

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

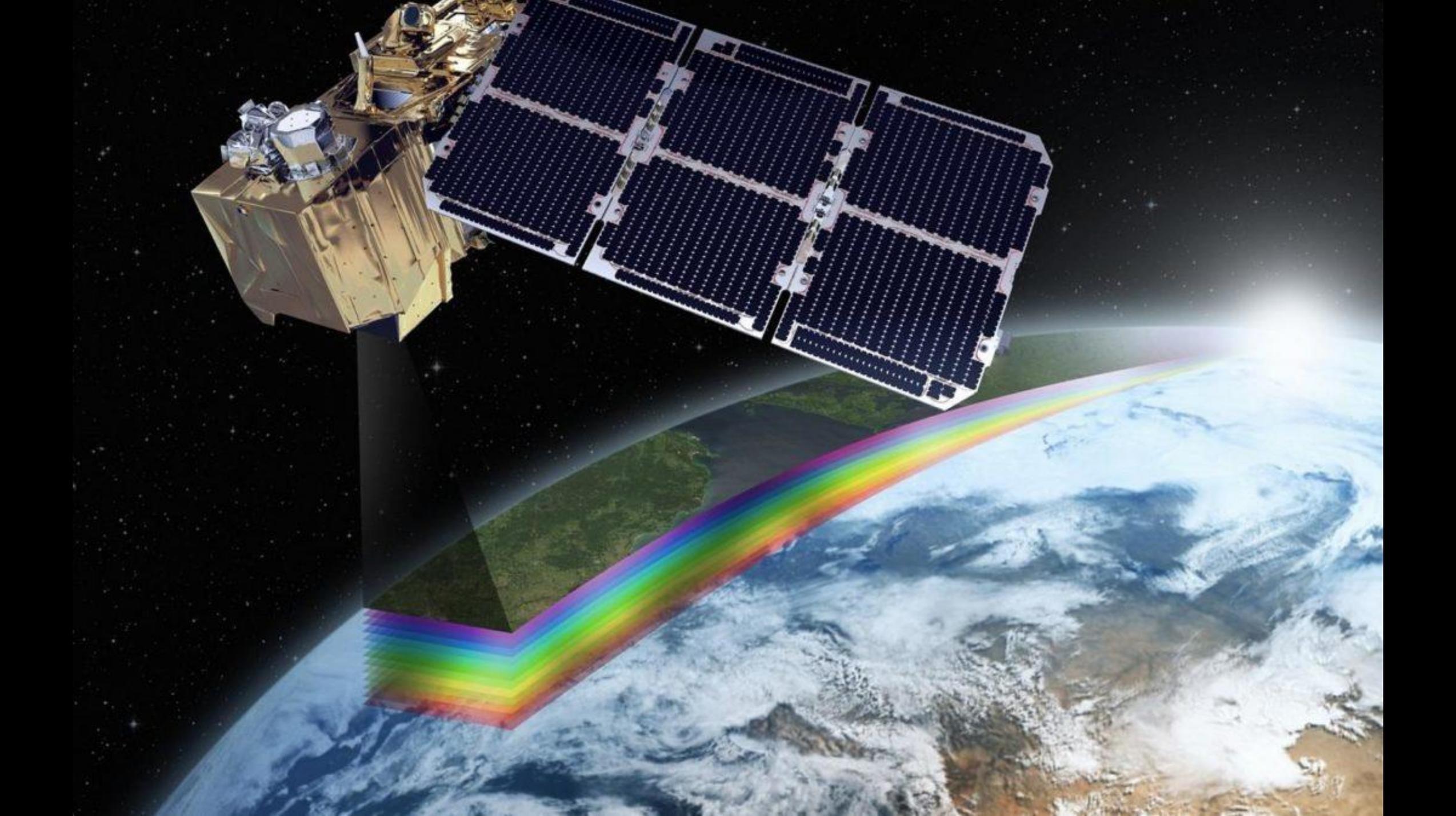


Roland Kays
North Carolina Museum of Natural Sciences
NC State University

Blue Marble
photograph
Apollo 17
1972



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

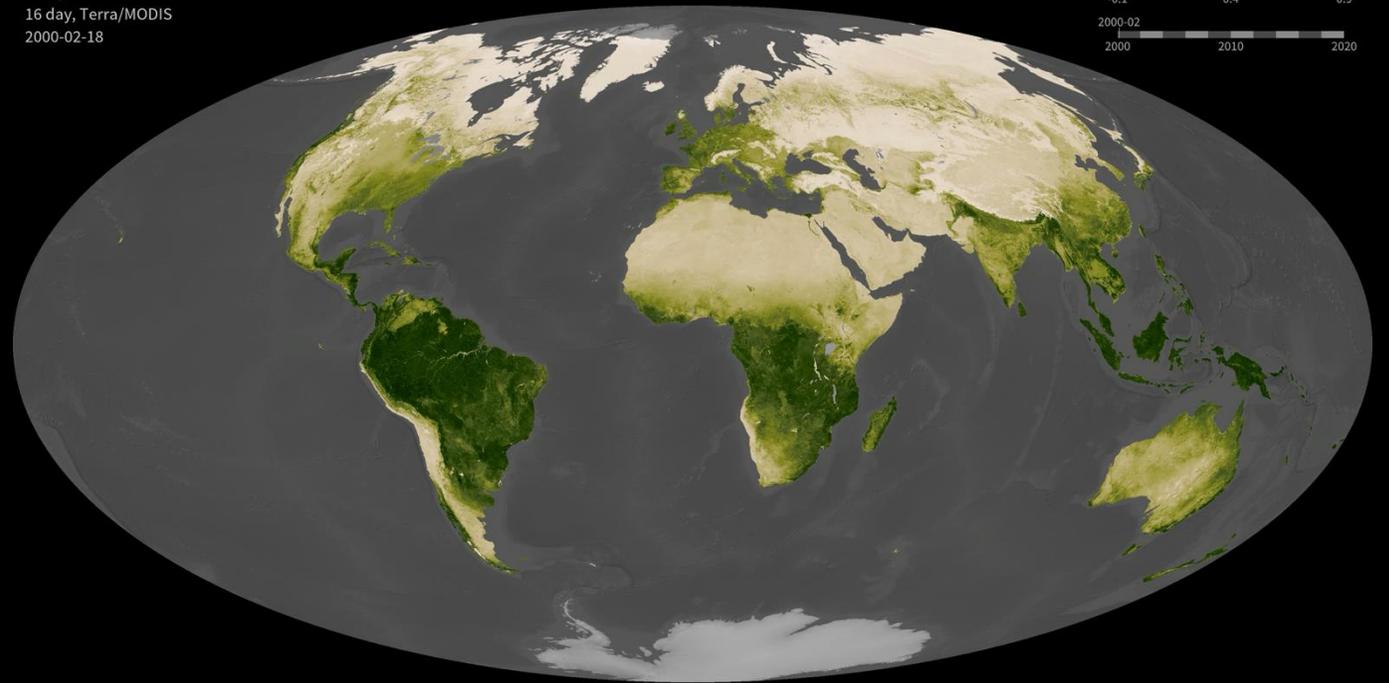


Remote Sensing



Snow cover from Modis

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



MOD13C1 CMG_0_05_Deg_16_days_NDVI

NDVI from Modis

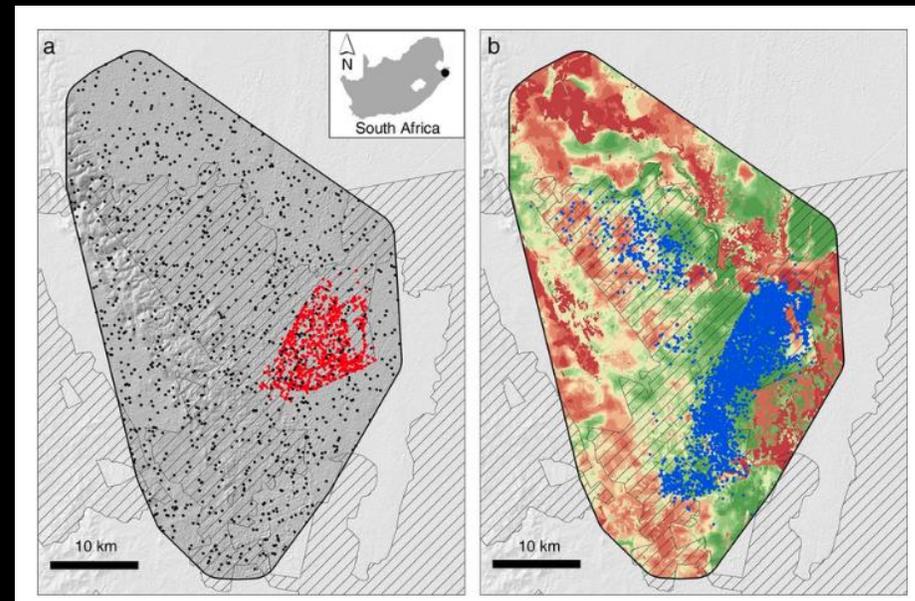
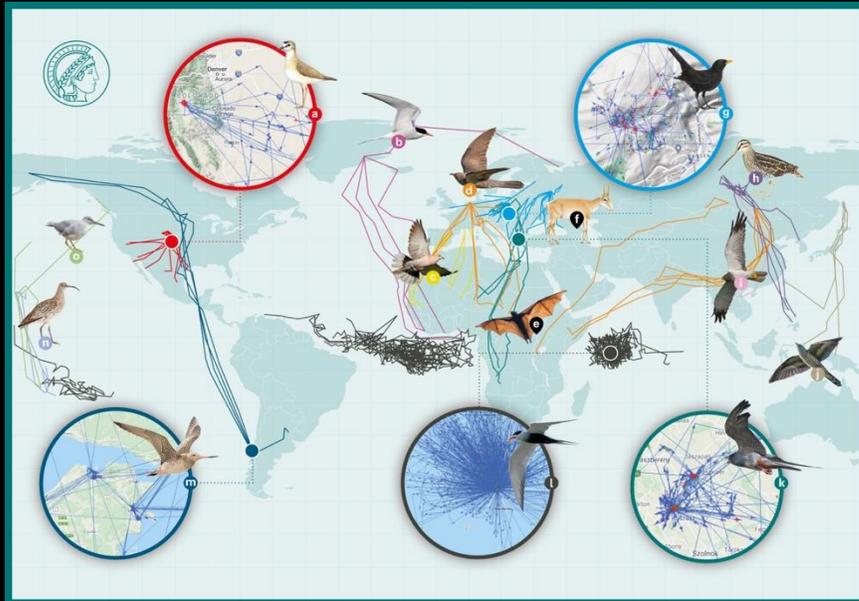
Satellite Animal Tracking



Animal Tracking + Remote Sensing

Where? + Why?

Maps + Resource Selection Functions

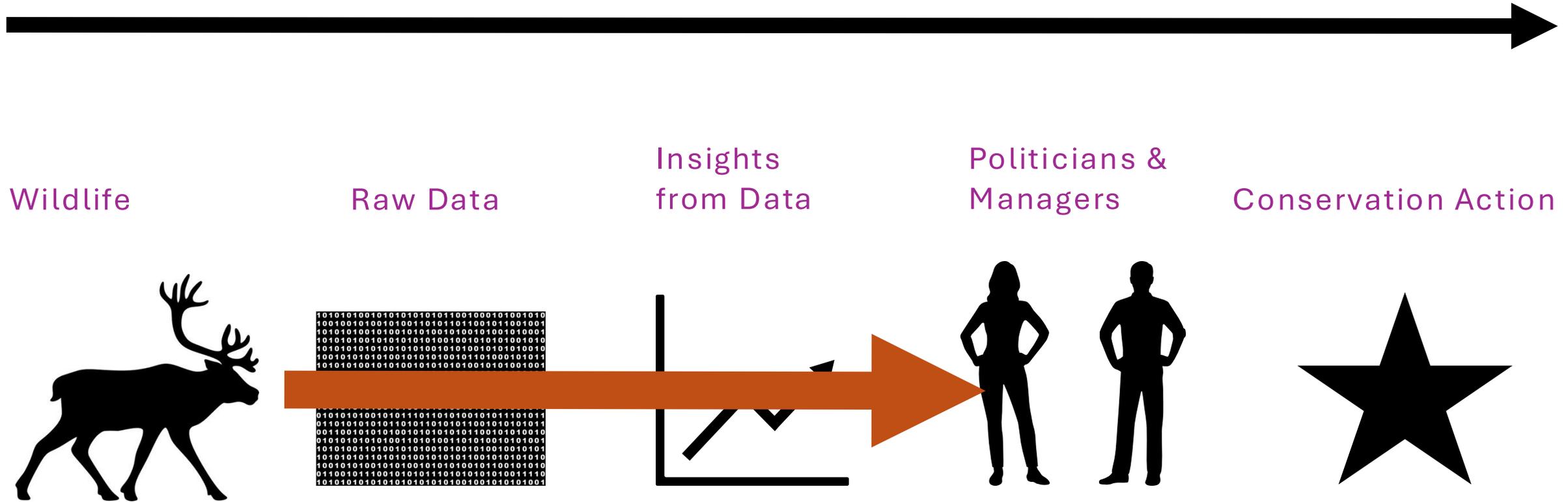


It can get complicated



```
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(landf = fct_collaps(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



MAX-PLANCK-GESellschaft



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

The screenshot displays the Movebank website interface. At the top left is the Movebank logo with the tagline "for animal tracking data". To the right is a navigation menu with links for "Data", "Help", "Tools", "Archiving", and "News". Below the navigation menu is a search bar labeled "Search documentation" and links for "About" and "Login/Register".

The main content area is divided into two sections. On the left is a search sidebar with a "Search" button and an "Advanced Search" tab. Below the search bar is a dropdown menu for "All Sensor Types" and a checkbox for "Only studies where I can see data". Below this is a "Search result" section with a "Sort by Animal Identifier" dropdown and a list of study entries, each with a search icon.

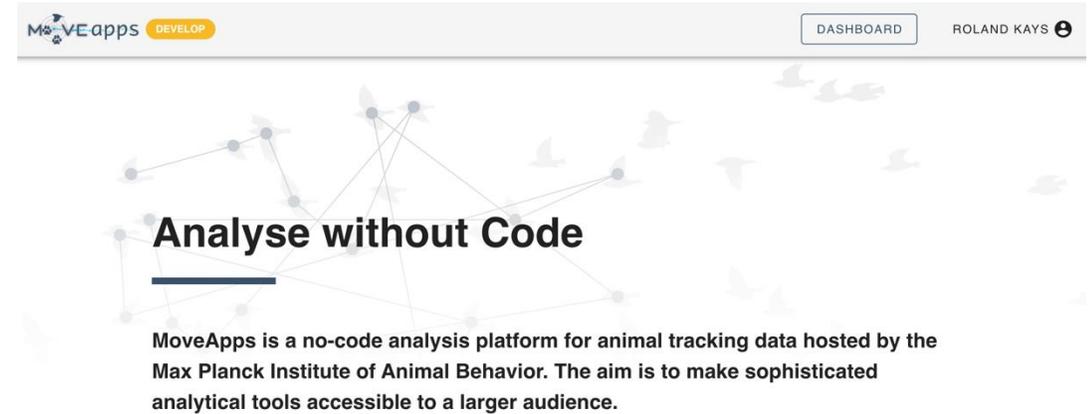
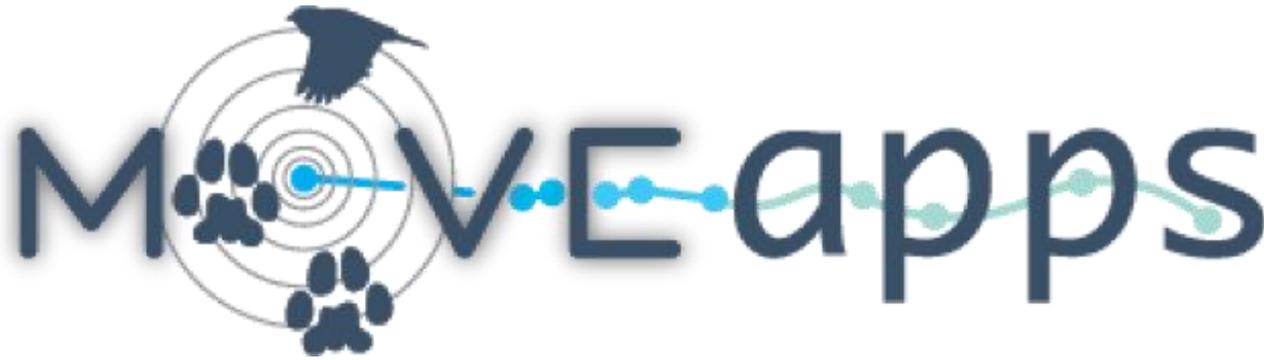
On the right is a map interface with a search bar and a "Search" button. Below the search bar is a toolbar with icons for "Select", "Zoom", "Options", "Link", "Google Maps", and "Open Layers". The map itself shows a world map with numerous tracking data points represented by colored circles (orange, blue, and grey) scattered across the globe.

Search result

Sort by Animal Identifier

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

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



Assess sampling.

Filter by Season



Run calving analysis.

Track Summary Statistics



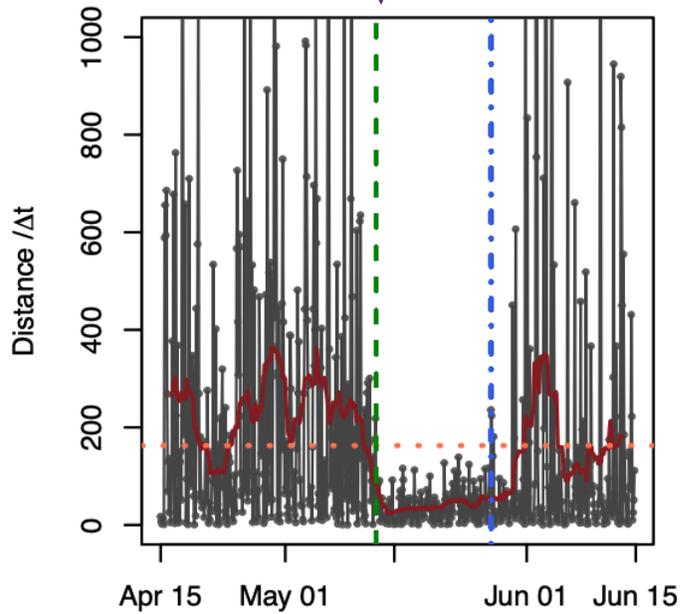
Run calving analysis.

Parturition Cluster Detection

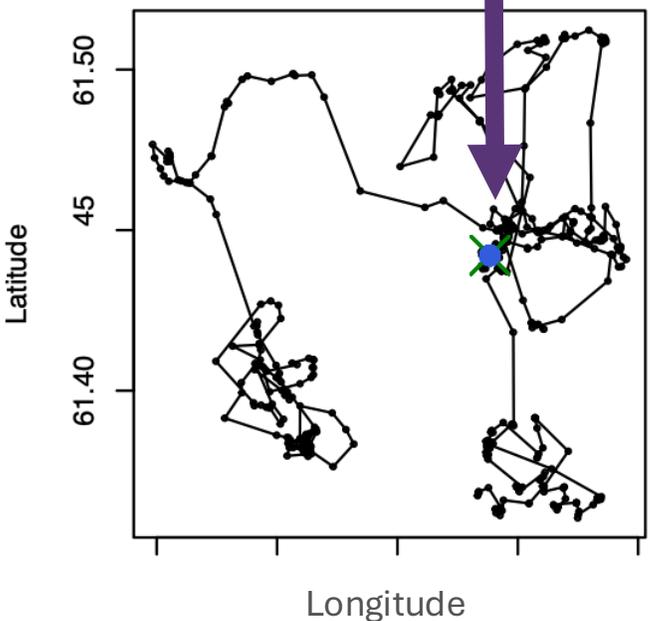
App Outputs

- 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

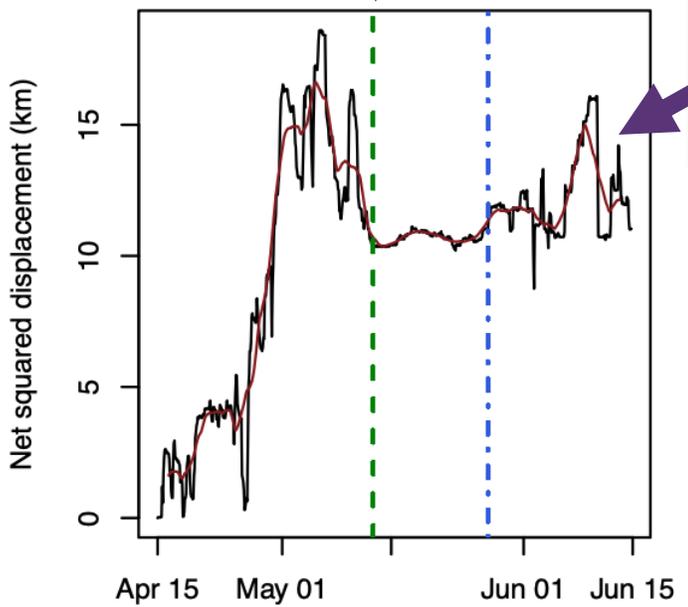
Movement speed



Location



Displacement



Government of Northwest Territories

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

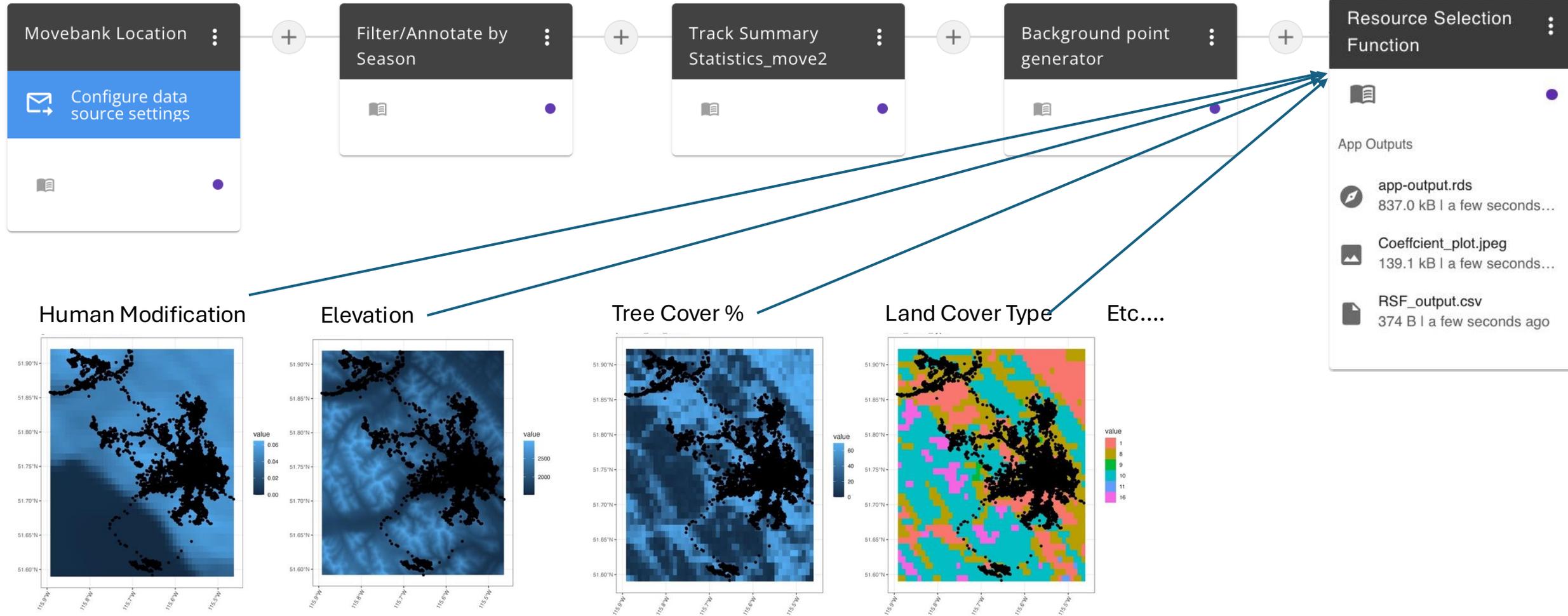


Impact 1

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

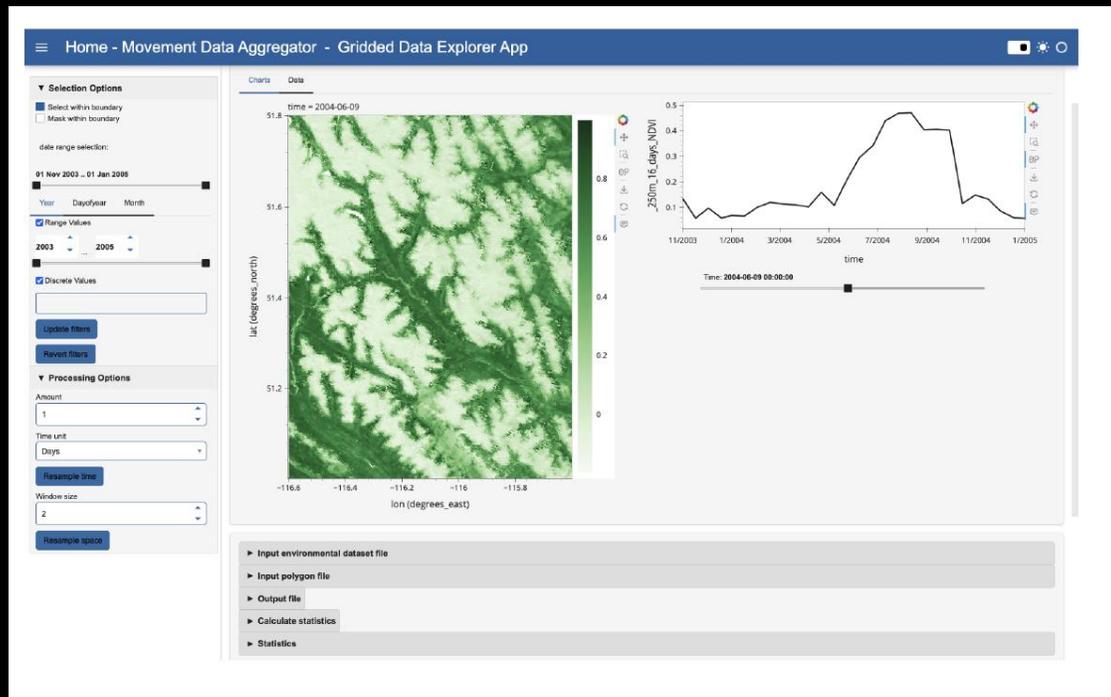


Gil Bohrer, OSU, PI

Solution 2

ECODATA – software to animate RS + Tracking

Software



Workflow

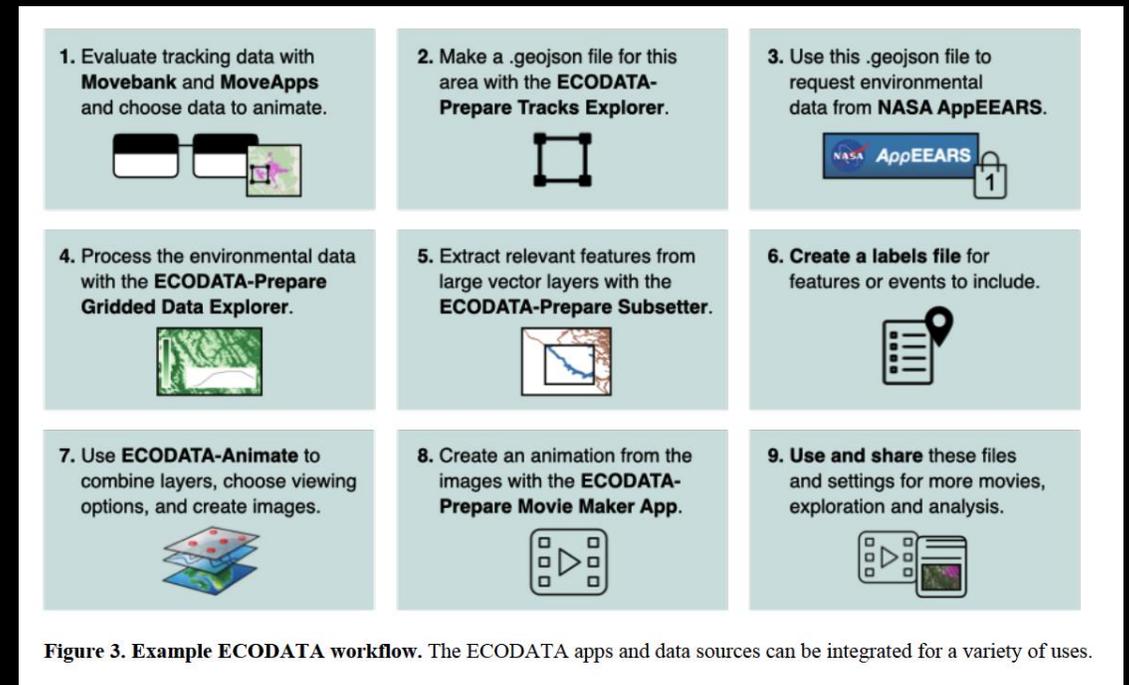
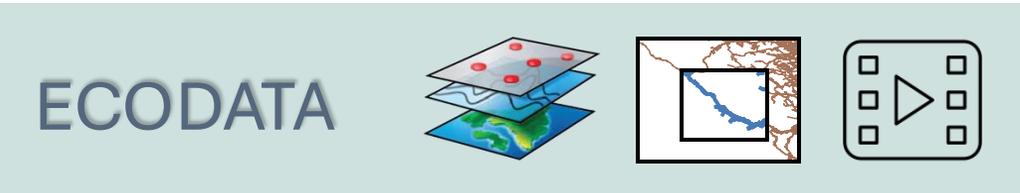


Figure 3. Example Ecodata workflow. The Ecodata apps and data sources can be integrated for a variety of uses.

Need: Create custom animations.

Missik et al in review
Government of the Northwest Territories, Canada



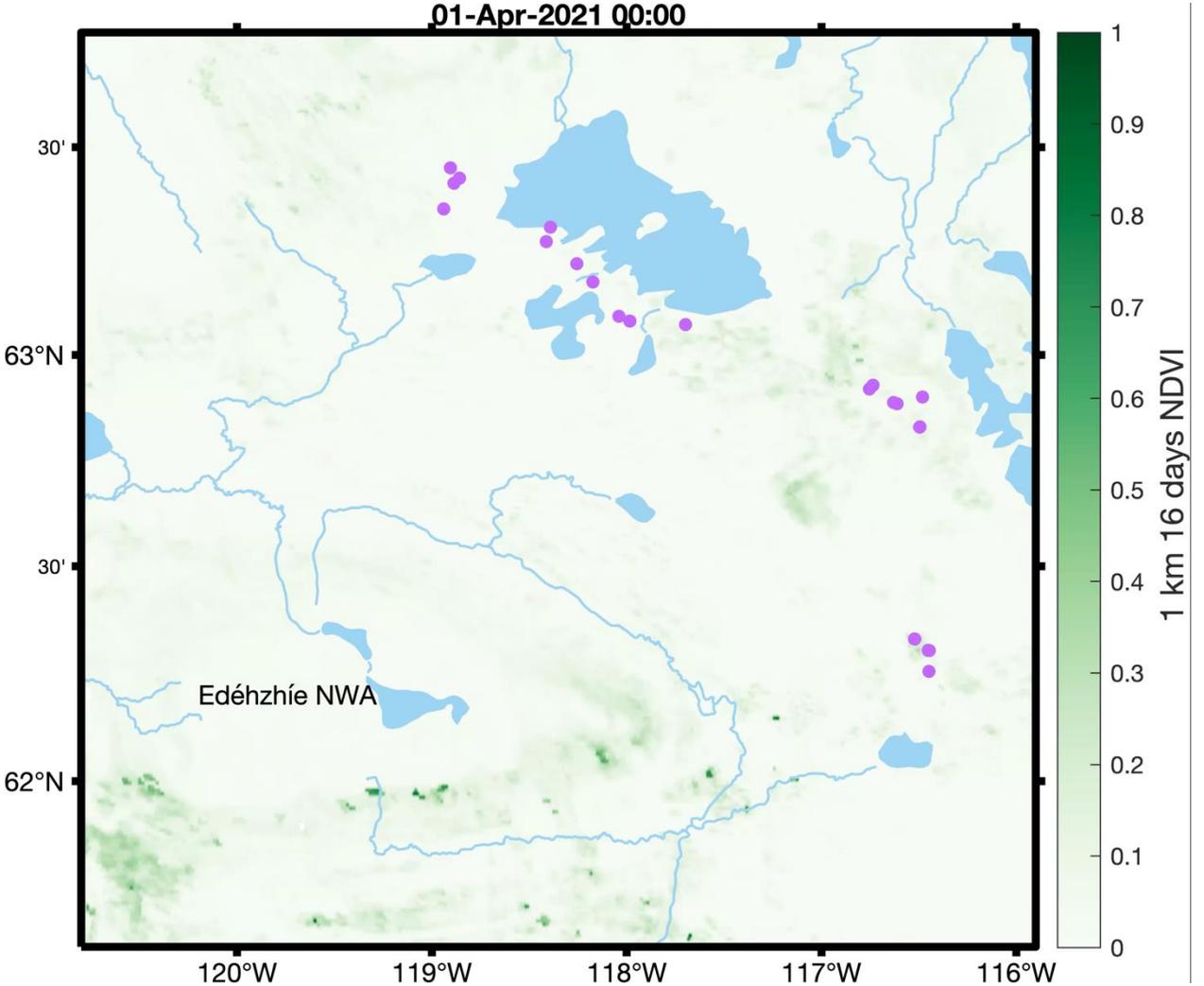
- Explore movements
- Communicate with stakeholders
- Process large geospatial layers

Mike Sutor

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



Bonus Impact

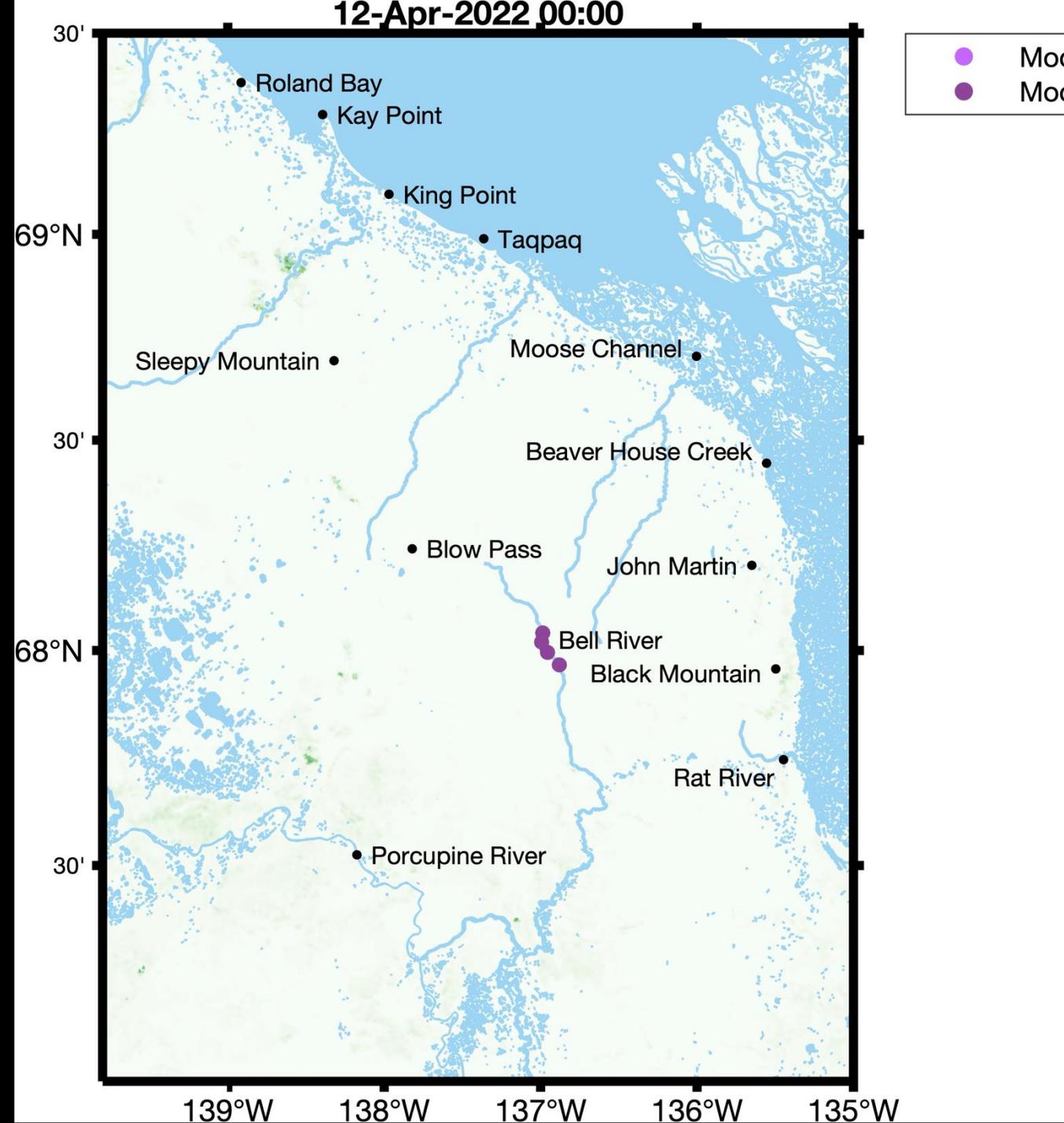
Mike Sutor

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

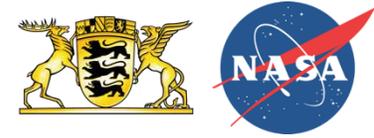
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