



Wildlife & Ecosystem Services Working Group

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Brinkman, Todd -- University of Alaska, Fairbanks

Fienup-Riordan, Ann -- Calista Elders Council
Frost, Gerald (JJ) -- ABR, Inc. Environmental Research

Gill, Michael (Mike) -- Polar Knowledge Canada

Hebblewhite, Mark -- University of Montana

Kimball, John -- University of Montana

McCaffery, Brian -- Fish and Wildlife Service

Prugh, Laura -- University Of Washington

Reynolds, Joel -- 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

Karin Clark, Government of Northwest Territories.

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

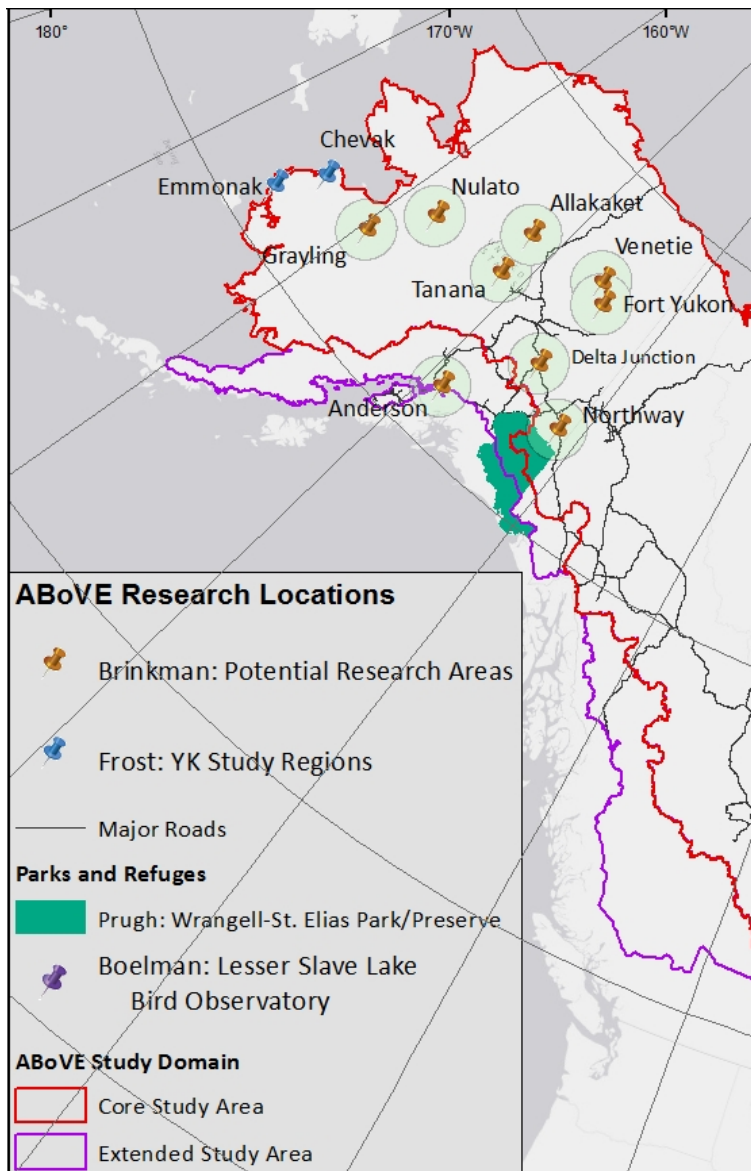
Objective #1. To **understand** how spatial and temporal dynamics in environmental and ecological conditions within the ABoVE Study Domain influence:

- (a) movement, habitat selection and population viability of a suite of highly mobile **terrestrial animals**, 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 – Ground Measurements

(Brinkman project)



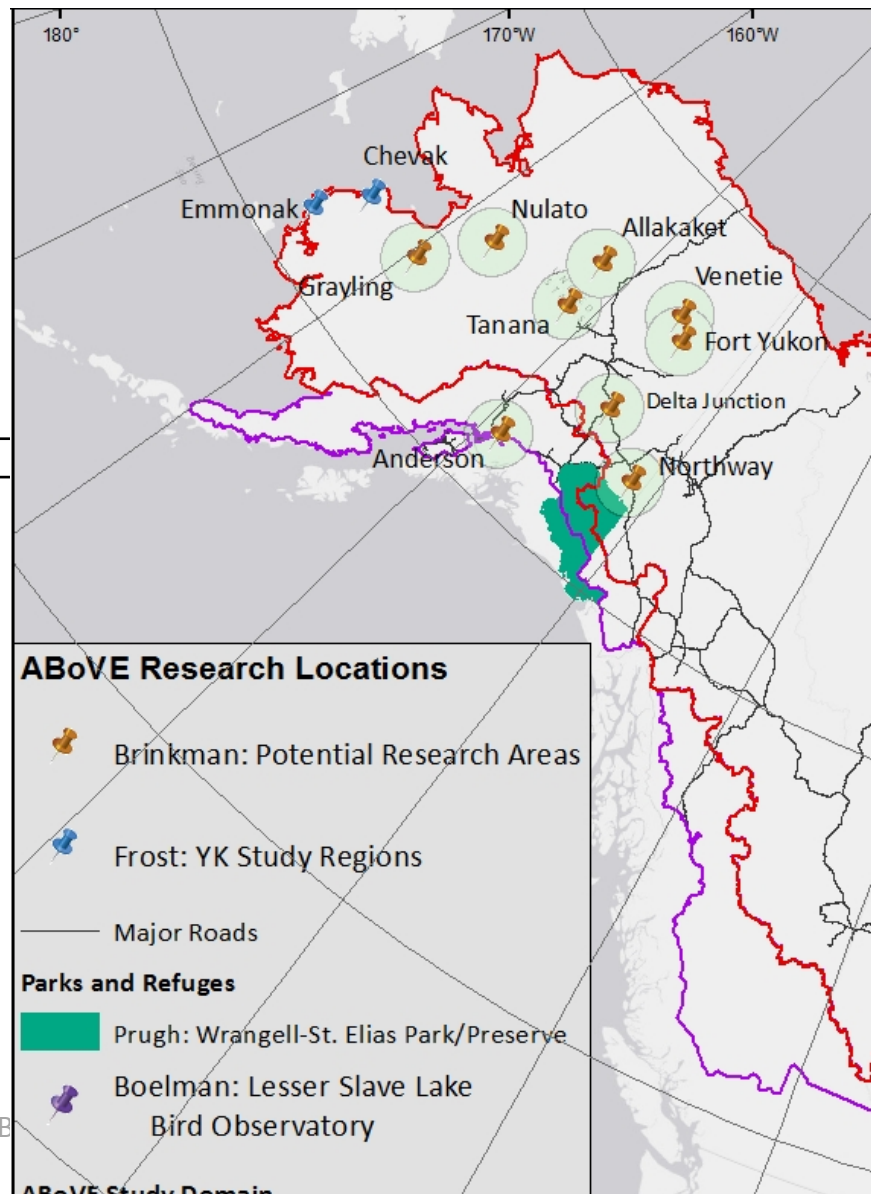
- **map subsistence travel networks and disturbance sites** via community-based monitoring & GPS (Feb. 2016 - Jan 2017)
- **document TEK of access to resources** via structured surveys (Feb. 2016 – May 2017)
- **document biophysical characteristics & underlying mechanisms** via ecosystem assessment of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

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 (Prugh project)

Wrangell St-Elias National Park (WRST)

Snow surveys:

- depth stakes & probes
- cover via remote cameras
- SWE via Federal sampler-type snow coring tubes + scale
- layer thickness, density, hardness, grain size/morphology
- Oct-April 2016/17 & 2017/18

Climate:

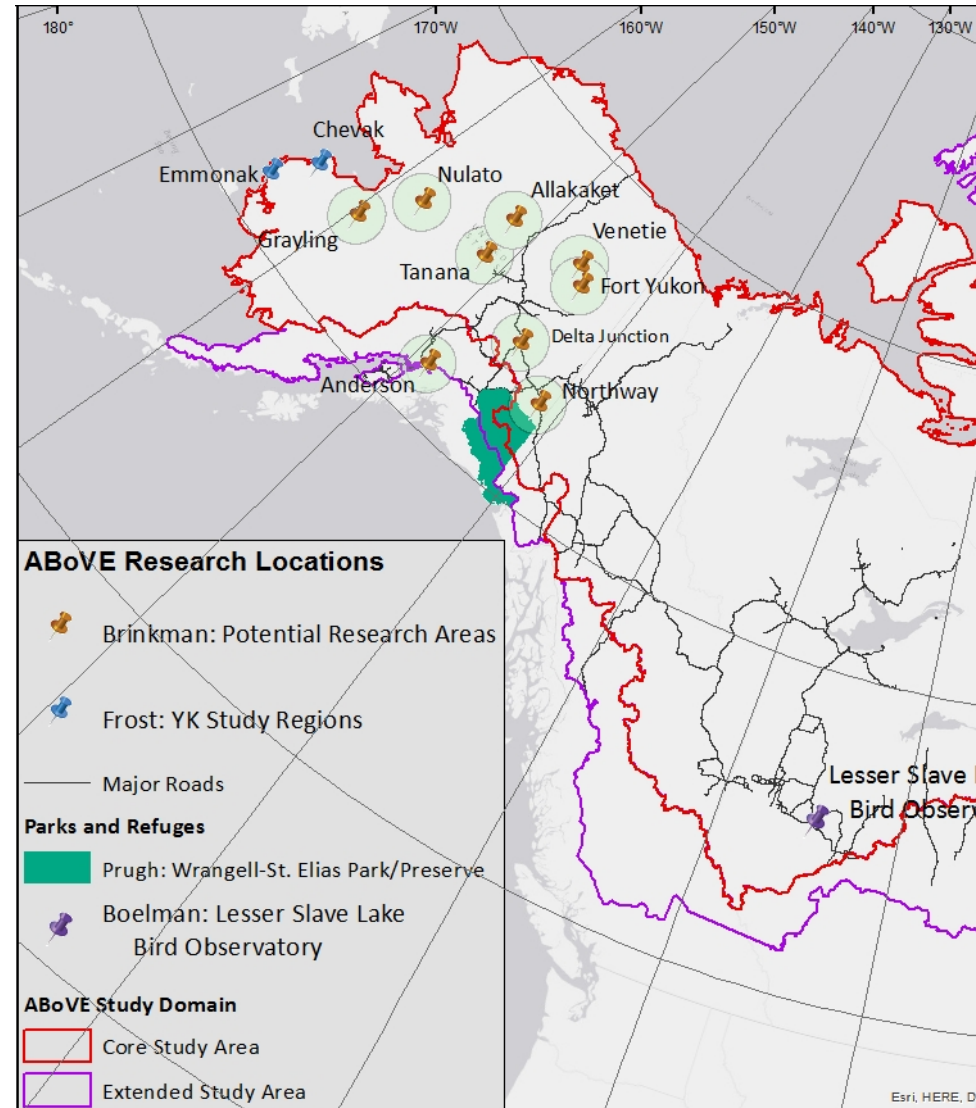
- 2-3 snotel stations
- October 2016-2018

Dall sheep locations:

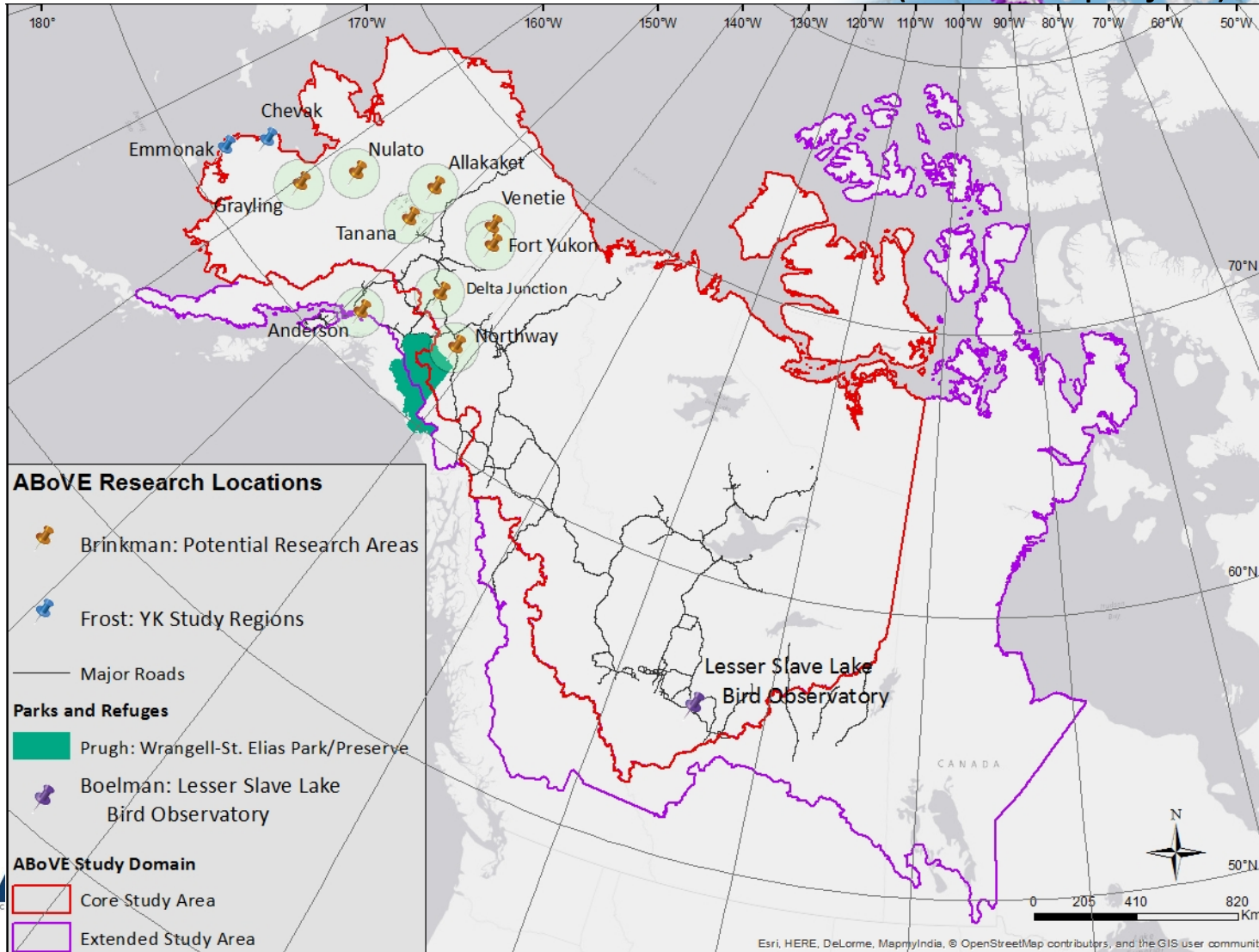
- 60 radio-collared (30 GPS, 30 VHF)
- 30/30 in hunting /no-hunting areas
- October 2016-2018

Body condition of rams:

- weight
- blood (disease, parasites, trace, minerals, metabolic analyses)
- rump depth via ultrasound
- October 2016 & 2017 during captures



Field Studies (Boelman project)



Lesser Slave Lake, AB
April – Sept/Oct
2016, 2017 & 2018

Field Studies

Synergies with other WG projects

- Tall deciduous shrub expansion: Goetz, Eitel, Frost, Ranson, Chopping, and Prugh
- Vegetation structure: Goetz, Boelman, Vierling, Frost, Chopping and Eitel
- Vegetation species composition: Frost, and ???
- Vegetation productivity & phenology: Prugh, Boelman, Gamon, Woodcock, Kimball, others?

Field Studies

Gaps & Needs

- **Meteorological data** from towers and stations throughout the domain, especially in alpine areas, would assist with Prugh's future snow modeling efforts outside the Wrangells
- **Maps of salmon runs** (would be very useful to Brinkman, and also useful to Boelman)
Current thinking: should we ask FWS if they are willing to share this data?
Current thinking: Riverscape Analysis Project – physical characs + habitat vulnerability rankings for the major salmonid stocks. Freely available at NACP website.
- **Comprehensive list of historical vegetation community composition plot data** throughout domain would be useful for flora/fauna studies.
Current thinking: is this something that the ABoVE Project Office could put together perhaps?

Spaceborne Remote Sensing

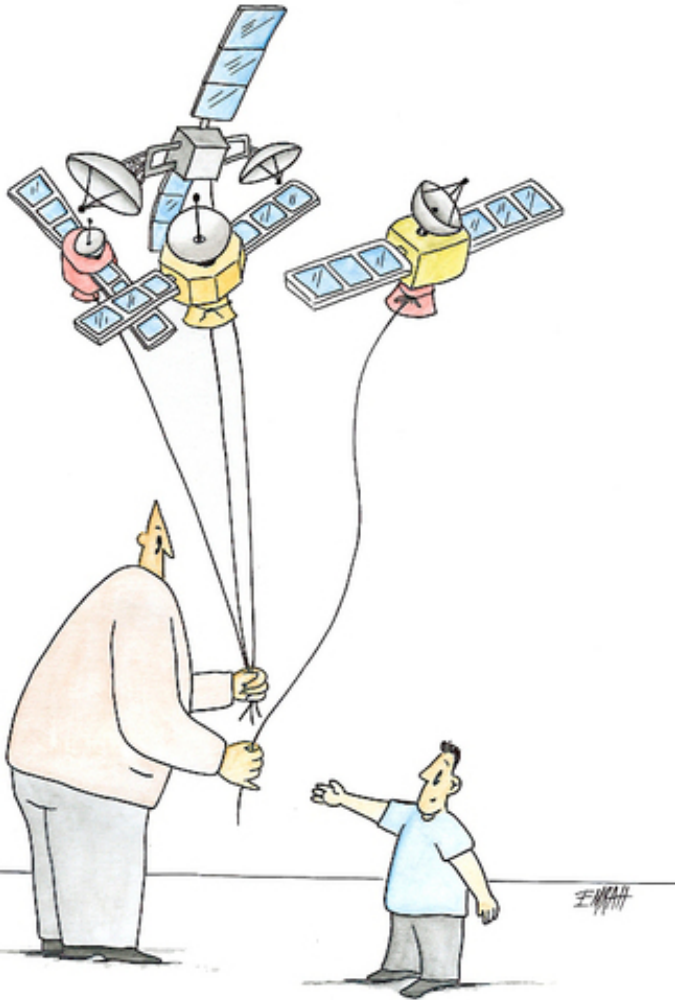
Overview

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)

ST WILL DEVELOP

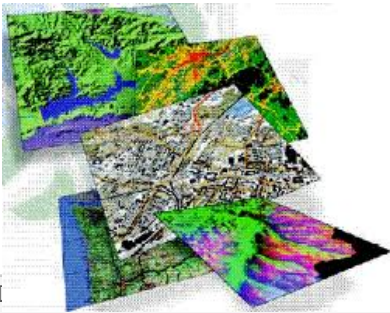
- physical structure of veg (S-T dynamics)
- rain-on-snow/icing event dynamics (S-T dynamics)
 - with help of J. Kimball
- lichen cover (S dynamics only)
 - from M. Macander on Goetz/Frost projects



Spaceborne Remote Sensing

Products we will use...

- **GLAS** for **vegetation canopy height map** (Simard et al. 2011)
- **Landsat archive** for **past vegetation disturbance, tree cover continuous fields**, open water dynamics
- **MODIS products** for:
 - **vegetation phenology and surface water extent** (MCD12; MOD/MYD13; MCD15; MOD/MYD15; MOD/MYD17; MCD43; MOD/MYD44; landcover dynamic, LAI; GPP; Tree cover)
 - **snow and ice cover fraction** (MOD/MYD10; MOD/MYD29; MCD43; MODSCAG)
 - **occurrence of fire & burned area** (MOD/MYD15; MCD45).
 - **Temperature** (MOD11A2)
 - **Cloud cover** (MOD06A2)
- **ASTER GDEM** for **thermal and orographic uplift** availability for bird flight
- **NOAA's Global Precipitation Measurement (GPM)** for precip & snow
- **AMSR-E, SMMR, SSM/I, SSMIS** for 'MEaSURES' product for global record of **daily landscape freeze/thaw status** (Kim et al. 2012)
- **NOAA Soumi NPP** satellite for **surface and vegetation** products
- **AVHRR**: GIMMS-3G NDVI; Land surface temperature, cloud product
- **CASA model** **monthly GPP** output (Chris Potter) (**+foliage biomass of shrubs, soil moisture, freeze-thaw depth, and surface water runoff**)
- **NGA** very high-resolution imagery
- **TCF model** for **daily GPP product** (Kimball)
- **Snow Property products** ie. ROS/icing products (need to talk to caribou biologists more about this – complicated issue)



Geospatial Products

WILI

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)

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)
- **GLiHT data**

ASPIRATIONS

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

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)

Modeling Activities

Driver Datasets

Common among at least 2 of our 4 projects:

- fire severity, time since fire (all but Prugh)
- veg cover/classification/structure, phenology, productivity (includes shrub expansion)
- snow extent (spatial and temporal dynamics)
- rain-on-snow/icing events & snow depth (see data gaps below)
- met data
- freeze up and thaw timing (shoulder seasons and winter)
- land ownership, community use areas/hunting areas (Brinkman, Prugh and Boelman)
- dynamically downscaled climate reanalysis product (1972–2015) for YK area; some basic reanalysis products may be provided to other study areas for basic variables such as surface temperature and precipitation

Only needed for one of our projects:

- human footprint (Boelman only)
- insect outbreaks (Boelman only)
- surface water extent/seasonality using Mark Carol's products of rivers and lakes (Boelman only)
- downscaled bias-corrected met data using MERRA-LAND, SNAP gridded data (Prugh only)
- thermokarst (erosion) maps (Brinkman only)
- hydrology related to navigability (Brinkman only)
- change in river and lake ice thickness (Brinkman only)
- extreme weather events (Brinkman and Boelman)



Modeling Activities

Key Identified Data Gaps / Needs

Nothing identified to date

Summary of AIP input

- ✓ All information (???) is captured in bullet points/tables that now need to be turned into paragraph + table form
 - Although many/most (?) synergies have been identified, we have not discussed timing nor coordination.
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- ✓ Field measurement efforts & expected datasets
 - ✓ Remote sensing efforts & expected products
 - ✓ Modeling efforts & expected outputs
 - Timing & coordination & synergies among WG projects and between WGs
 - ✓ Identified data gaps / needs
 - ✓ Airborne observation desires