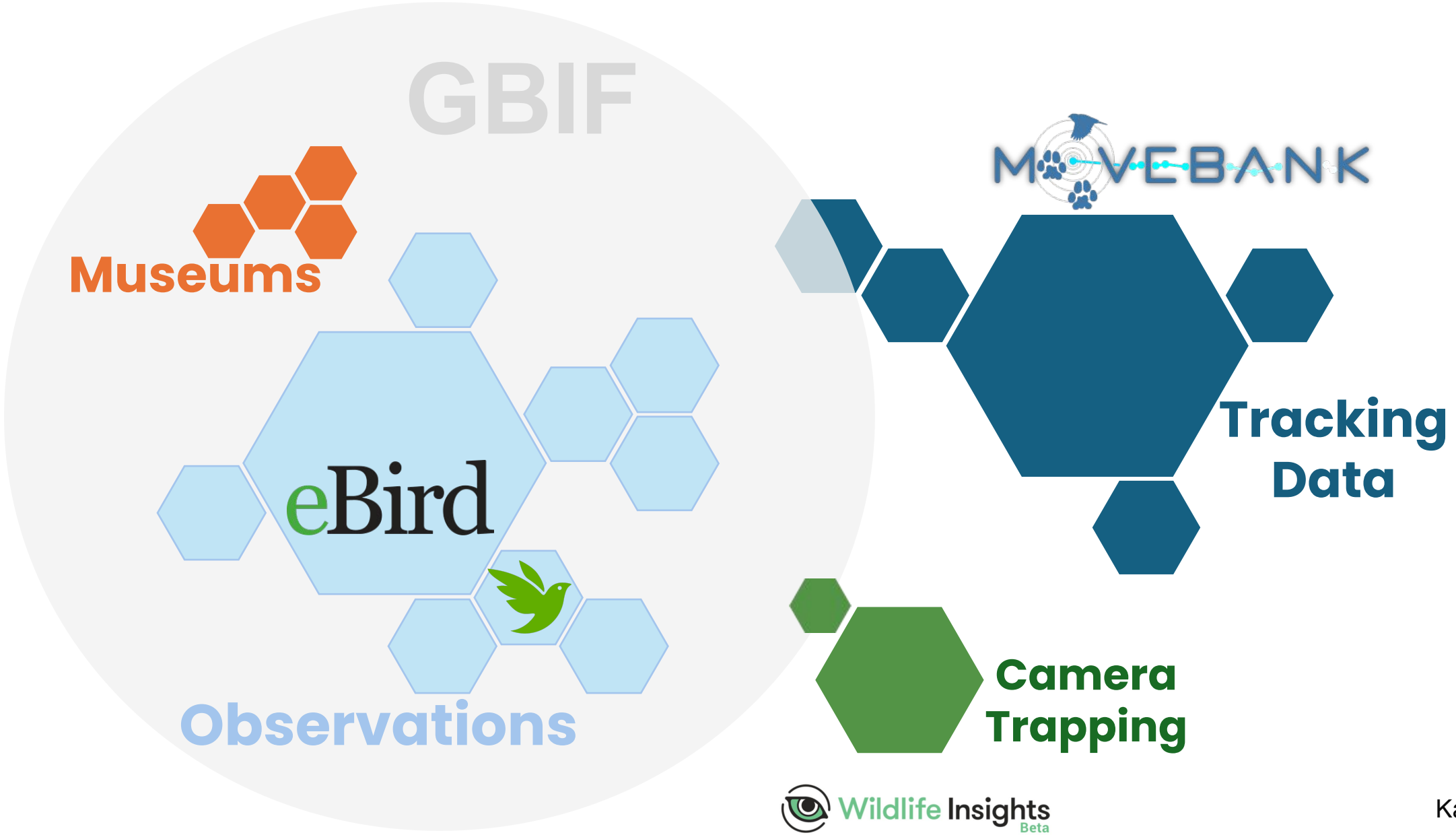
Introduction to Movebank, MoveApps and Room to Roam: Y2Y Wildlife Movements

Roland Kays
North Carolina Museum of Natural Sciences
NC State University

odiversity Records



Kays and Wikelski 2023

Born Digital Biodiversity

observations, photographs, camera traps, tra

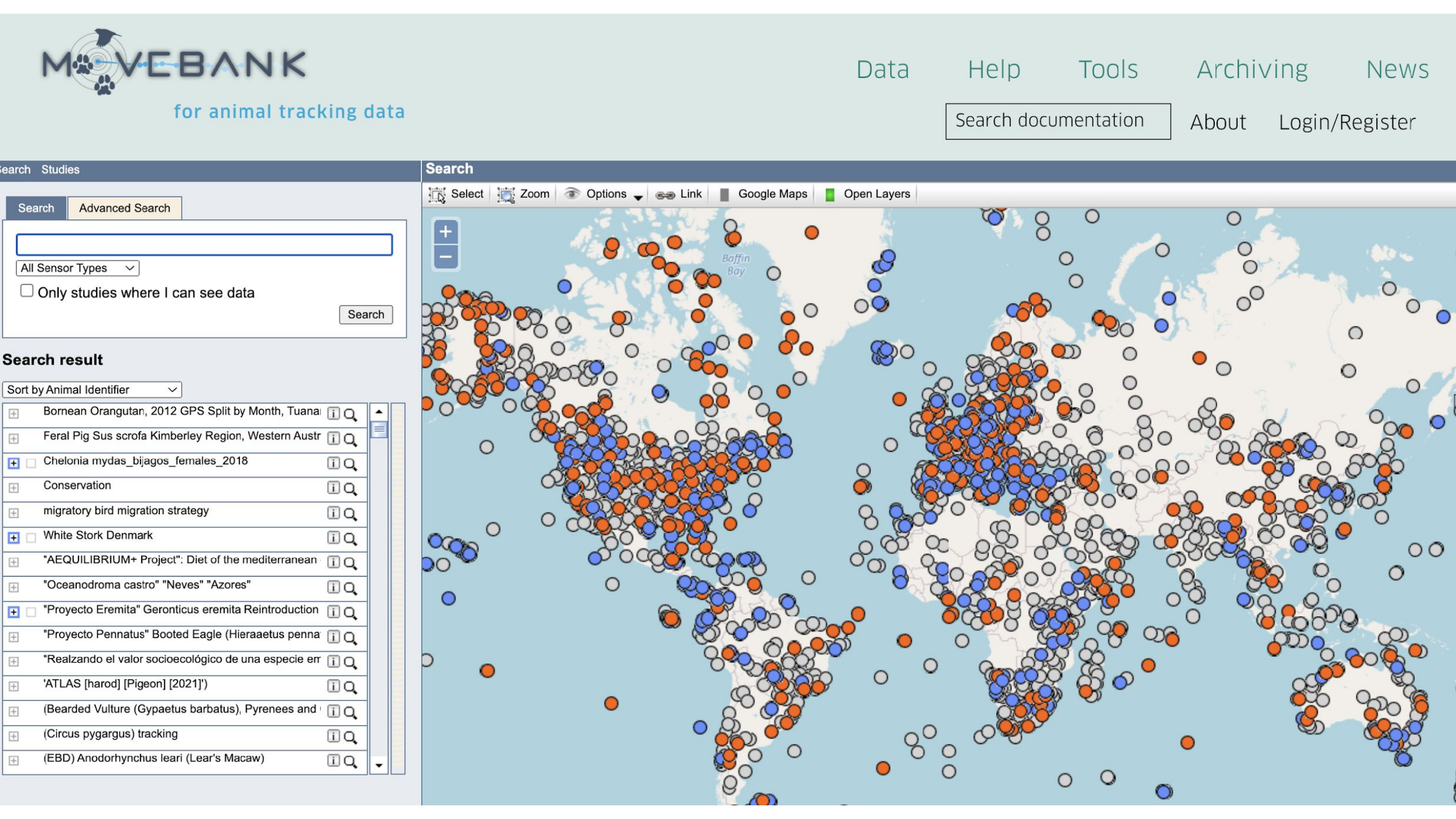
GBIF – 2.3B records

- Mostly now born digital
  - Mammals 80% (last 5 years 99%)
  - Birds 99%

Movebank – Tracking Data

- 6.3 Billion Locations
- Growing 6M/day

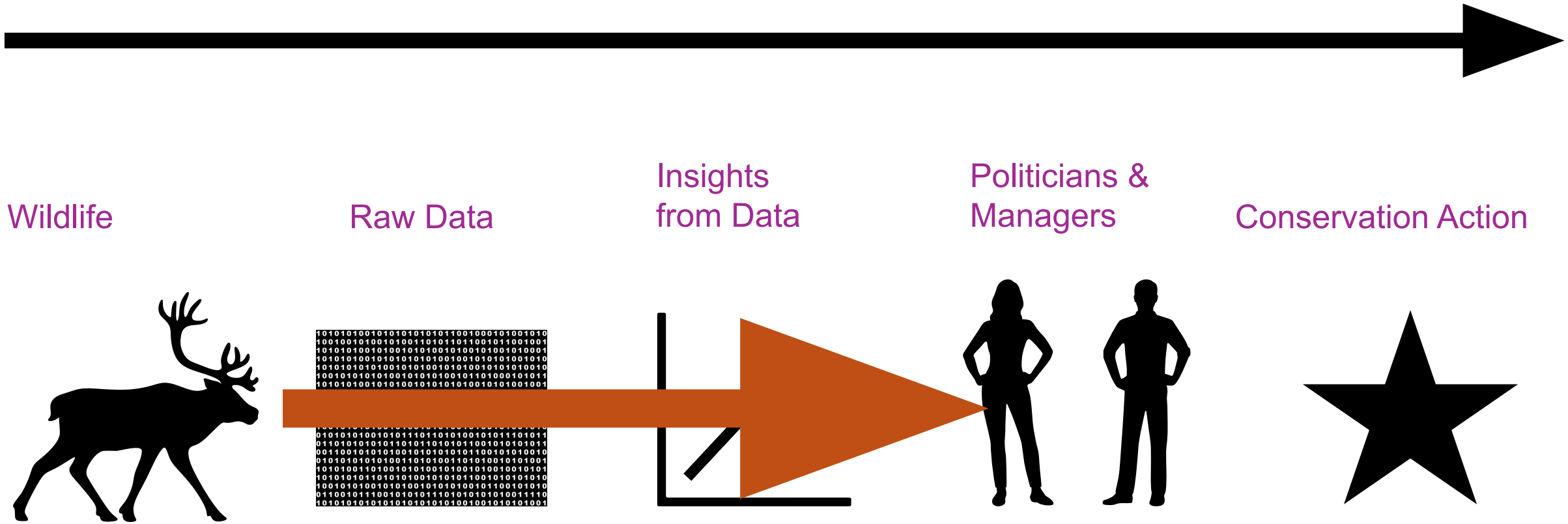

ANIMAL TRACKING DATA

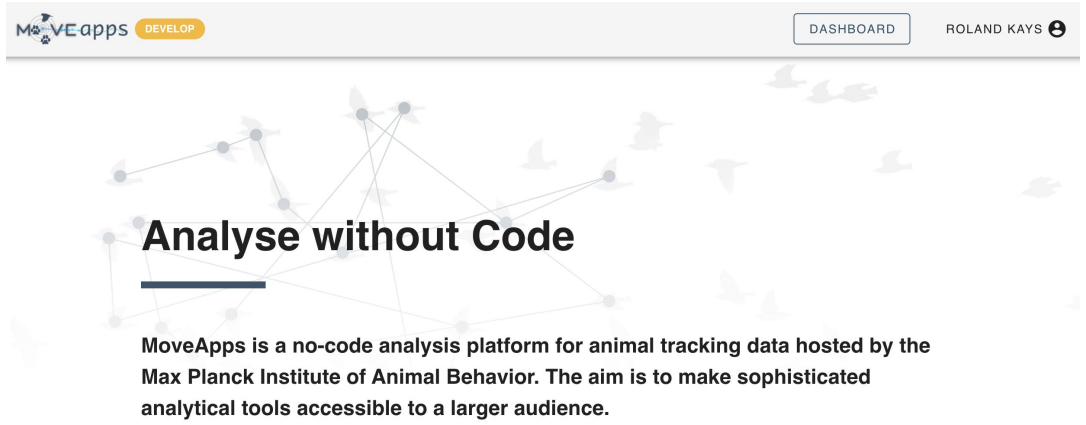

MOVEBANK
for animal tracking data
Data
Help
Tools
Archiving
News
Search documentation
About
Login/Register
Search
Studies
Search
Advanced Search
All Sensor Types
Only studies where I can see data
Search
Search result
Sort by Animal Identifier
Bornean Orangutan, 2012 GPS Split by Month, Tuana
Feral Pig Sus scrofa Kimberley Region, Western Austr
Chelonia mydas_bijagos_females_2018
Conservation
migratory bird migration strategy
White Stork Denmark
"AEQUILIBRIUM+ Project": Diet of the mediterranean
"Oceanodroma castro" "Neves" "Azores"
"Proyecto Eremita" Geronticus eremita Reintroduction
"Proyecto Pennatus" Booted Eagle (Hieraaetus penna
"Realzando el valor socioecológico de una especie en
'ATLAS [harod] [Pigeon] [2021]')
(Bearded Vulture (Gypaetus barbatus), Pyrenees and
(Circus pygargus) tracking
(EBD) Anodorhynchus leari (Lear's Macaw)
Search
Select
Zoom
Options
Link
Google Maps
Open Layers
Baffin Bay

Data Owners Control Access

- You don’t have to share data, but if you want to, we make it easy

Motivation: How can we make the insights of wildlife data easier to access?





- Apps: small analysis tools with customizable settings
- Workflows: combinations of multiple apps
- Any programmer can make an app
- Workflows and apps are published, citable, and sharable

Room to Roam: Yellowstone to Yukon Wildlife Movements

Y2Y partners

HawkWatch International — Conserving Raptors and Our Shared Environment

teton raptor center

Yellowstone to Y Conservation Initia

CENTER for LARGE LANDSCAPE CONSERVATION

Yukon CANADA

Northwest Territories

Development partners

The Ohio State University

North Carolina Museum of Natural Sciences

Max-Planck-Gesellschaft

University of Minnesota Driven to Discover®

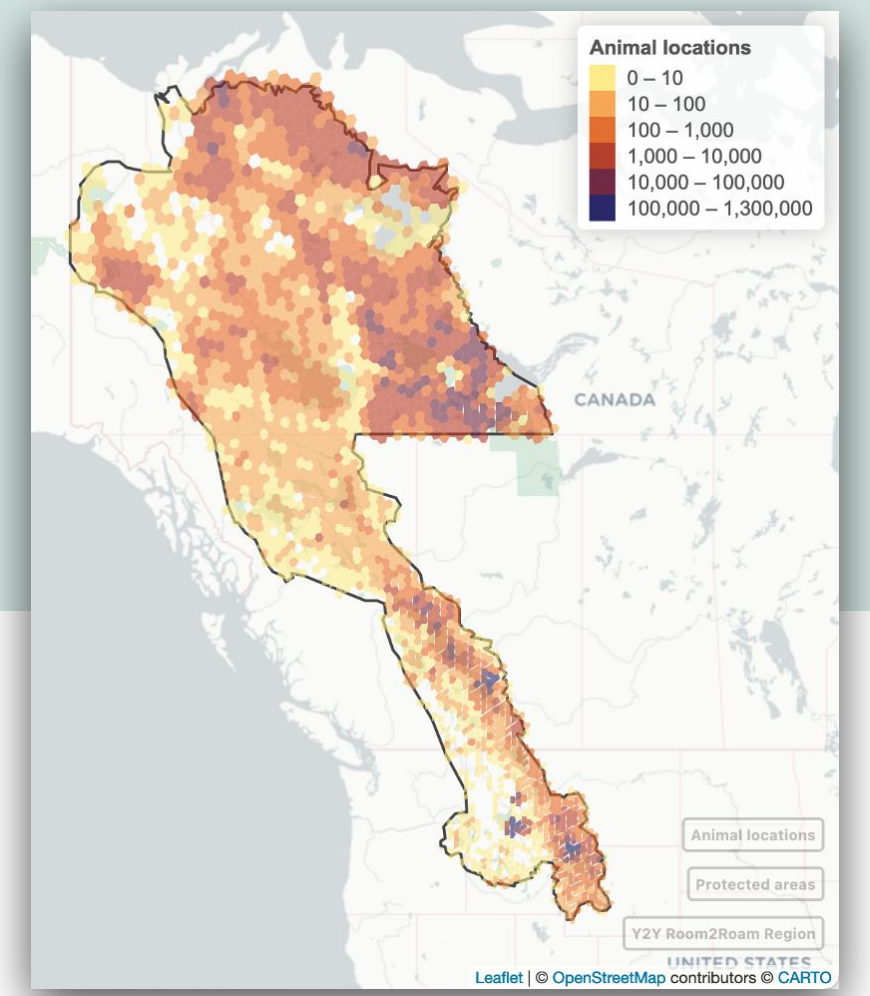
MoveBank

NASA

https://ceg.osu.edu/Y2Y_Room2Roam

Room2Roam goals

1. Build an archive of wildlife tracking data in the Y2Y.



Room2Roam goals

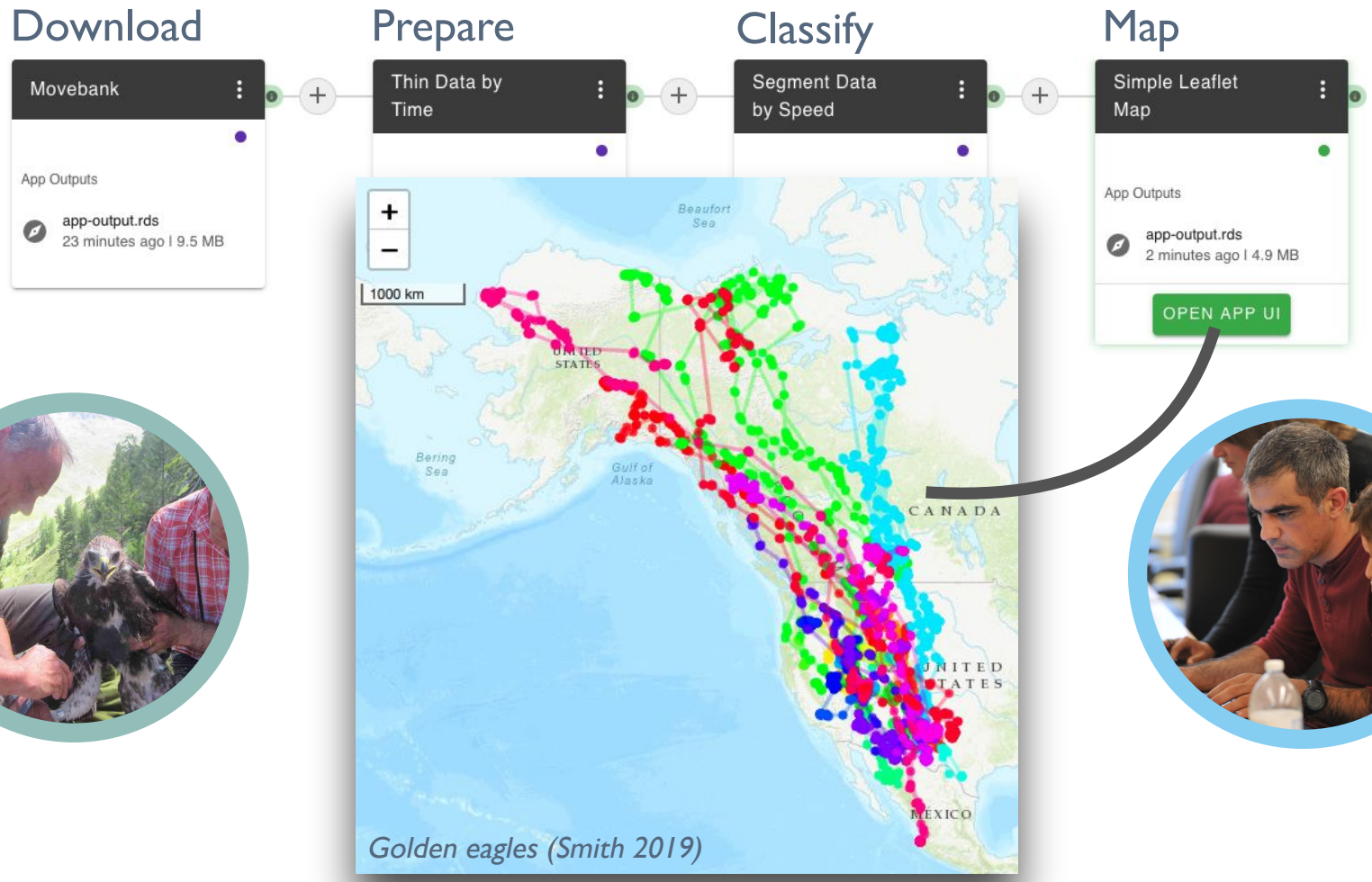
1. Build an archive of wildlife tracking data in the Y2Y.
2. Identify analysis needs in the region.


HELLO
MY NAME IS
Ashley
HELLO
MY NAME IS
Joh
n
HELLO
MY NAME IS
Sarah
HELLO
MY NAME IS
Nilanjan
HELLO
MY NAME IS
Gil

Room2Roam goals

1. Build an archive of wildlife tracking data in the Y2Y.
2. Identify analysis needs in the region.
3. Develop open and shared tools to meet these needs.

Build repeatable workflows out of user-contributed analysis Apps.



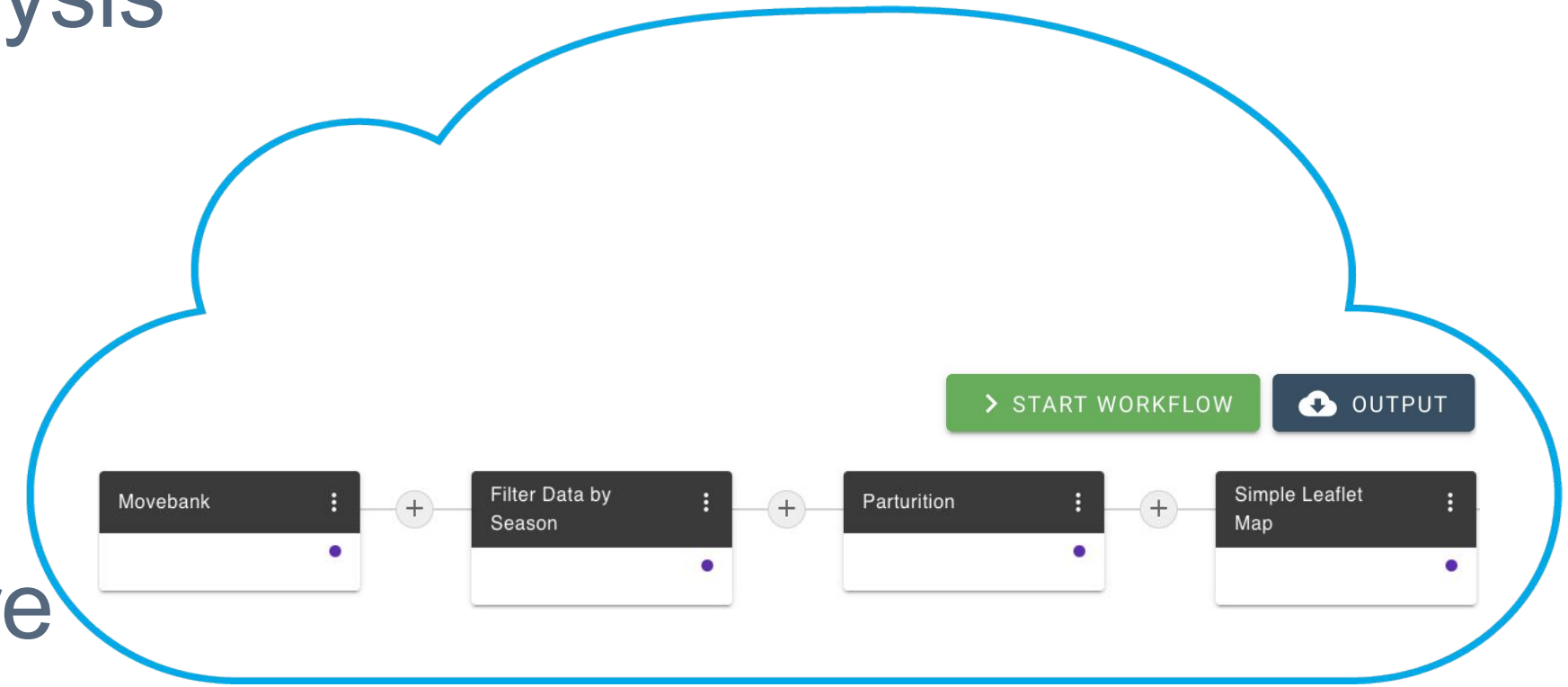
Kölzsch et al. (2022) Movement Ecol.

- No-code analysis
- Open App development
- R & Python
- Cite and share

Kölzsch et al. (2022) Movement Ecol.

MOVEapps

- No-code analysis
- Open App development
- R & Python
- Cite and share
- Cloud computing, real time



Kölzsch et al. (2022) Movement Ecol.

Case study: Ungulate calving behavior

Chisana herd, Kathi Egli, Yukon Government

Yukon CANADA

Northwest Territories

NEED: Identify calving events

Get data.

Movebank

Reduce to females and calving period.

Filter by Animal Data

Filter by Season

Assess sampling.

Track Summary Statistics

Run calving analysis.

Parturition Cluster Detection

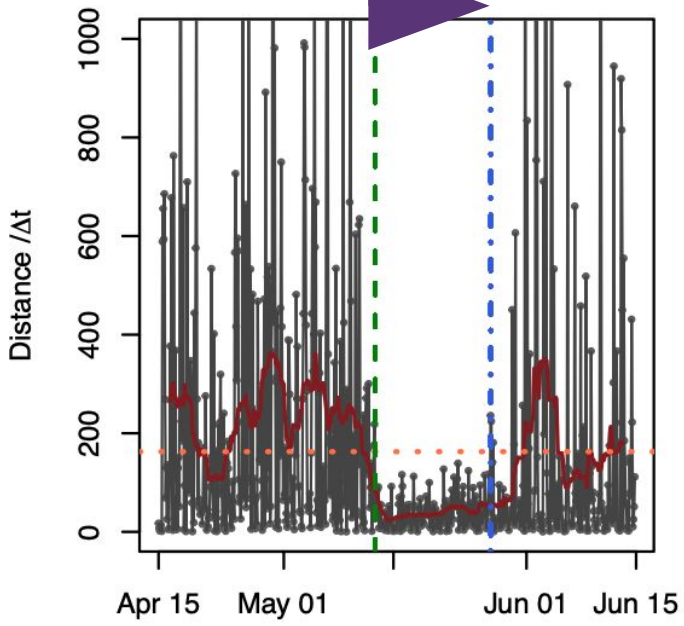
App Outputs

app-output.rds
1.8 MB | 5 minutes ago

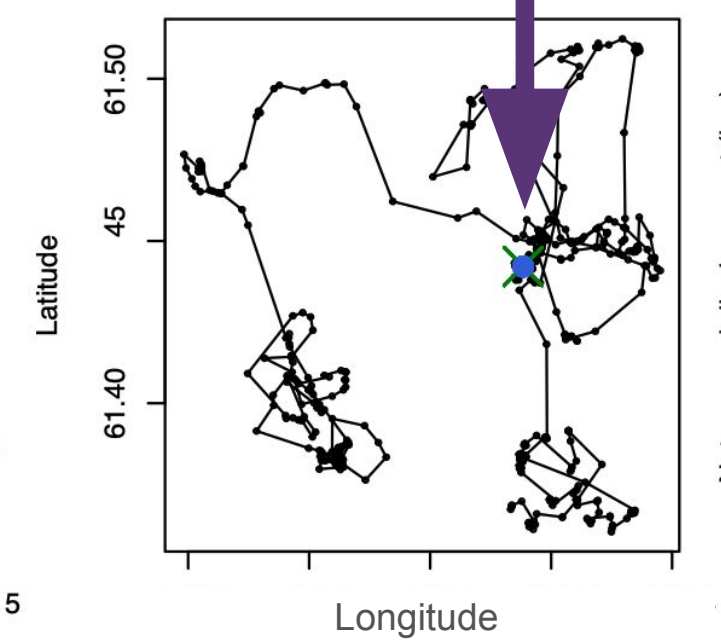
Parturition_output.csv
34.7 kB | 5 minutes ago

Parturition_vel.pdf
3.1 MB | 5 minutes ago

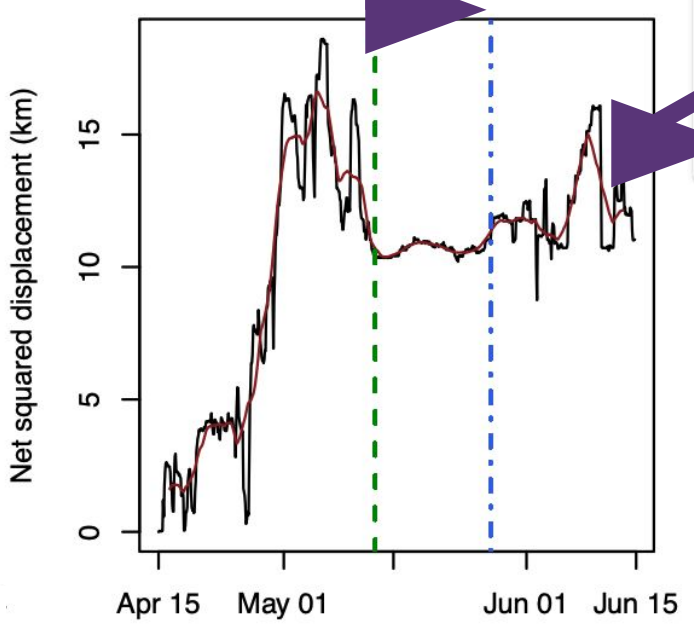
Movement speed



Location



Displacement



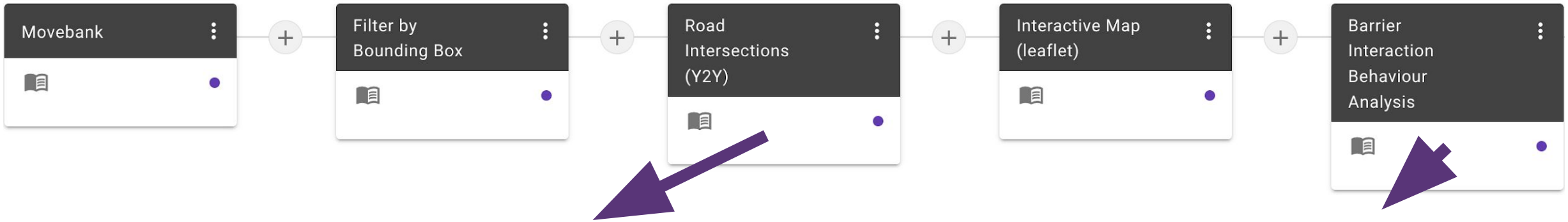
Government of Northwest Territories

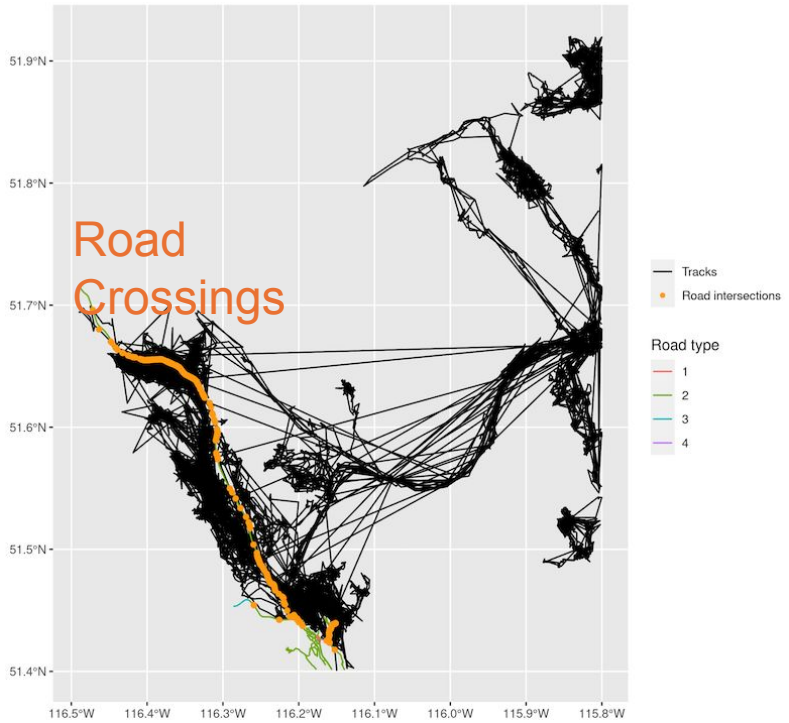
Boreal caribou monitoring data

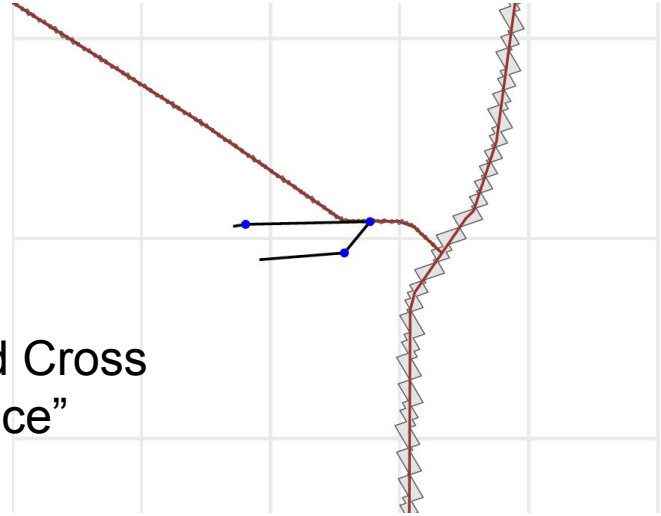
Validating this season with aerial surveys
Hope its last year of these flights

NEED: Assess impacts of roads and linear infrastructure

Get data → Prepare → Analyze → Visualize → Analyze







Failed Cross
“bounce”

Need: Identify carcass sites.

Get

Predation Cluster Detection

Radius for cluster search

Define the radius (in meters) for searching for GPS locations and cluster formation.

50

Time window for clus

Provide the maximum time duration (in

3

Minimal locations use

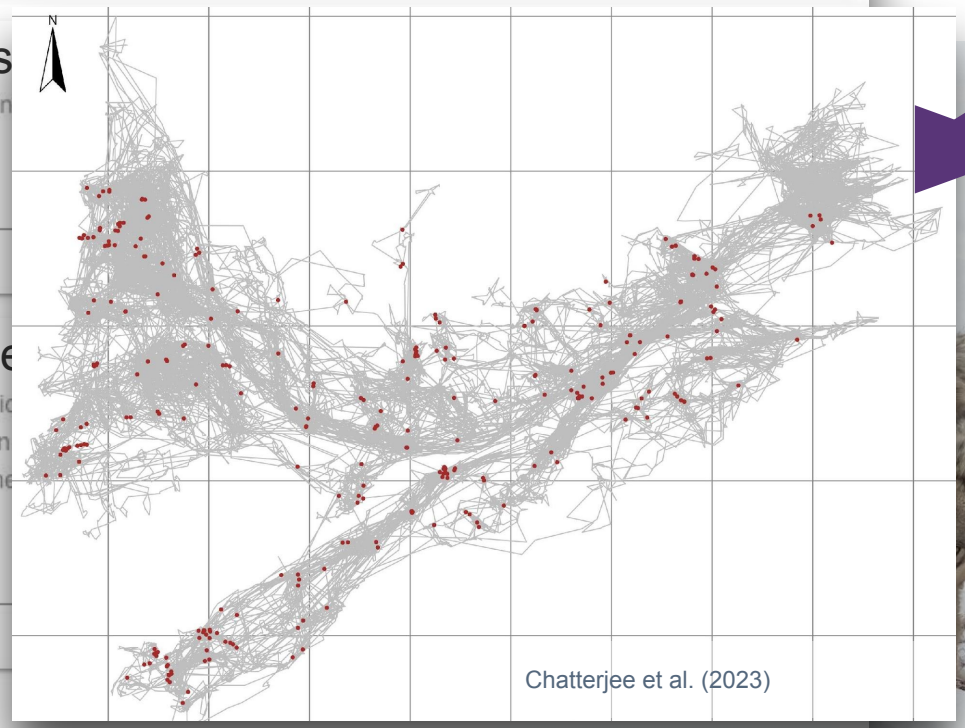
Provide the minimum number of locatio
predation clusters and other sites (den
animal has come back and spent some

8

CANCEL

SAVE CONFIGURATION

Adapted from Clapp et al. (2021)



Chatterjee et al. (2023)

Analyze

Predation Cluster Detection

App Outputs

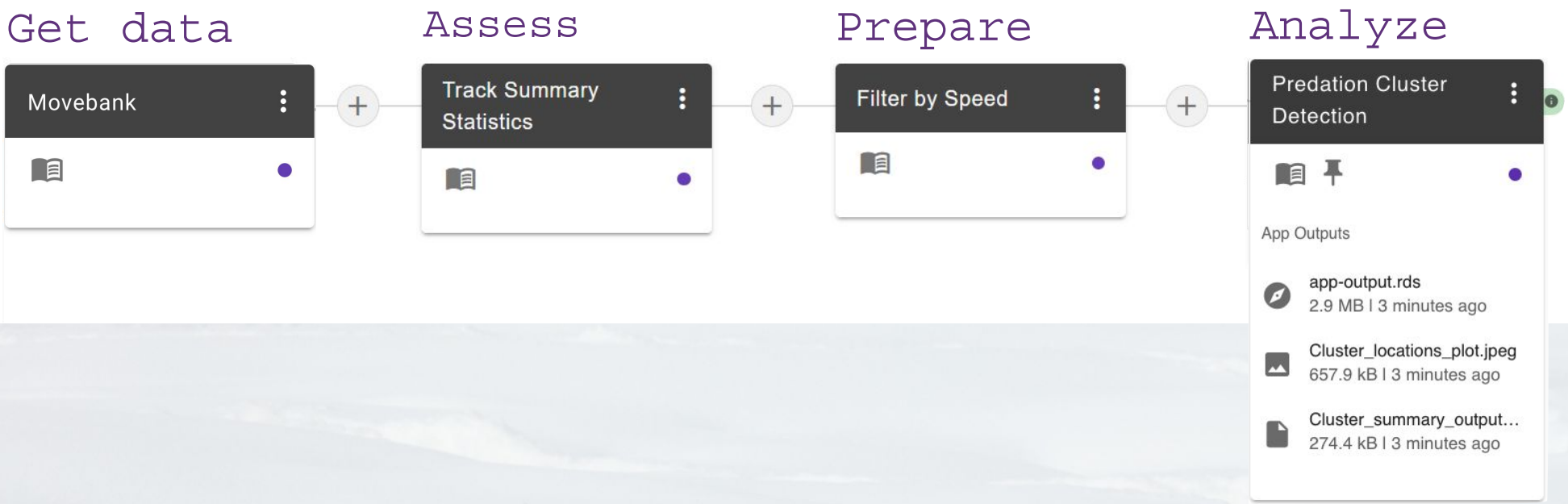
app-output.rds
2.9 MB | 3 minutes ago

Cluster_locations_plot.jpeg
657.9 kB | 3 minutes ago

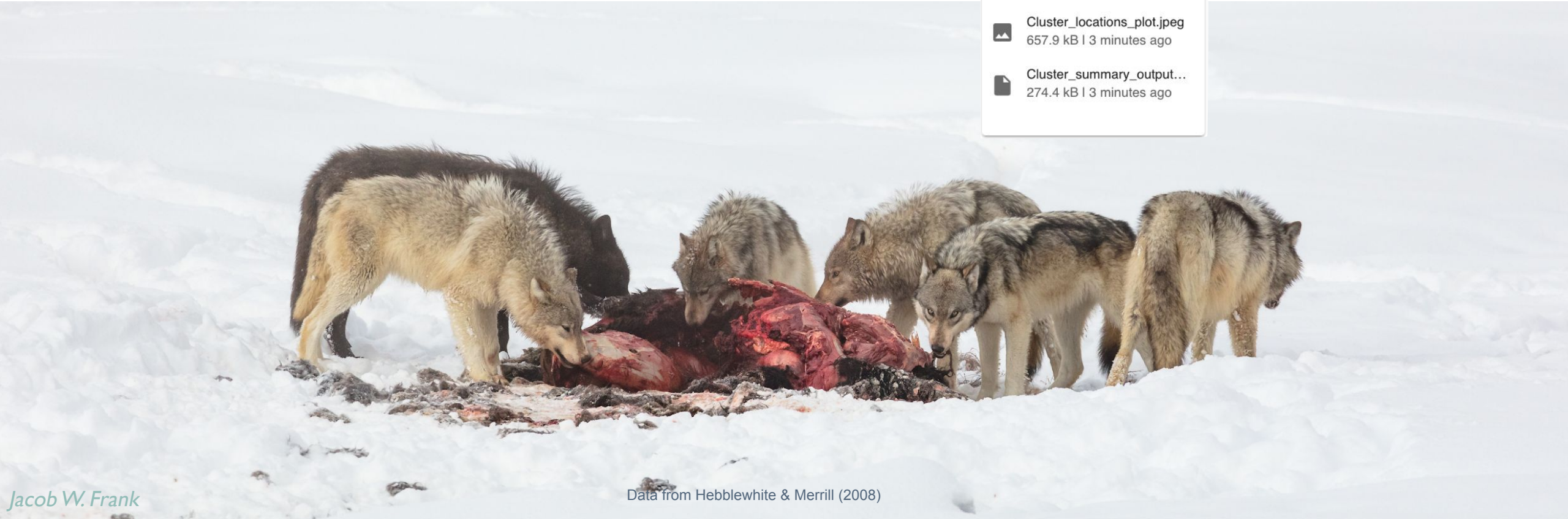
Cluster_summary_output…
274.4 kB | 3 minutes ago

Data from Hebblewhite & Merrill (2008)

Need: Identify carcass sites.



- Schedule Daily
- Convert to PDX
- eMail to user



Jacob W. Frank

Data from Hebblewhite & Merrill (2008)

NEED: Model habitat selection

Get tracking data.

Movebank

Generate unused points.

Background point generator

Annotate.

EARTHDATA

GFCC30TC

Global Land Analysis & Discovery

Model resource selection.

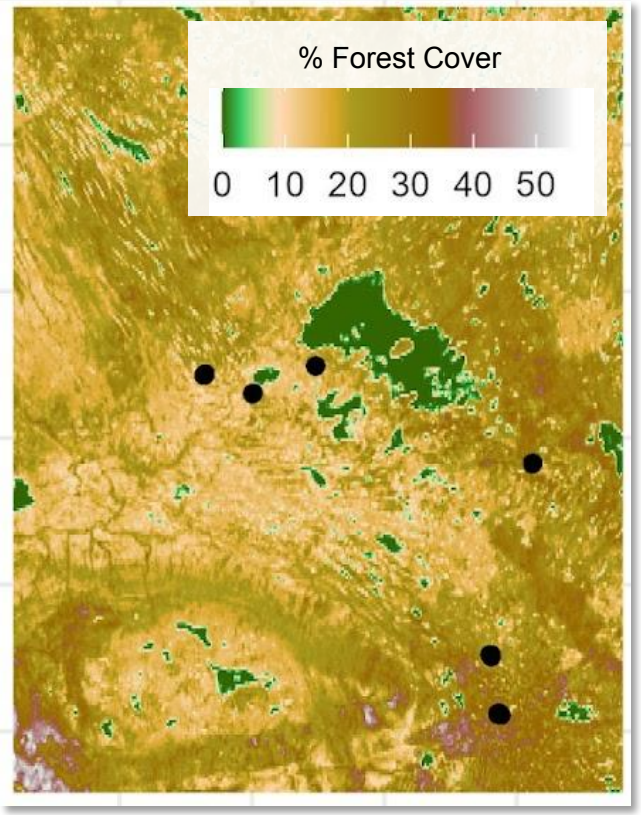
Resource Selection Function

App Outputs

app-output.rds
837.0 kB | a few seconds…

Coeffcient_plot.jpeg
139.1 kB | a few seconds…

RSF_output.csv
374 B | a few seconds ago



Preliminary results indicate that caribou prefer forested, low elevation areas.

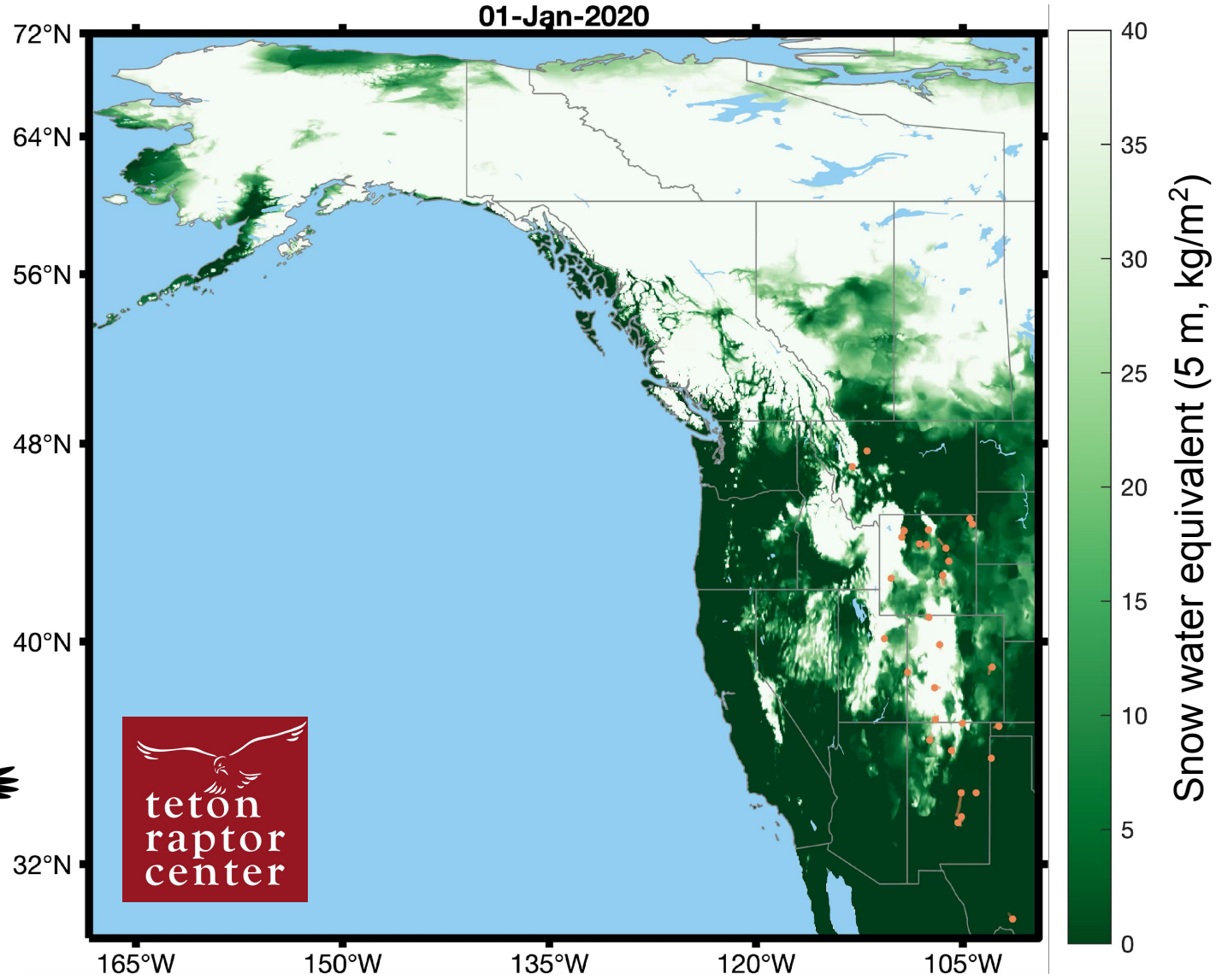
Government of Northwest Territories

Need: Create custom animations.

ECODATA

- Explore movements
- Communicate with stakeholders
- Process large geospatial layers

- Golden eagles (Teton Raptor Center)
- Snow water equivalent (DayMet)
- Oceans and lakes (Natural Earth)

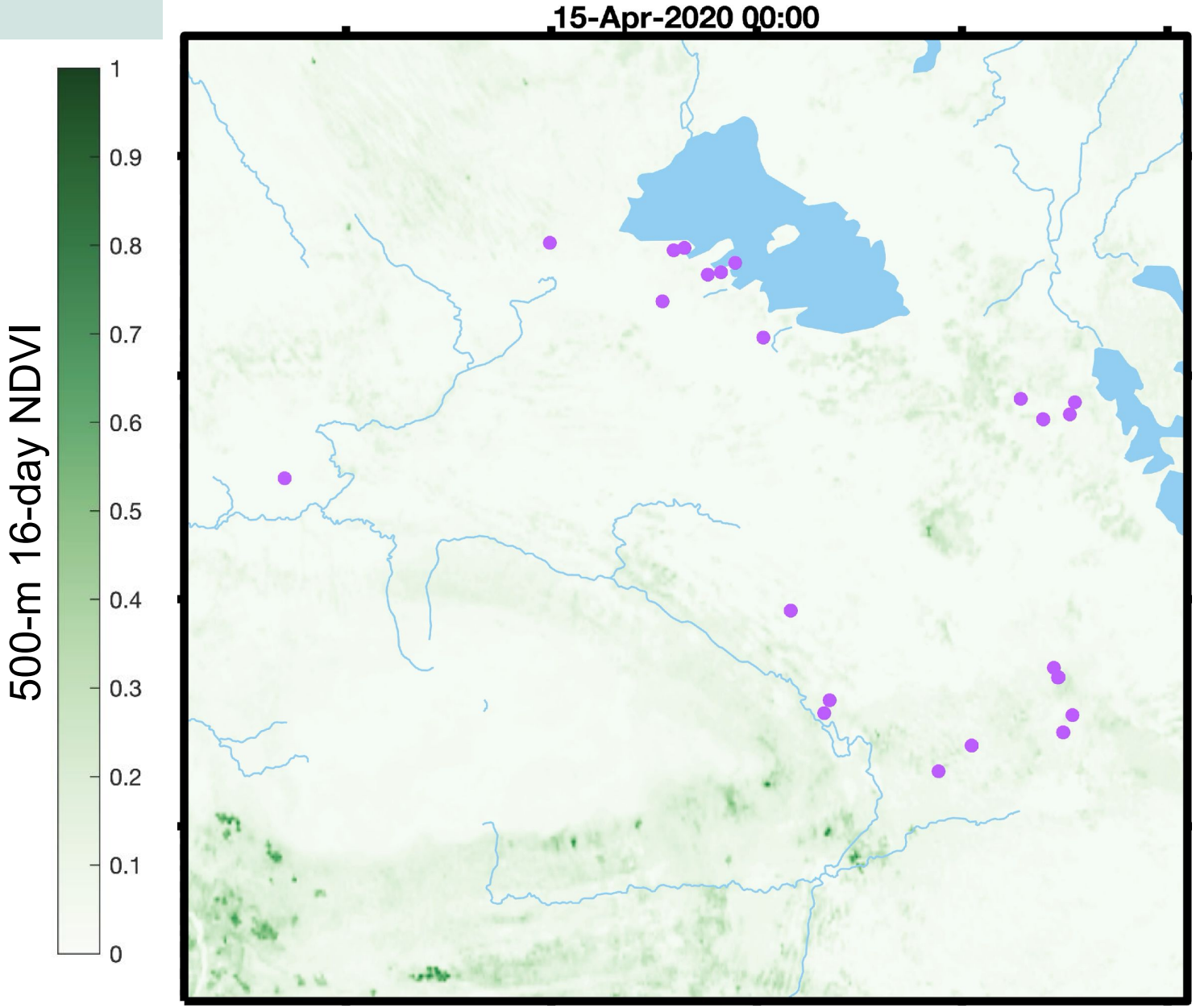


NASA python MathWorks

Animate calving season with ECODATA.

Boreal caribou, spring 2020

- GPS locations (GNWT*)
- Parturition events (MoveApps validated by GNWT biologist A. Kelly)
- Rivers (GNWT)
- Lakes (Natural Earth)
- NDVI (NASA VNP13A1 V1)



*GNWT: Government of the Northwest Territories,

Room2Roam goals

1. Build an archive of wildlife tracking data in the Y2Y.
2. Identify analysis needs in the region.
3. Develop open and shared tools to meet these needs.
4. Expand our coalition across the Y2Y…

...and beyond.

Acknowledgements

Thank you to all participants and partners!

PIs

Martin Wikelski
Roland Kays
Gil Bohrer
Sarah Davidson
Kamran Safi

Development and support

couchbits GmbH
Schäuffelhut Berger GmbH
Robin Alford
Nilanjan Chatterjee
John Fieberg
Andrea Kölzsch
Ashley Lohr
Justine Missik
Anne Scharf