

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

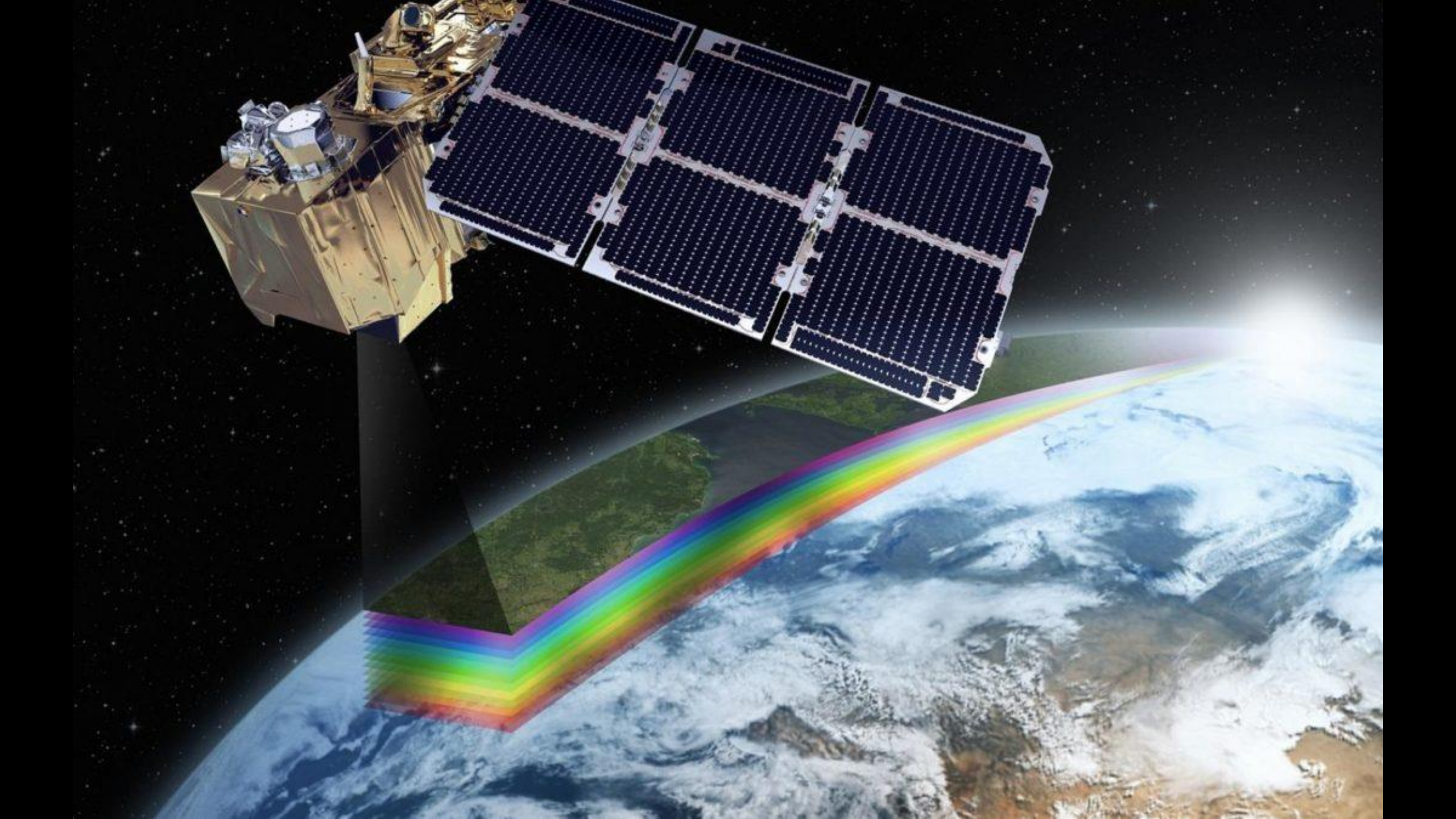


Roland Kays
North Carolina Museum of Natural Sciences
NC State University

Blue Marble
photograph
Apollo 17
1972



Profound
impact on
humanity's
perception of Earth
and the environment

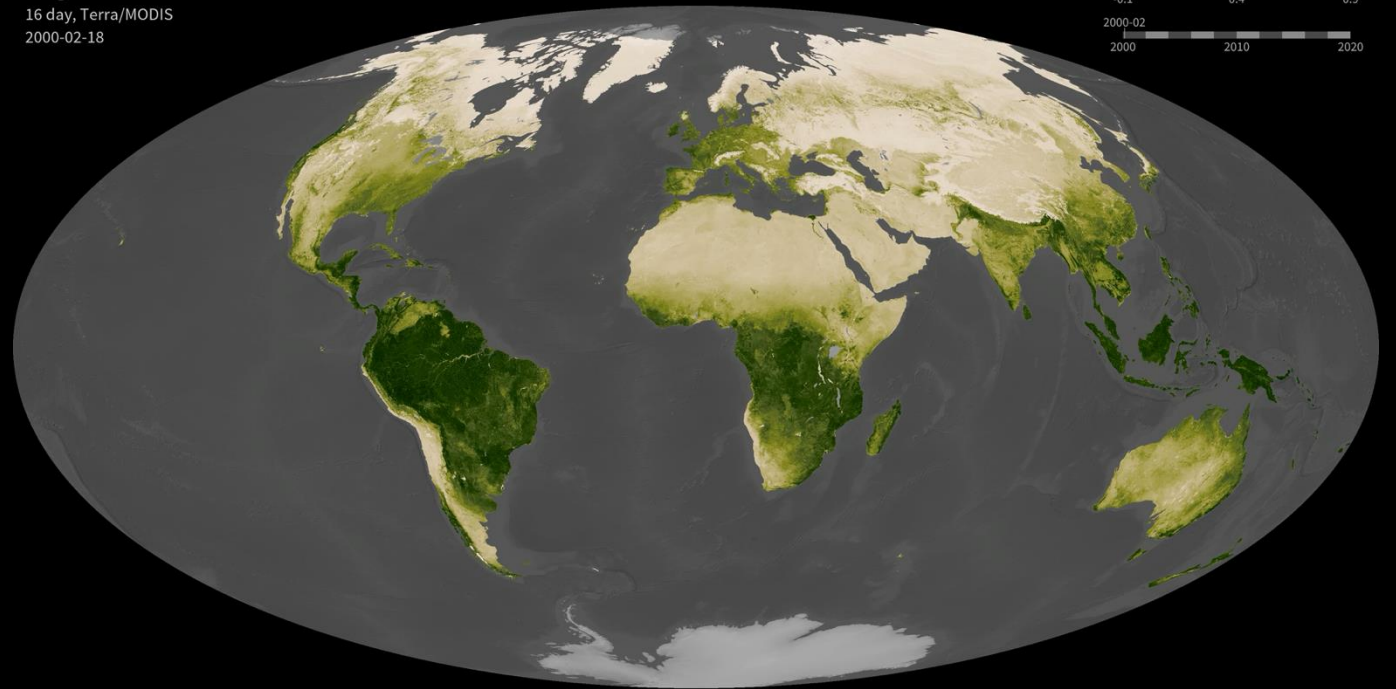


Remote Sensing



Snow cover from Modis

Vegetation Index
16 day, Terra/MODIS
2000-02-18



MOD13C1 CMG_0_05_Deg_16_days_NDVI

NDVI from Modis

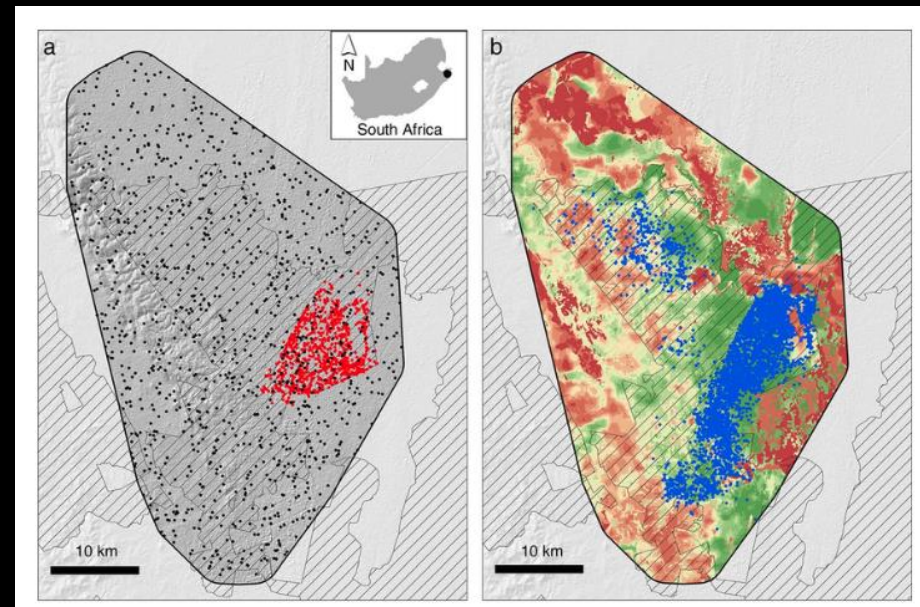
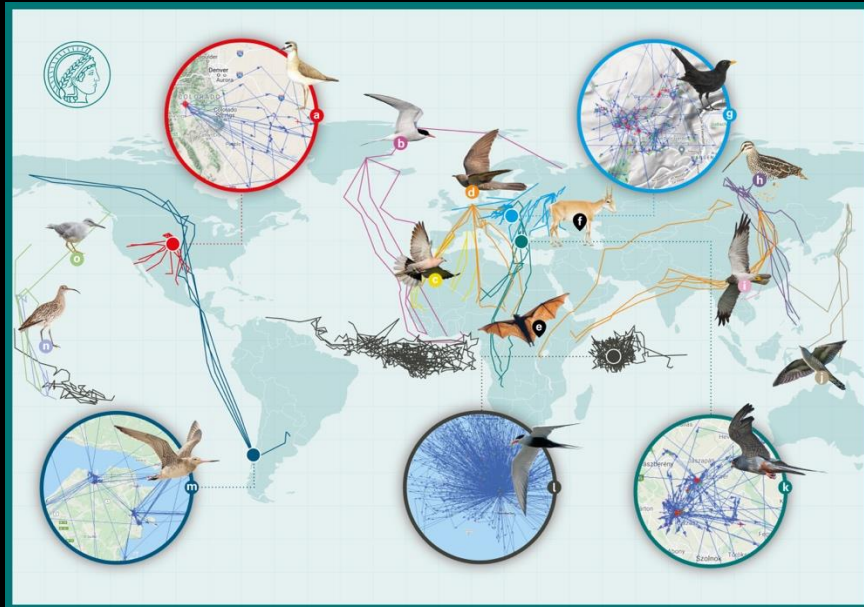
Satellite Animal Tracking



Animal Tracking + Remote Sensing

Where? + Why?

Maps + Resource Selection Functions

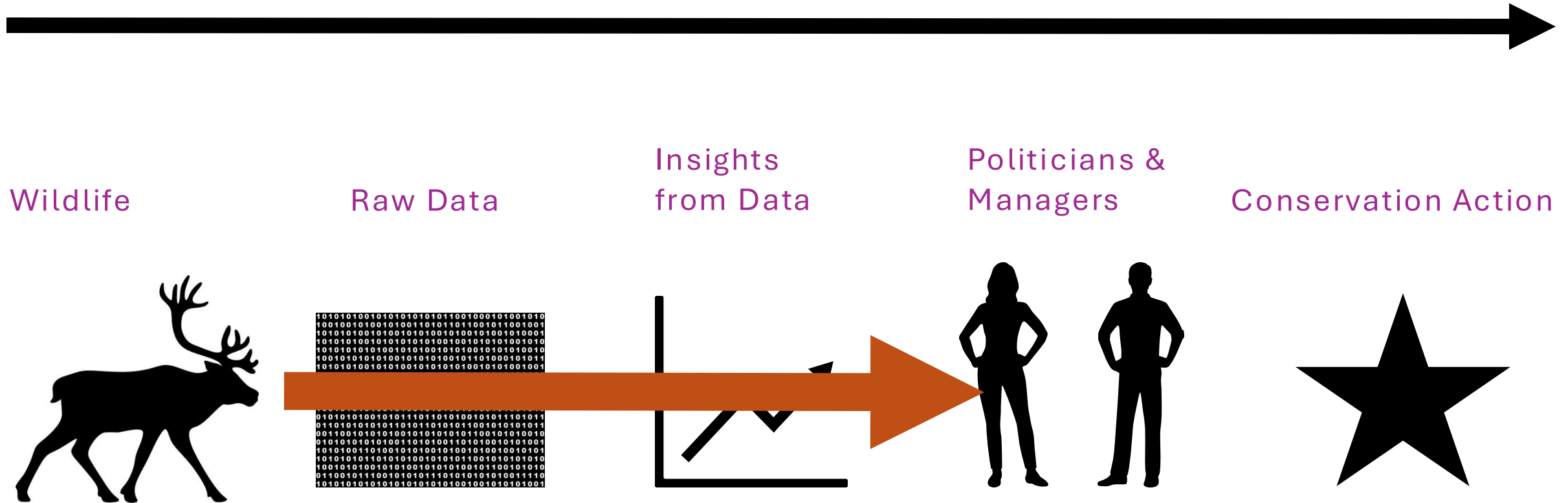


It can get complicated



```
4 #'
5 #' Load amt libraries
6 #+warning=FALSE, message=FALSE
7 library(ezknitr)
8 library(knitr)
9 library(lubridate)
10 library(raster)
11 library(move)
12 library(ggplot2)
13 library(amt)
14 library(broom)
15 library(nlme)
16 library(lme4)
17 library(purrr)
18 library(dplyr)
19 library(forcats)
20 library(tidyverse)
21 options(width=165)
22 opts_chunk$set(fig.width=12,fig.height=4.5, error=TRUE,cache = F)
23
24 #' Read in data.
25 #' Read in annotated available data for RSF modeling
26 #avail_rsf<-read.csv("data/fisherAvailRSF-envdata-results-available.csv")
27 rsfdat<-read.csv("data/FisherRSF2018-EnvDATA-results.csv")
28
29 #' Simplify some variable names
30 names(rsfdat)[c(1,8:10)]<-c("id","LandClass", "Elevation", "PopDens")
31 rsfdat$case_<-as.numeric(rsfdat$case_)
32
33 #' Create landcover classes (as suggested by Scott Lapointe :)
34 rsfdat$LandClass<-as.character(rsfdat$LandClass)
35 rsfdat<-rsfdat %>% mutate(LandC = for_collapsa/LandClass
```


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



Mike Sutor
Yukon Fish and Wildlife

Problem 1
Monitoring Caribou Populations



Problem 2
Communicating results to
stakeholders

Room to Roam: Yellowstone to Yukon Wildlife Movements

Y2Y partners



Development partners



https://ceg.osu.edu/Y2Y_Room2Roam



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.



HELLO
MY NAME IS
Ashley

HELLO
MY NAME IS
John

HELLO
MY NAME IS
Sarah

HELLO
MY NAME IS
Nilanjan

HELLO
MY NAME IS
Gil

Movebank animal tracking database

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

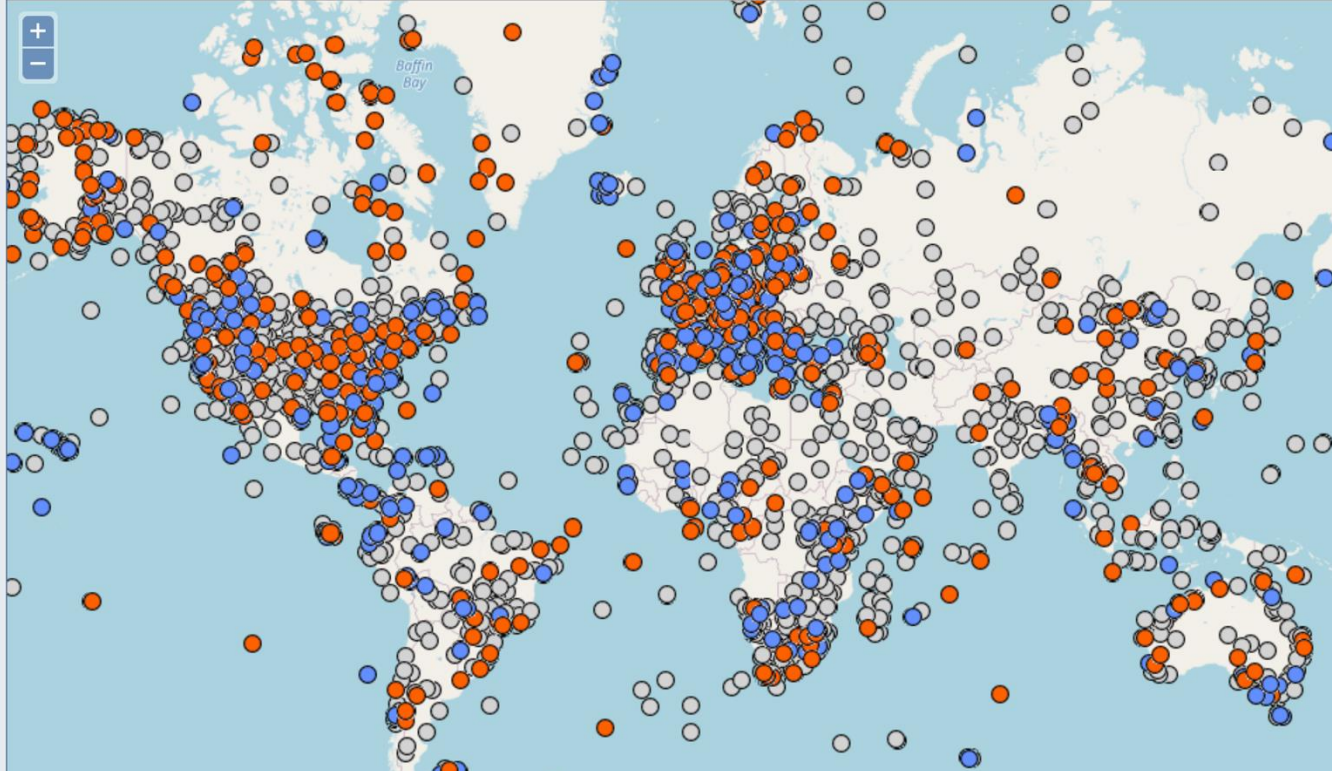
Search

Search result

Sort by Animal Identifier

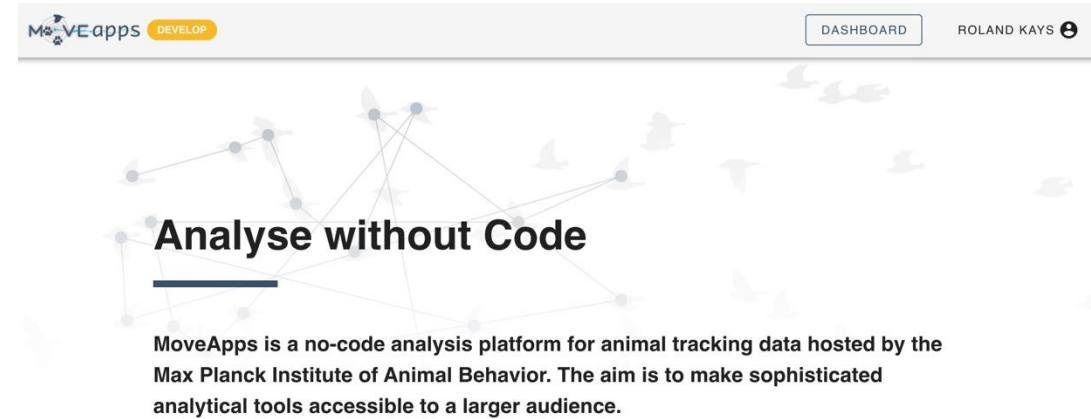
- Bornean Orangutan, 2012 GPS Split by Month, Tuana
- Feral Pig Sus scrofa Kimberley Region, Western Austr
- ☒ Chelonia mydas bijagos_females_2018
- Conservation
- migratory bird migration strategy
- ☒ White Stork Denmark
- "AEQUILIBRIUM+ Project": Diet of the mediterranean
- "Oceanodroma castro" "Neves" "Azores"
- ☒ "Proyecto Eremita" Geronticus eremita Reintroduction
- "Proyecto Pennatus" Booted Eagle (Hieraaetus penna
- "Realizando el valor socioecológico de una especie err
- 'ATLAS [harod] [Pigeon] [2021]'
- (Bearded Vulture (Gypaetus barbatus), Pyrenees and
- (Circus pygargus) tracking
- (EBD) Anodorhynchus leari (Lear's Macaw)

Select Zoom Options Link Google Maps Open Layers



The map displays a global distribution of animal tracking data points. Orange dots are concentrated in Southeast Asia, particularly in the Indonesian archipelago. Blue dots are scattered across Europe, North Africa, and parts of Asia. Grey dots are more widely distributed across the Americas, Europe, and Africa. The map includes a search bar, zoom controls, and a legend for Google Maps and Open Layers.

Moveapps analysis platform



- 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

Case study: Ungulate calving behavior



Chisana herd, Kathi Egli, Yukon
Government

NEED: Identify calving events

Solution 1

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

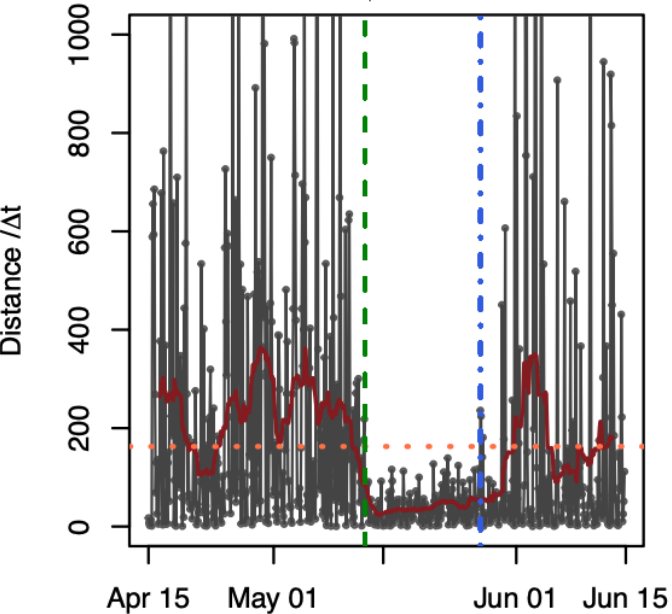
App Outputs

app-output.rds
1.8 MB | 5 minutes ago

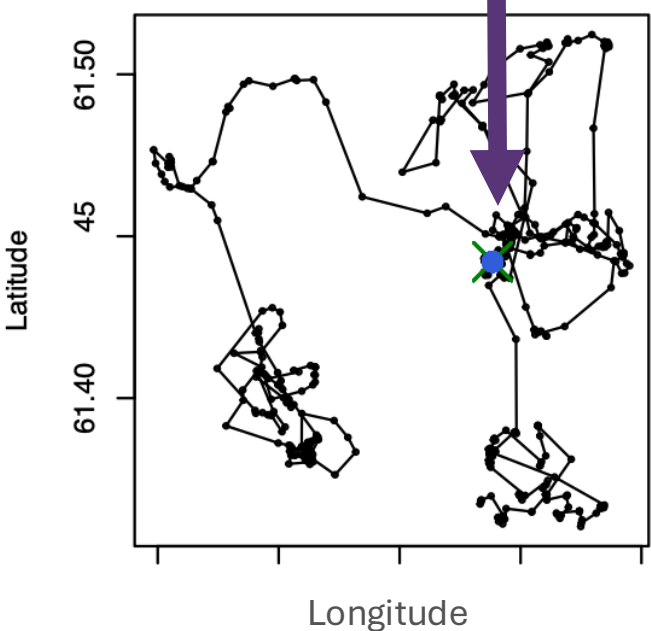
Parturition_output.csv
34.7 kB | 5 minutes ago

Parturition_vel.pdf
3.1 MB | 5 minutes ago

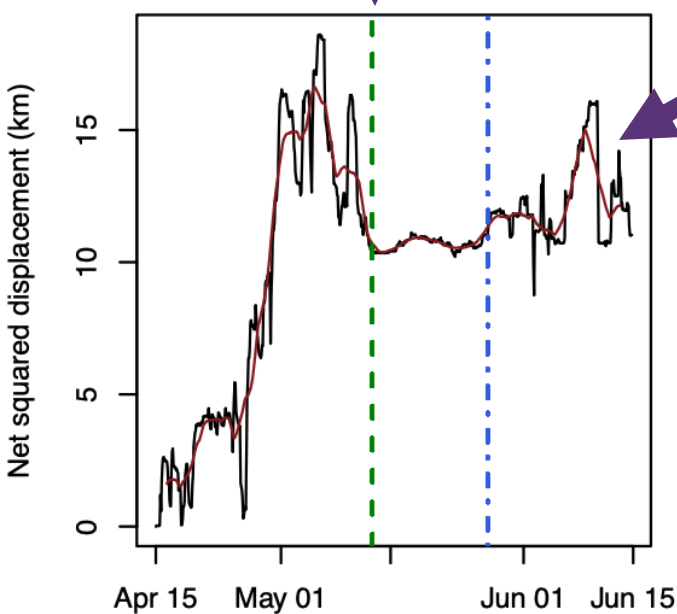
Movement speed



Location



Displacement



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

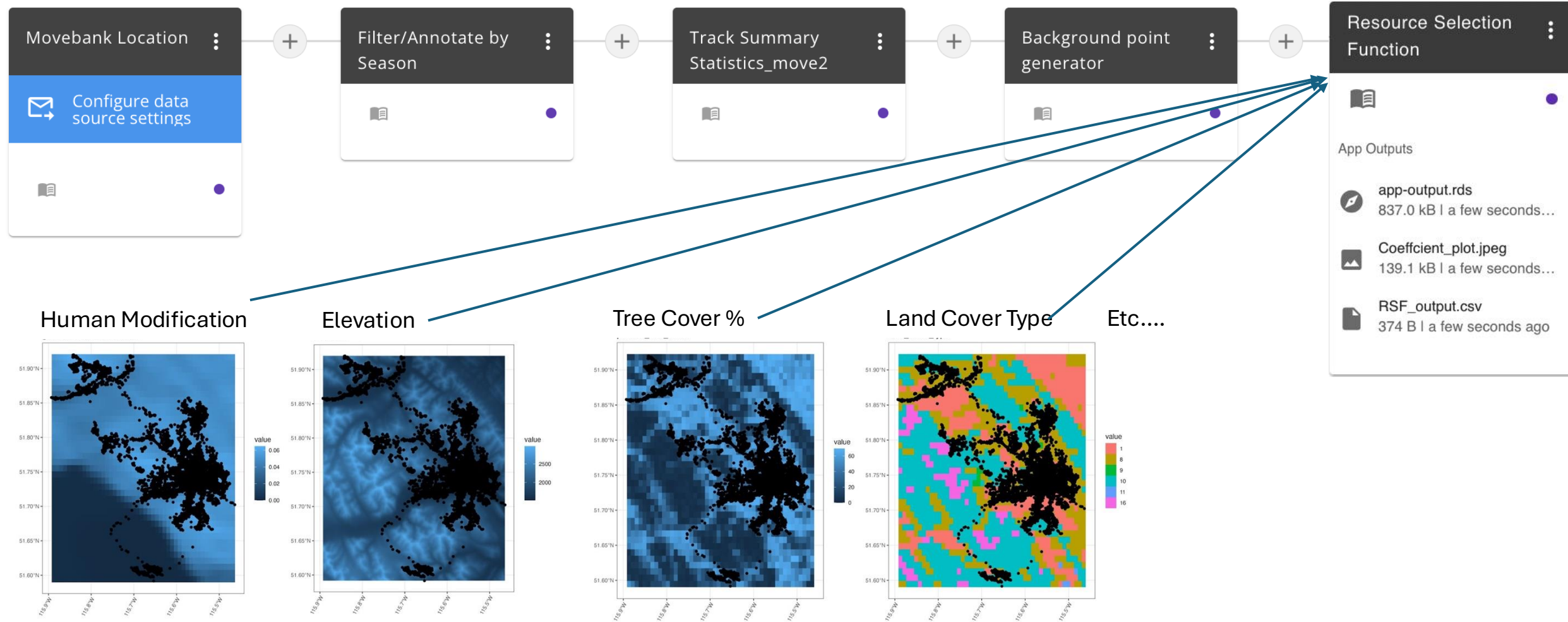


Impact 1

Mike Suitor: We are using the parturition tool this weekend to identify priority animals to be viewed while flying parturition surveys on the Yukon North Slope. This work costs tens of thousands of dollars, so we don't want to be wasteful.



Resource Selection App



Listening to stakeholders - They want animations

Kelsey Russell & Mike Sutor, Yukon Fish and Wildlife

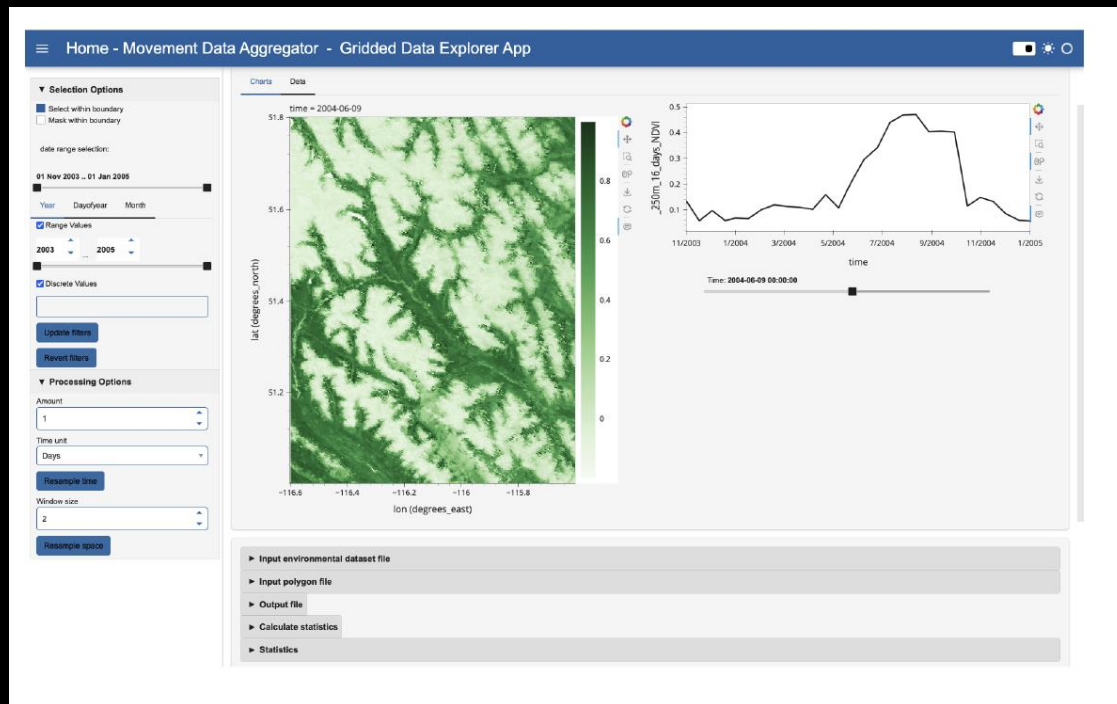


Gil Bohrer, OSU, PI

Solution 2

ECODATA – software to animate RS + Tracking

Software



Workflow

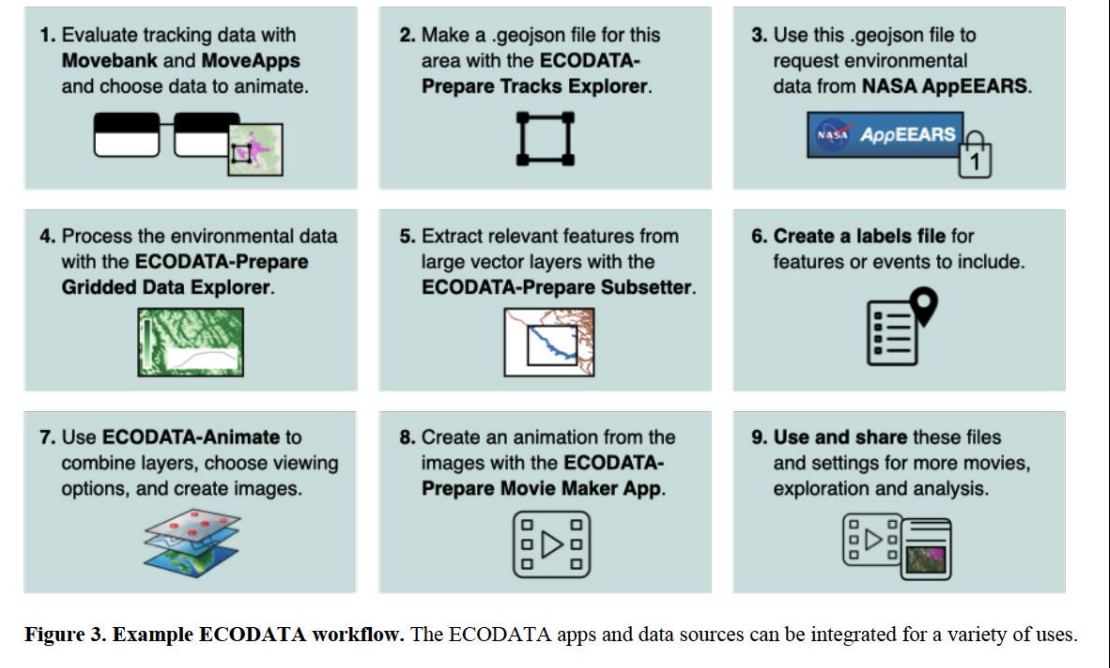
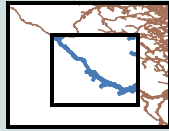
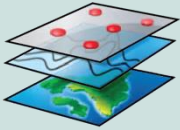


Figure 3. Example ECODATA workflow. The ECODATA apps and data sources can be integrated for a variety of uses.

Need: Create custom animations.

ECODATA



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

Mike Suitor

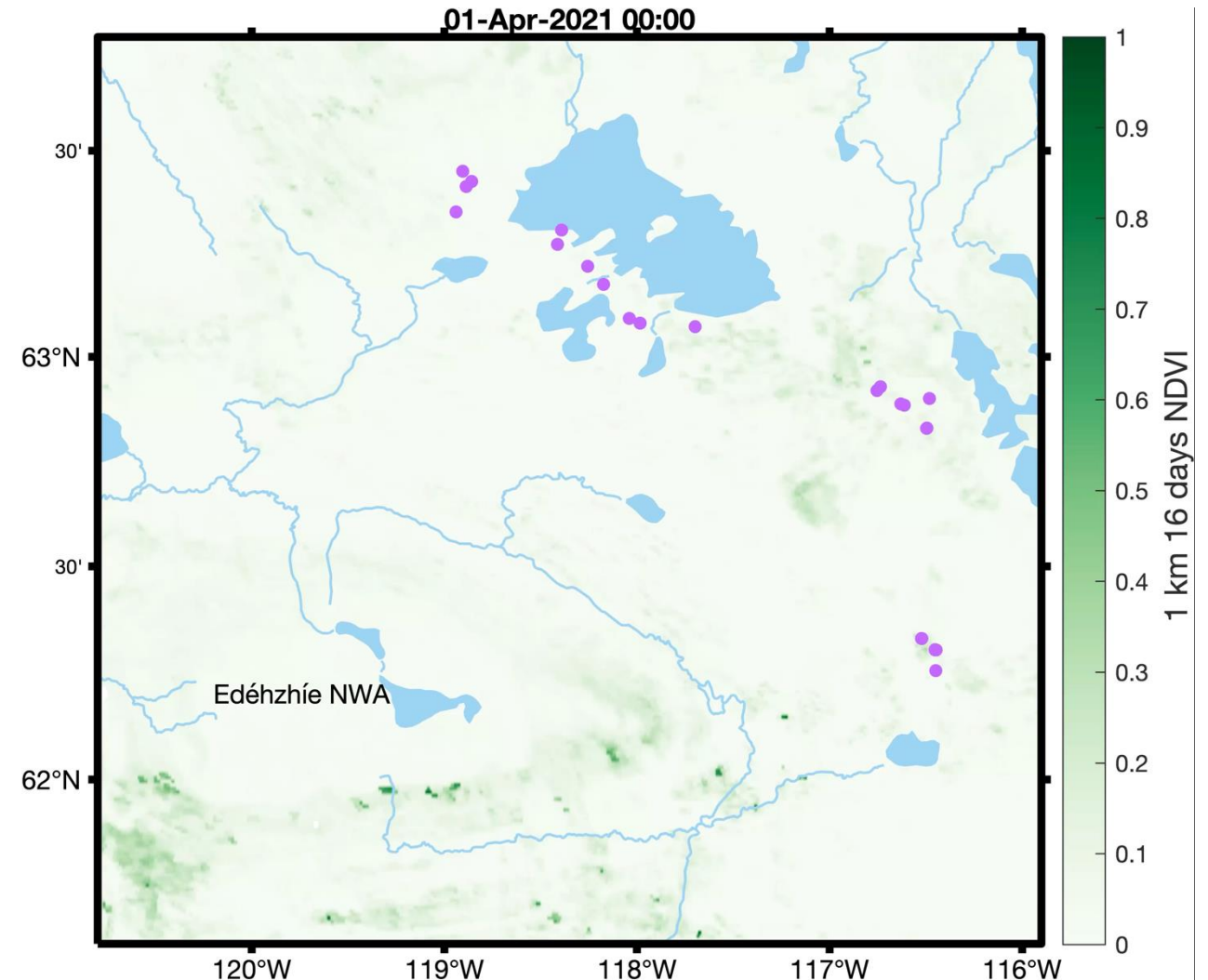
The inclusion of the animations is a game changer

The number of times I've heard "this is how science should be presented" or "this is really good information that I can understand" this year can't be counted on my fingers!

Impact 2

Missik et al in review

Government of the Northwest Territories, Canada



Bonus Impact

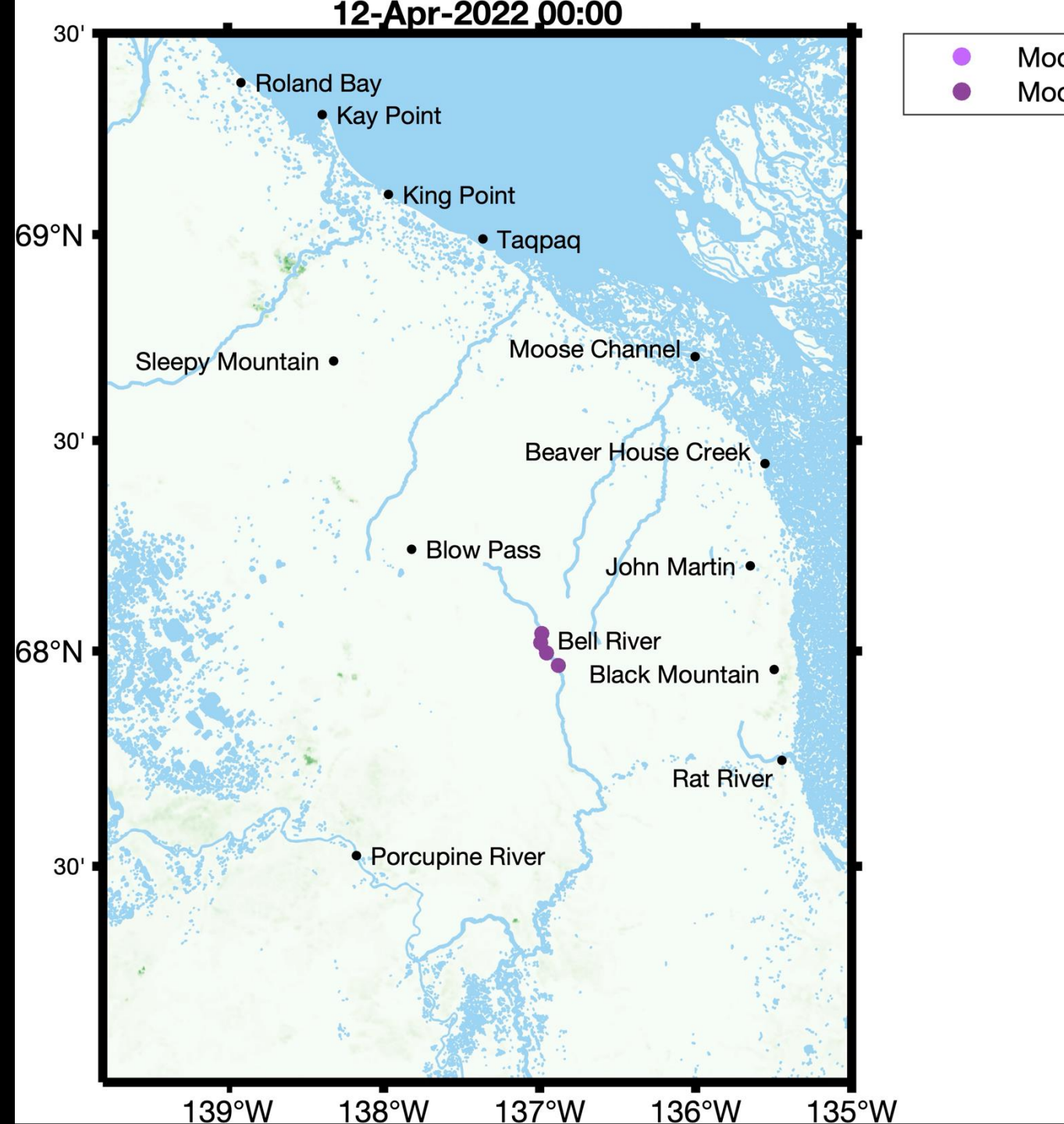
Mike Suitor

I've had a number of students really stuck on the green wave theory which totally doesn't work up here. **Instead of arguing until my face turned red, I just have to show them the animations with green up.**

Its very clear what's going on and that arctic species pre-empt green up with their migration to be in the right spot when it occurs relative to lactation demands.

Watching the Ecodata animations its clear it has to do with senescence of willows in the Mackenzie Delta.

As a result we can get our graduate students to form appropriate hypotheses and we will be building their models using satellite data in the coming year, guided by these initial findings



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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

