Research, USA
- Alaska Ecoscience, USA
- Harvey Ecology Consultants, USA
- Lesser Slave Lake Bird Observatory, Alberta, Canada
- Max Plank Inst. of Ornithology, Germany 

Science Objectives

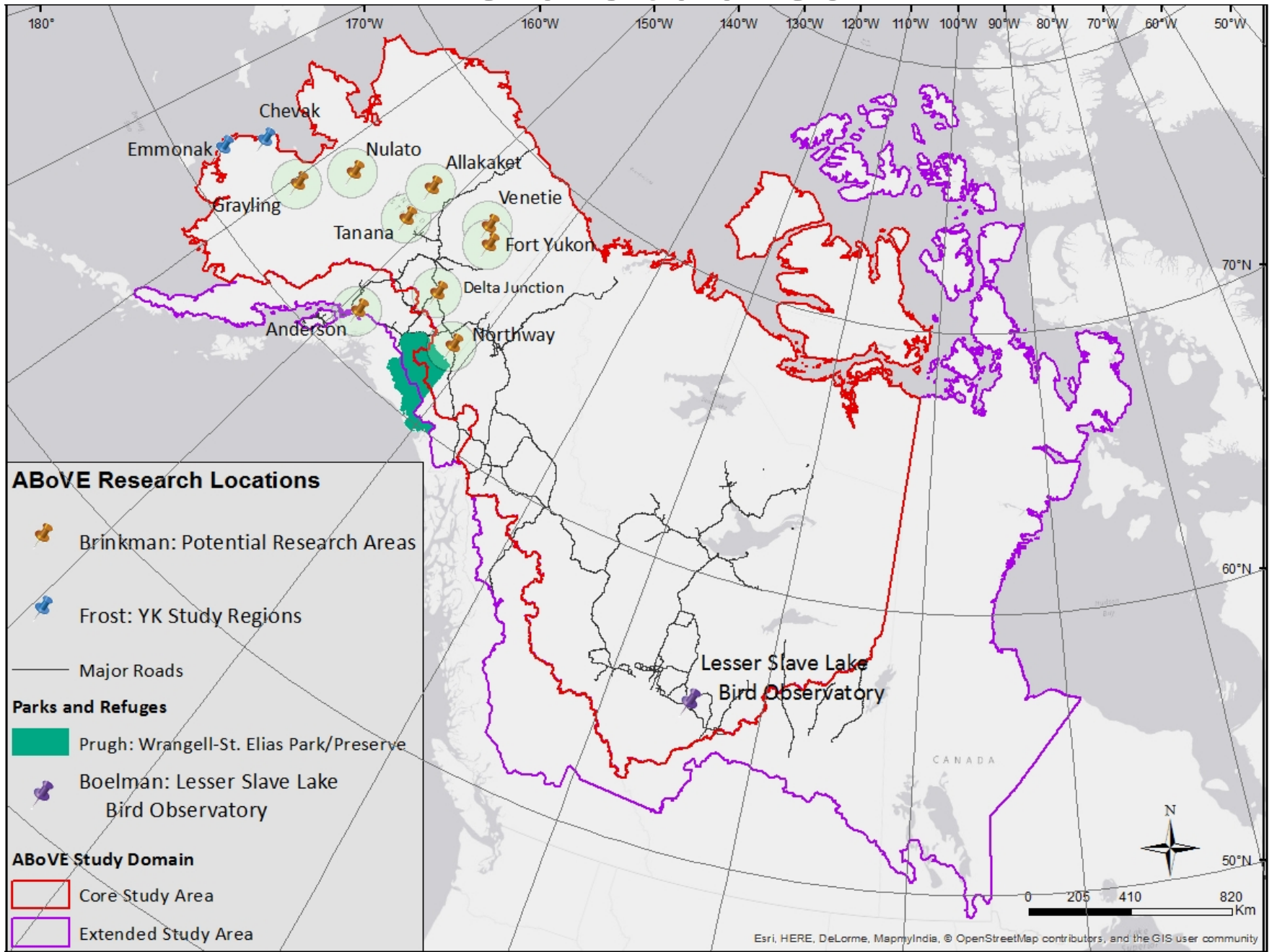
Objective #1. To **understand** how spatial and temporal dynamics in environmental and ecological conditions within the ABoVE Study Domain influence:

(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.

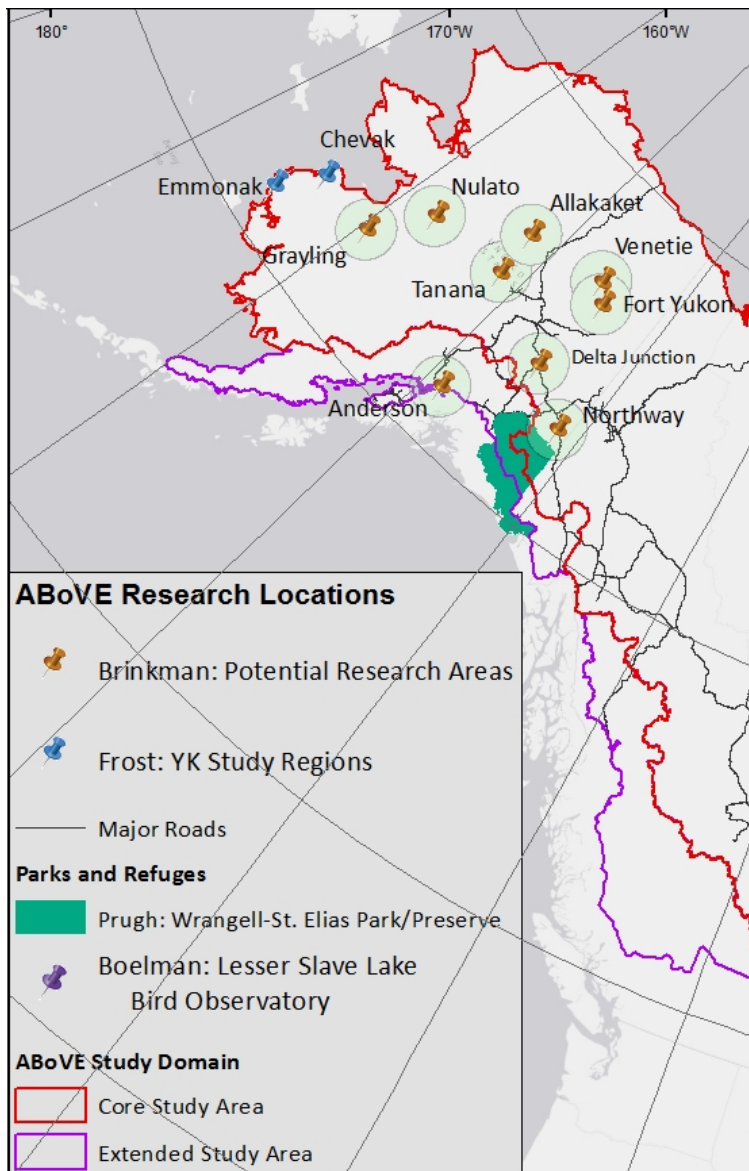
Objective #2. To **provide local stakeholders** - including natural resource agencies, wildlife managers, First Nations, Alaskan natives, and other stakeholders - with knowledge, products, and tools that will aid them in making informed management and adaptation decisions.

Field Studies



Field Studies – Ground Measurements

(Brinkman project)



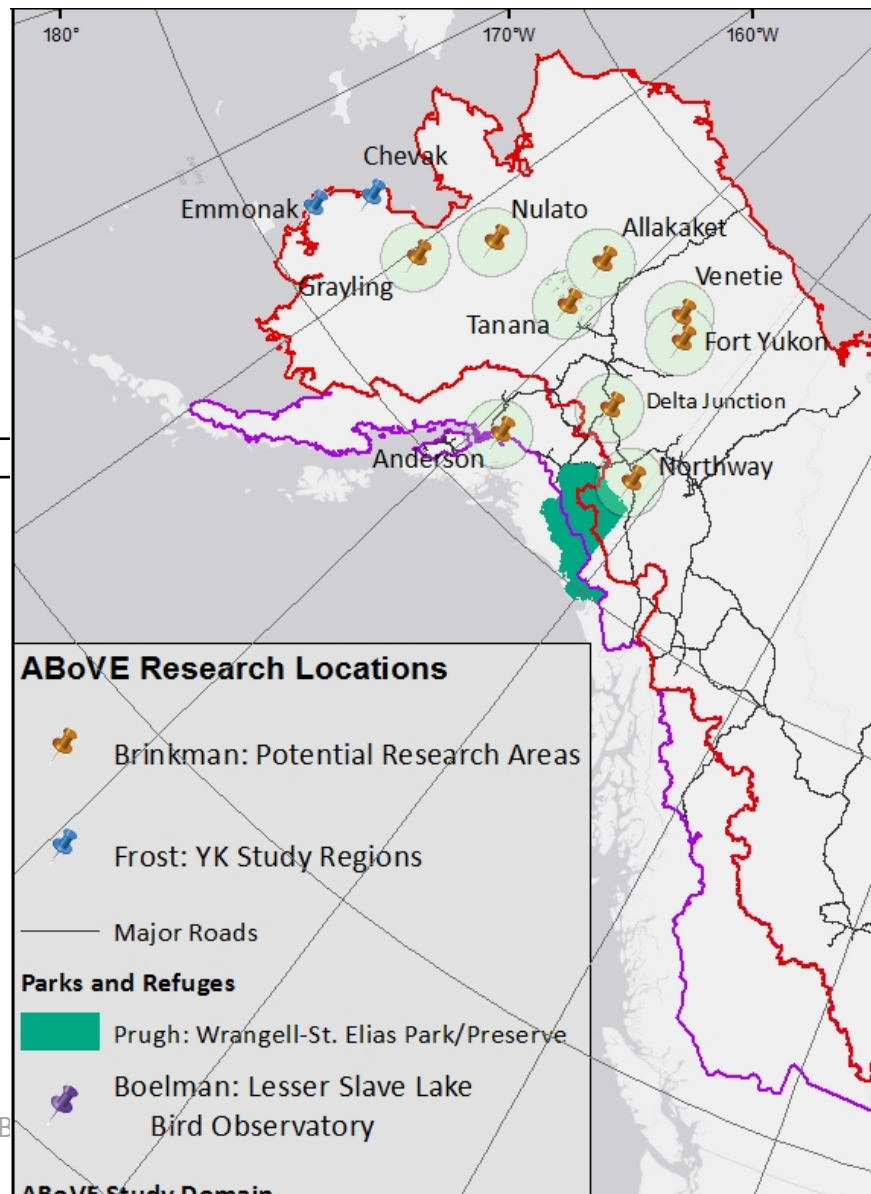
- **map subsistence travel networks and disturbance sites** via community-based monitoring & GPS (Feb. 2016 - Jan 2017)
- **document TEK of access to resources** via structured surveys (Feb. 2016 – May 2017)
- **document biophysical characteristics & underlying mechanisms** via ecosystem assessment of hydrology, forest, permafrost, weather, and wildfire characteristics (June 2016 – June 2017)

Field Studies – Ground Measurements

(Frost project)

- **Societal data:** gathered at village meetings at Chevak (2016, 2018) and Emmonak (2017). Led by cultural anthropologist (Fineup-Riordan).
- **Scientific data:** field efforts in central coast (2016) and Yukon Delta (2017)

Data type	Description
Long-term monitoring data	point-intercept metrics, plot photographs
Vegetation species-cover	point-intercept metrics within plots
Surface elevation (m)	referenced to N.Am. Vertical Datum
Water depth (cm)	water table depth (above/below surface)
pH	pH measured w/ portable meter
Electrical conductivity	salinity measured w/ portable meter
Soil organic depth (cm)	surface organic thickness
Thaw depth (cm)	depth to permafrost
Depth to redoximorphic features (cm)	depth to seasonally saturated soil
Ecotype class	classification (Jorgenson 2000)
Geomorphic unit	classification (Jorgenson 2000)
Surface form	classification (Jorgenson 2000)



Field Studies – Ground Measurements

(Prugh project)

Entire range

Dall sheep locations:

- 60 radio-collared (30 GPS, 30 VHF)
- 30/30 in hunting /no-hunting areas (October 2016-2018)

Body condition metrics of rams:

(October 2016 & 2017 during captures)

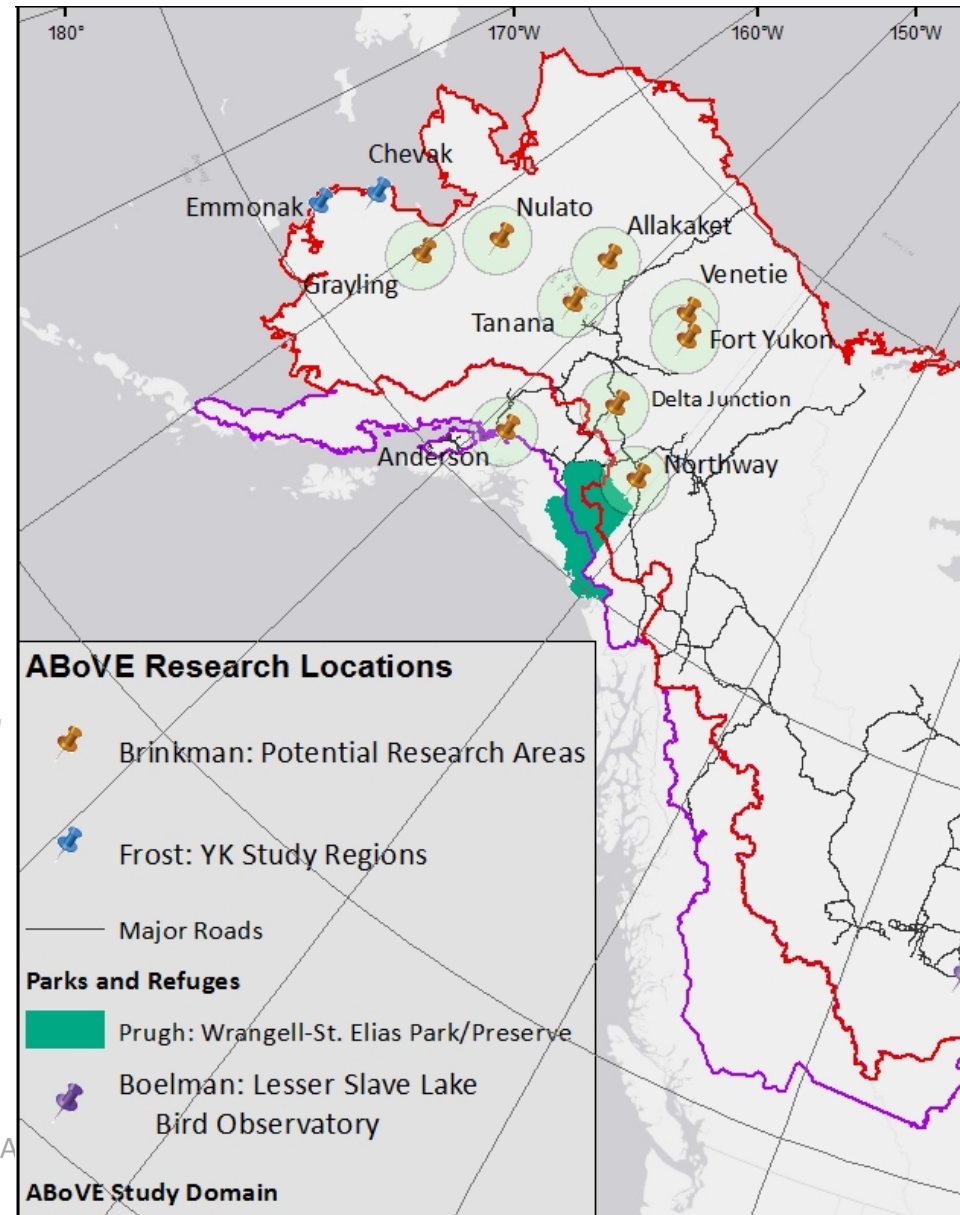
Wrangell St-Elias National Park (WRST)

Snow surveys:

- depth, cover, SWE, layer thickness, density, hardness, grain size/morphology, icing/rain-on-snow events (Oct-April 2016/17 & 2017/18)

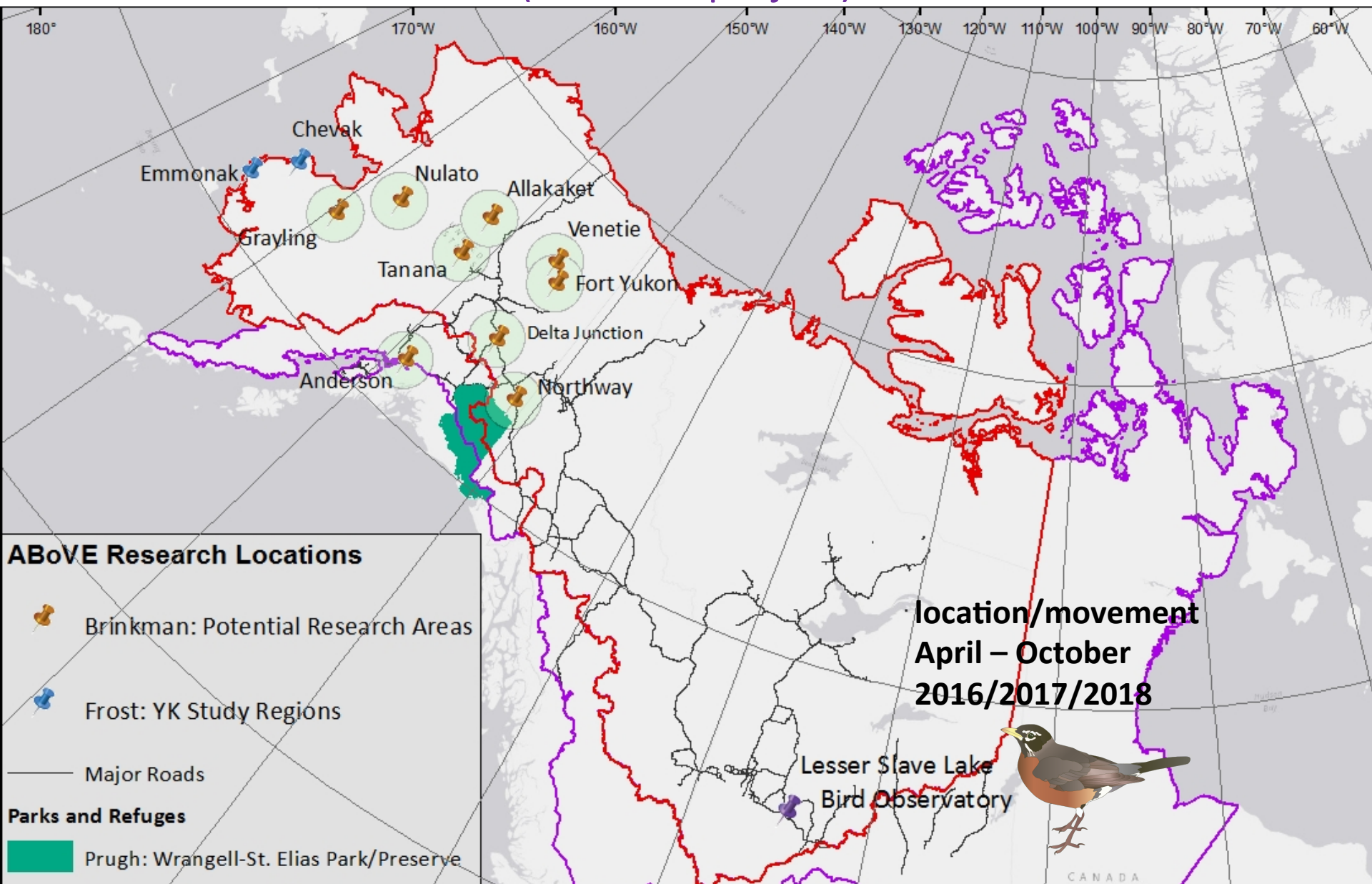
Climate:

- 2-3 Snotel stations (October 2016-2018)



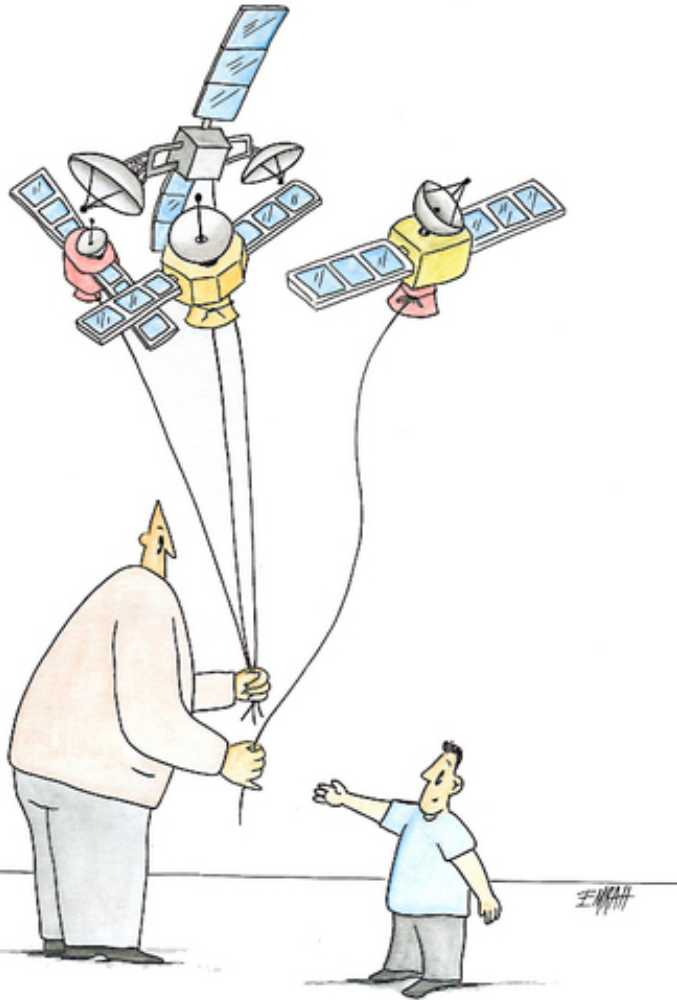
Field Studies – Ground Measurements

(Boelman project)



Spaceborne Remote Sensing

(includes Spectral, LiDAR & Radar sensors)



EXISTING

- veg productivity, cover & phenology (S-T dynamics)
- canopy height (low spatial rsln) (S dynamics only)
- snow/ice cover (S-T dynamics)
- surface water dynamics (S-T dynamics)
- occurrence of fire & burned area (S-T dynamics)
- temp, precip, thermal/orographic uplift (S-T dynamics)
- cloud cover (S-T dynamics)

WILL DEVELOP

- physical structure of veg (S-T dynamics)
- rain-on-snow/icing event dynamics (S-T dynamics)
- lichen cover (S dynamics only)

Airborne Remote Sensing



EXISTING

- **LiDAR** (S dynamics only)
 - ✓ ~3,000 km of data from AK tundra & boreal
from PI L. Vierling (Toolik Lake) and AK DOT (along Dalton Highway)
 - ✓ ~25,000 km of data from Canadian boreal forest regions
from Collaborator Mike Wulder (NRCAN)
 - ✓ along the Tibbitt to Contwoyto Winter Road (NWT)
from NOR-EX Ice Engineering Inc.
- **Alaska High-Altitude Photography (AHAP)**
for snow cover (S-T dynamics in alpine areas)

ASPIRATIONS

- **LiDAR** (more!) from anywhere in the ABoVE Study Domain
- time series of **insect outbreaks** (from B. Cook project)

Modeling Efforts



MODEL TYPES

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

SnowModel

MicroMet Model

Population Viability Analyses

Harvest Models

**Structural Equation & Agent-based
Modeling**

EXPECTED PREDICTIONS

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

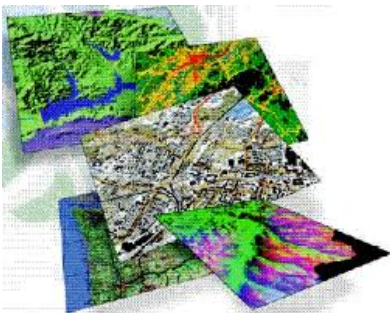
Maps of multiple snow property variables
(high spatial res, in Wrangell St-Elias study area only)

Maps of met variables
(high spatial res, in Wrangell St-Elias study area only)

Trajectories of Dall sheep populations
throughout their present day range

Key factors that affect Dall sheep harvest levels

**Maps of changes in prevalence of disturbances altering
human access & rural travel suitability in Interior Alaska**
(spatially & temporally explicit)



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)

Other expected products / outcomes

Webinars and online-tutorials for natural resource agencies, wildlife managers, First Nations, Alaskan natives, and others:

- RSF habitat & animal movement modeling
- MOVEBANK and Env-DATA tutorials
- Snow Model tutorial for ABoVE ST
- Spatially explicit story maps
- 1st webinar was on December 2015 (available on ABoVE website)

Downloadable RSF modeling software developed during the project

Traditional ecological knowledge - transcripts from village meetings (ELOKA)

Mobile apps for documenting disturbances to subsistence systems

Community-based monitoring protocols for climate-driven disturbances

We are seeking help in developing potential partnerships with Alaskan Native organizations – we would love any help in making these connections!

