Natalie Boelman

Animals on the Move

Project Code: Boelman-01

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Jan Eitel (Univ. of Idaho)
Mark Hebblewhite (Univ. of Montana)
Laura Prugh (Univ. of Washington)
Lee Vierling (Univ. of Idaho)

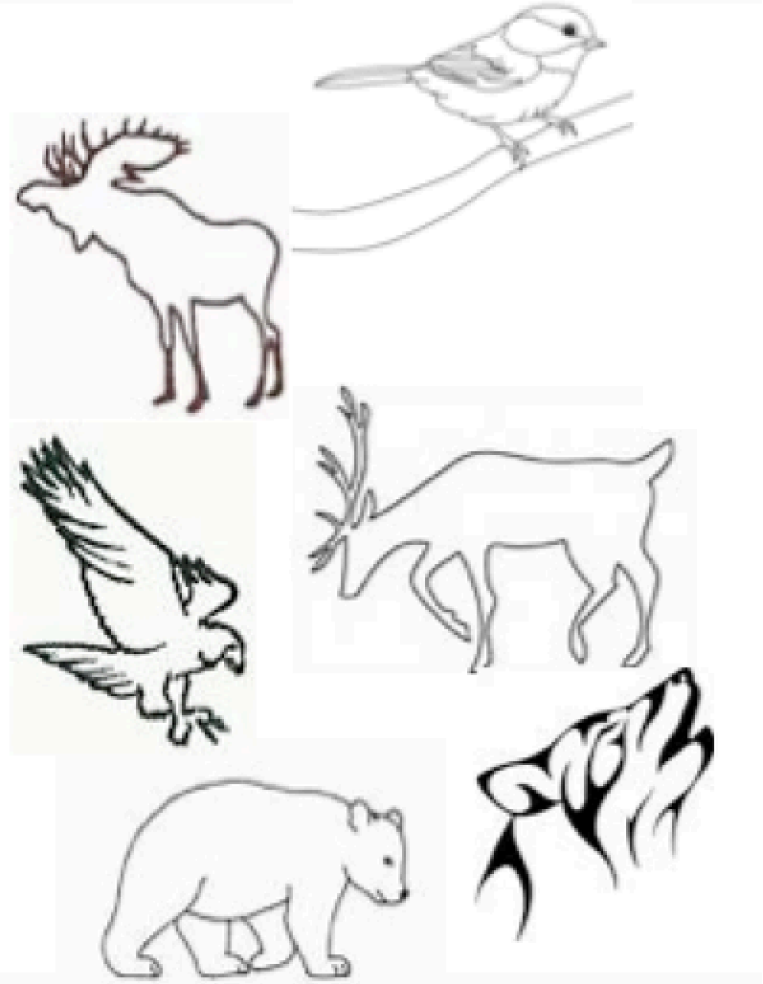
22 Institutional Collaborations

PI	Institution/Agency
Dave McGuire	USGS
Dave Hervieux, Jocelyn Hudon	Province of Alberta
Richard Krikun	Lesser Slave Lake Bird Observatory
Troy Hegel	Yukon Territory Government
Bruno Croft	Northwest Territories Government
Mike Wulder	Natural Resources Canada
Jesko Partecke	Max Plank Inst. of Ornithology
Torsten Bentzen, Travis Booms, Nick Demma, Kim Jones, Kalin Kellie, Kerry Nicholson	State of Alaska
Jeff Smith	Harvey Ecology Consultants
Steve Lewis, Eric Wald	AK Fish and Wildlife Service
Steve Arthur, John Burch, Kyle Joly, Carol McIntyre, Patricia Owen	National Parks Service

Elevator Speech

- Wildlife habitats are changing drastically in ways that overlap in both space & time, **and** thus highly mobile fauna must navigate an increasingly complex mosaic of conditions.
- **But** we know little about how they do this…
- **Therefore,** we propose to examine how movements and habitat selection by birds, large herbivores & mammalian carnivores are influenced by spatial-temporal variation in environmental conditions, ecological characteristics, disturbances & human development.

Tier 2 Science Question Addressed



How are flora and fauna responding to changes in biotic and abiotic conditions?

Tier 2 Science Objectives addressed

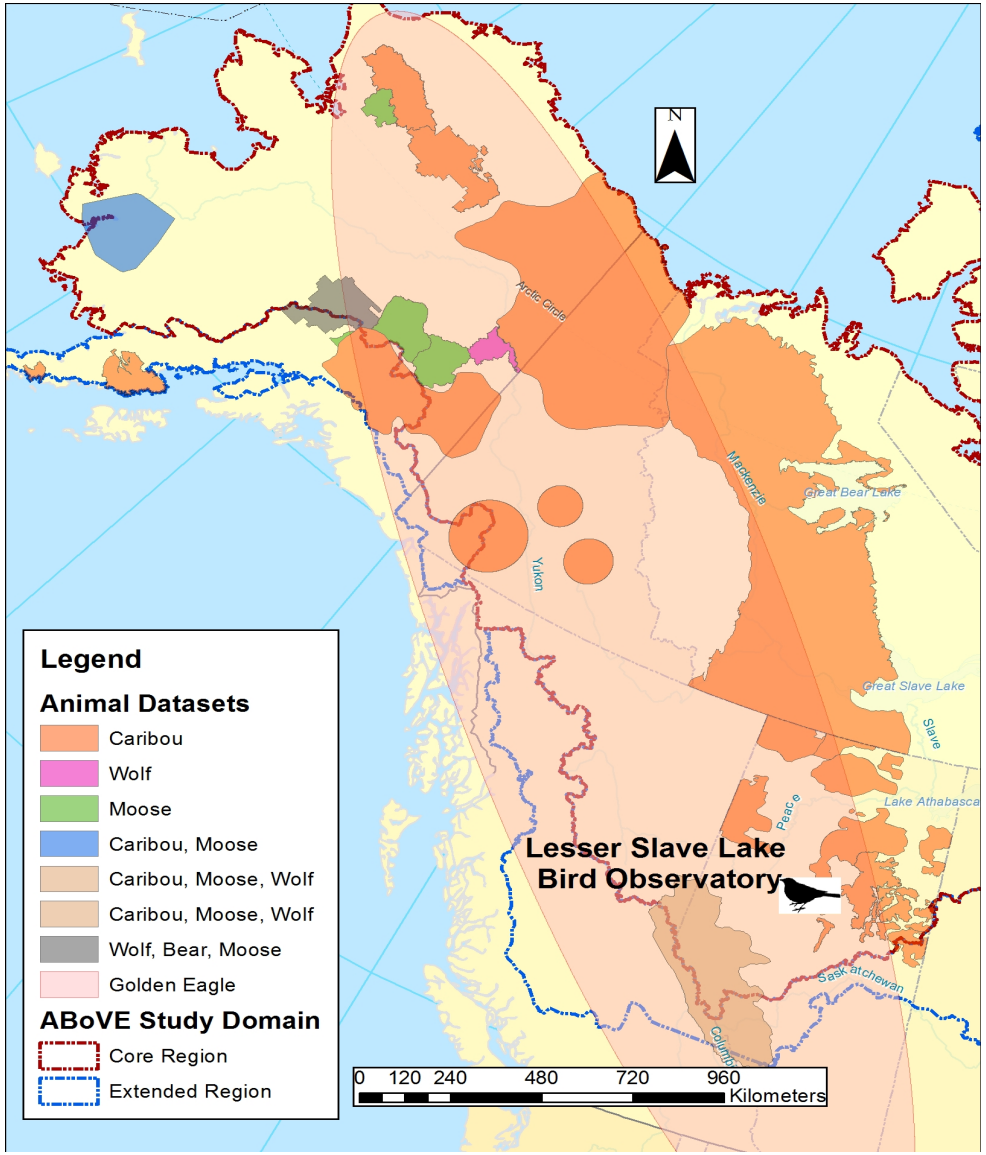
(1) Determine how the spatial and temporal dynamics in both faunal abundance and characteristics of fish and wildlife habitat co-vary across gradients of climate and disturbance.

- by linking wildlife habitat selection and movements to suites of environmental, ecological and disturbance variables across the entire ABoVE Study Domain, across seasons, and over multiple decades.

(2) Quantify how changes in the spatial and temporal distribution of snow impacts ecosystem structure and function.

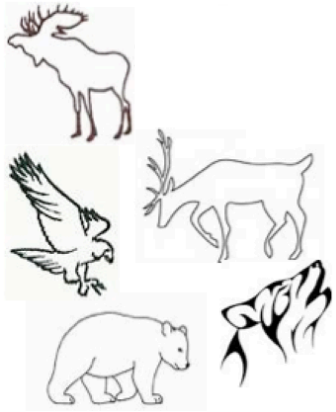
- by linking wildlife habitat selection and movements to spatiotemporal dynamics in snow cover measured via remote sensing.

Field Studies



- **Only field data = animal location data**

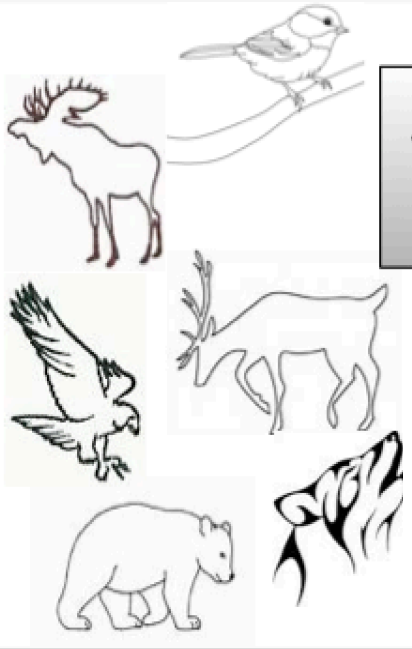
- Collected via **GPS tags/collars** worn by the animals all over the ABoVE Study Domain.



- The **majority has already been or will be collected** by our many no-cost collaborators (data sharing agreements!).

- **Only fieldwork = collect location data for songbirds (American Robins)**, in April of each study year.

Obj. 1



Space-based
Wildlife Location Datasets
(1990s – 2019)
Movebank

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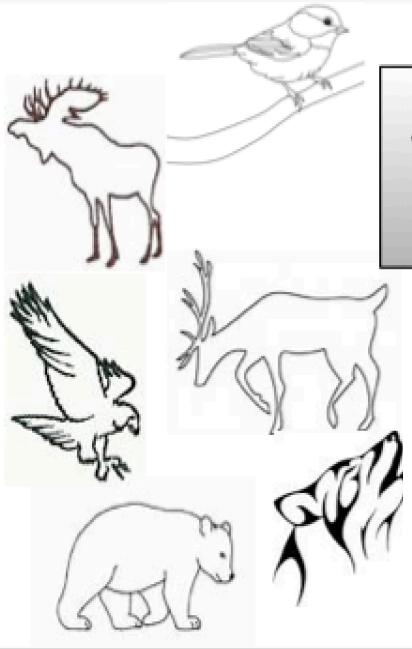

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Remote Sensing,
Met. Networks & Models

Spaceborne Remote Sensing

- **GLAS** for vegetation canopy height map (Simard et al. 2011)
- **Landsat archive** for past vegetation disturbance, tree cover continuous fields, and possibly rain-on-snow freezing events
- **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)
  - occurrence of fire & burned area (MOD/MYD15; MCD45).
  - temperature
- **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

1990s to present, depending on product availability

Airborne Remote Sensing - LiDAR

Existing:

- ~3,000 km of data already in hand by the project PI team, including near Toolik Lake, AK (Vierling et al., 2013), and, along the Dalton Highway (AK DOT)
- ~25,000 km of data from Canadian boreal forest regions from Collaborator Mike Wulder (NRCAN) (Wulder et al., 2012)
- imagery along the Tibbitt to Contwoyto Winter Road (NWT) from NOR-EX Ice Engineering Inc. (from Eitel project)

Desired:

(1)The more the better! For assessment of the impact of accuracy/spatial resolution of GLAS derived dataset on vegetation structure- wildlife associations.

(2)

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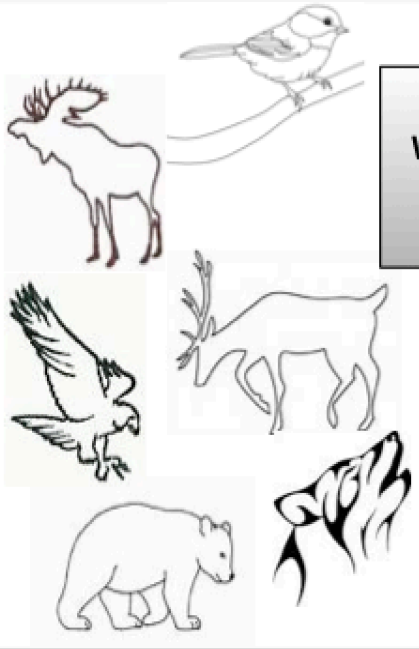

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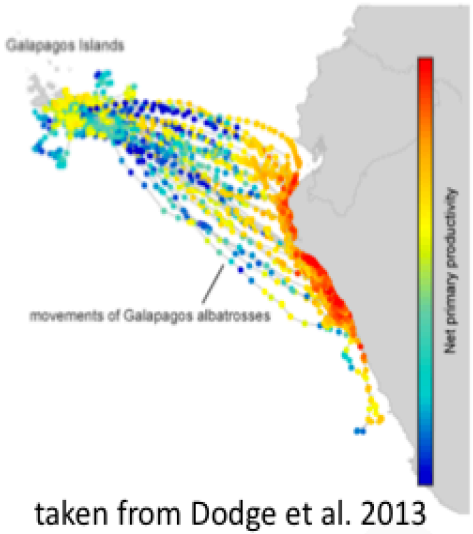
Annotate wildlife locations
with Environmental Change variables
Env_DATA



taken from Dodge et al. 2013

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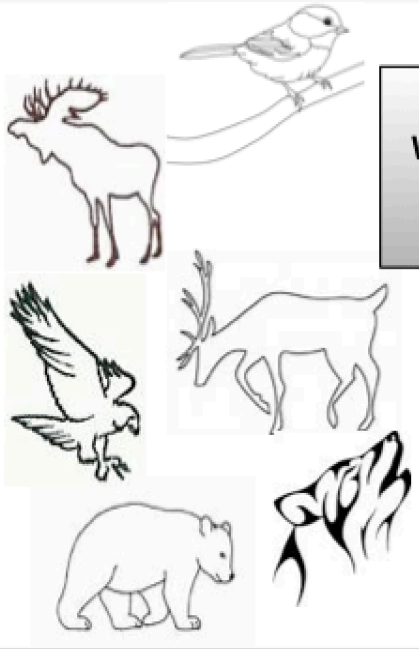

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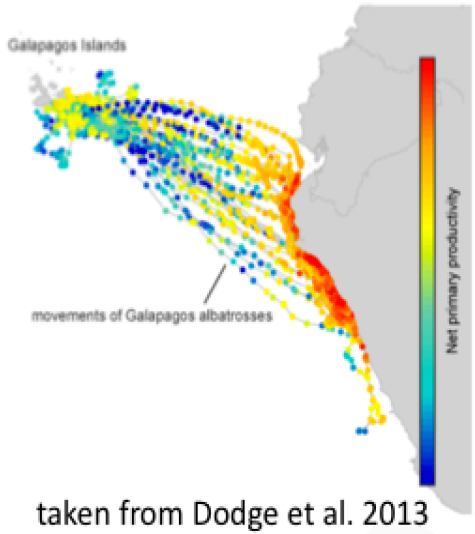


taken from Dodge et al. 2013

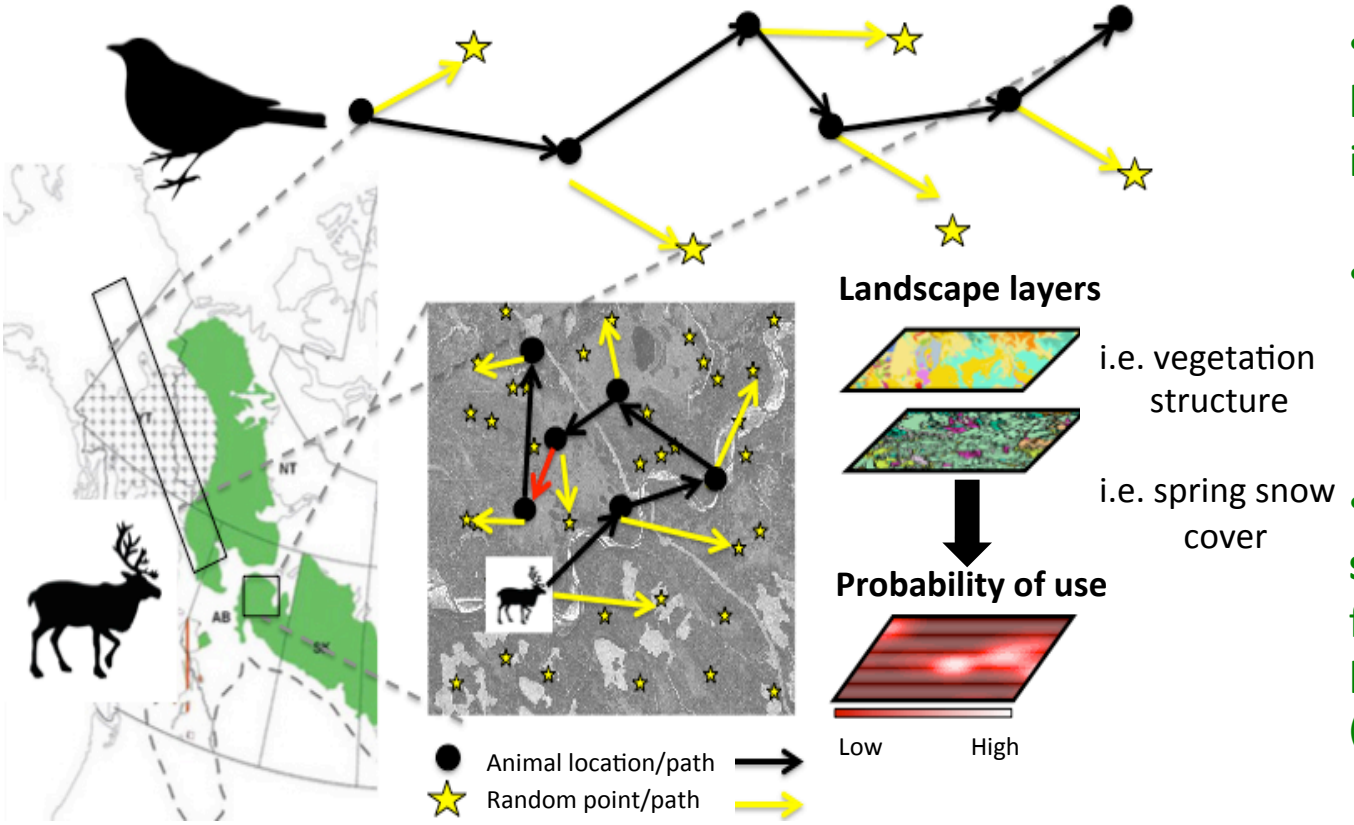
Obj. 2

Build empirical models to
understand drivers of wildlife habitat selection and movement
RSF Modeling

Modeling Approach:

Resource Selection Functions (RSF)

with Generalized Functional Responses (GFR) extension



- **Understand patterns** of habitat selection/movement in space & time
- **Used** locations/paths
  vs.
  Unused locations/paths
- GFR extension **allows selection to change** as a function of changing habitat availability (Matthiopolous et al. 2011)

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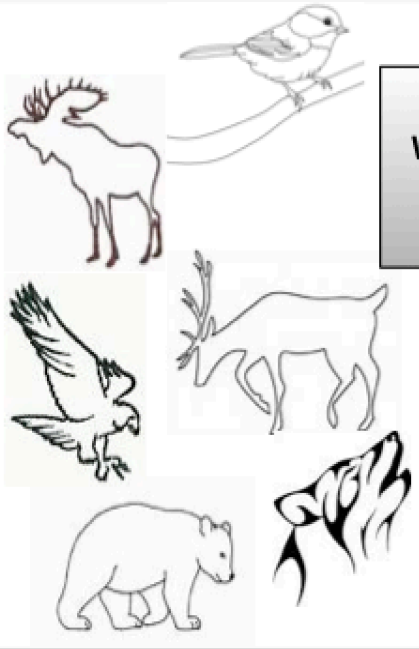

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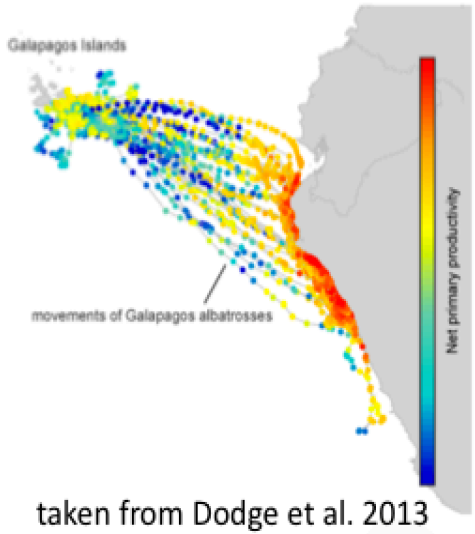

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Obj. 3

'Present Day' Decision Support Tools & Products
to aid stakeholders make informed management and adaptation decisions for present day
Webinars & Online Tutorials

Expected products:
Phase I

(1) Maps of probability of habitat use over the ABoVE Study Domain for all groups of study animals.

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

- RSF habitat and movement modeling
- Use of MOVEBANK and Env-DATA

(3) Downloadable RSF modeling software developed during the project

Both will be made available on the MOVEBANK and ABoVE web servers.

Geospatial Data Products:
Phase II and III

- **Types of products:** Mapped projections of future wildlife movement and habitat selection for all groups of studied animals.
- **Geographic coverage:** ABoVE Study Domain
- **Data formats, grids, and projections:** TBD
- **Temporal range**: Present day to 2100
- **Product Users:** Natural resource agencies, wildlife managers, First Nations, Alaskan natives, and others