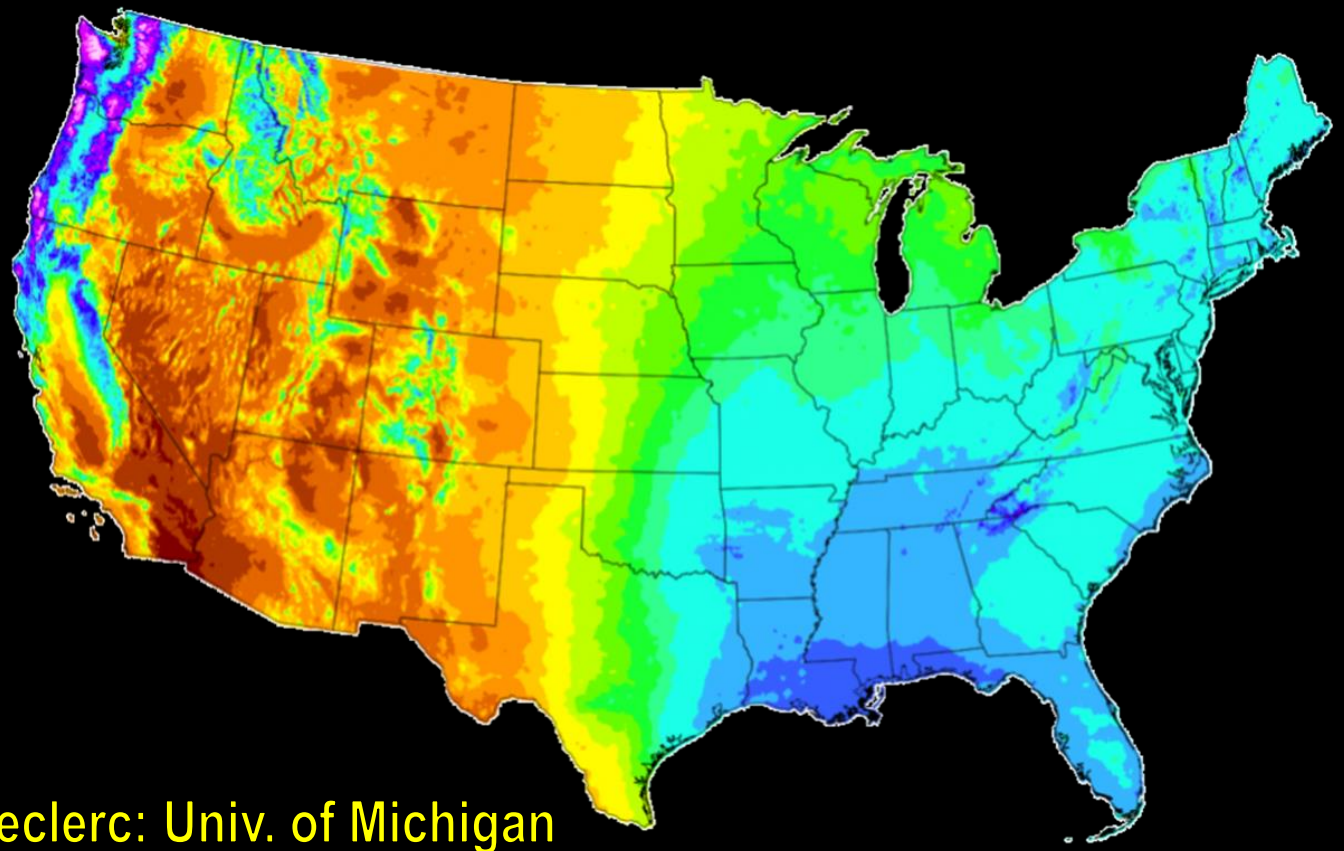
The Landscape of Fitness: fusing animal GPS measures with GEDI and ECOSTRESS to map species responses to vegetation structure and water stress

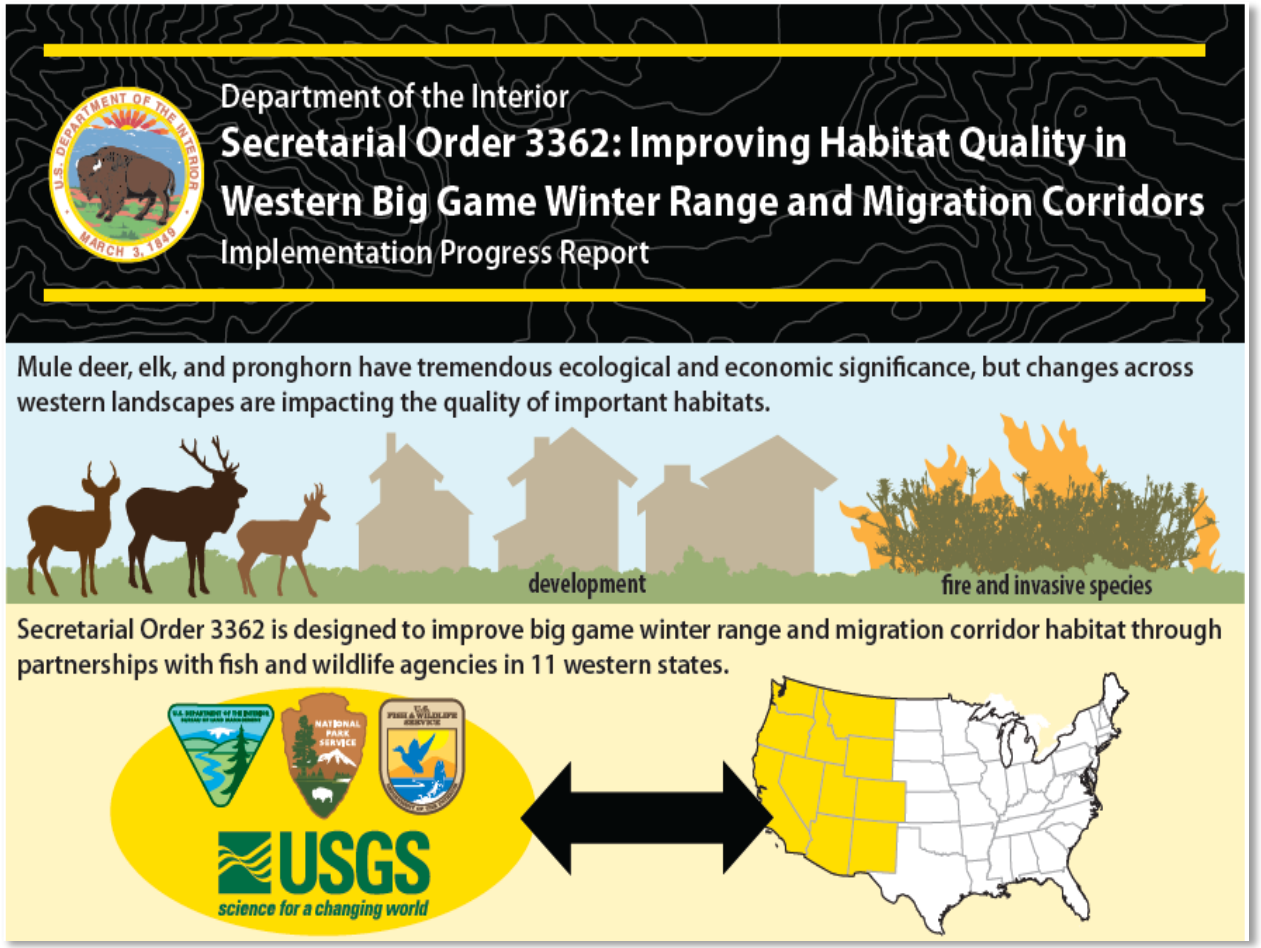


Project Team:
Neil Carter, Martin Leclerc: Univ. of Michigan
David Stoner: Utah State University
Joseph Sexton, Panshi Wang: terraPulse
Mark Ditmer: USDA RMRS

Changing American West

- Fire regimes / woodland expansion / urban development
- Reduced ppt / increasing water demands
- Exotic species (plants, animals)
- **Result**: Δ veg structure / type / condition

SO 3362 "*Enhance and improve the quality of Rocky Mountain elk, mule deer, and pronghorn antelope winter range and migration corridor habitat*"



- Concern for loss, fragmentation of migration routes and seasonal ranges;
- Conserve, restore habitat
- Focus on western states (% BLM, USFS)

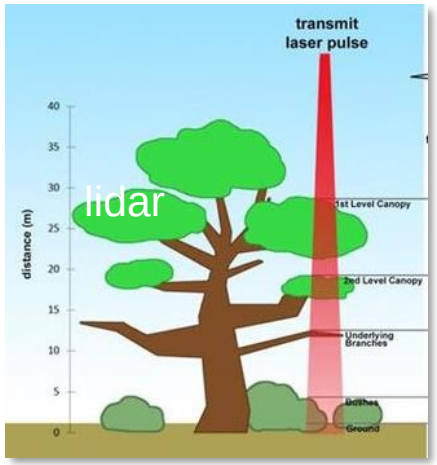
Earth Observations from ISS

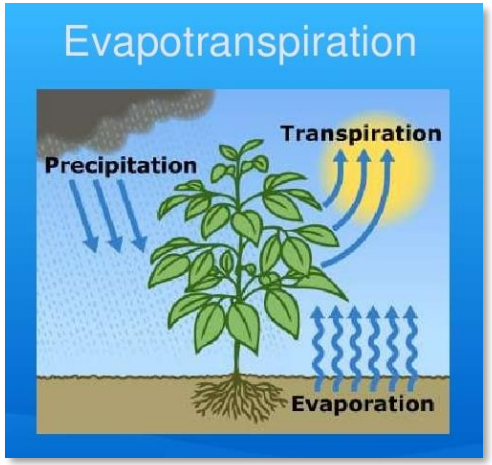
GEDI

- Measures of vegetation 3D structure at broad spatial extents

ECOSTRESS

- Measures of evapotranspiration and vegetation water stress at fine spatial resolutions

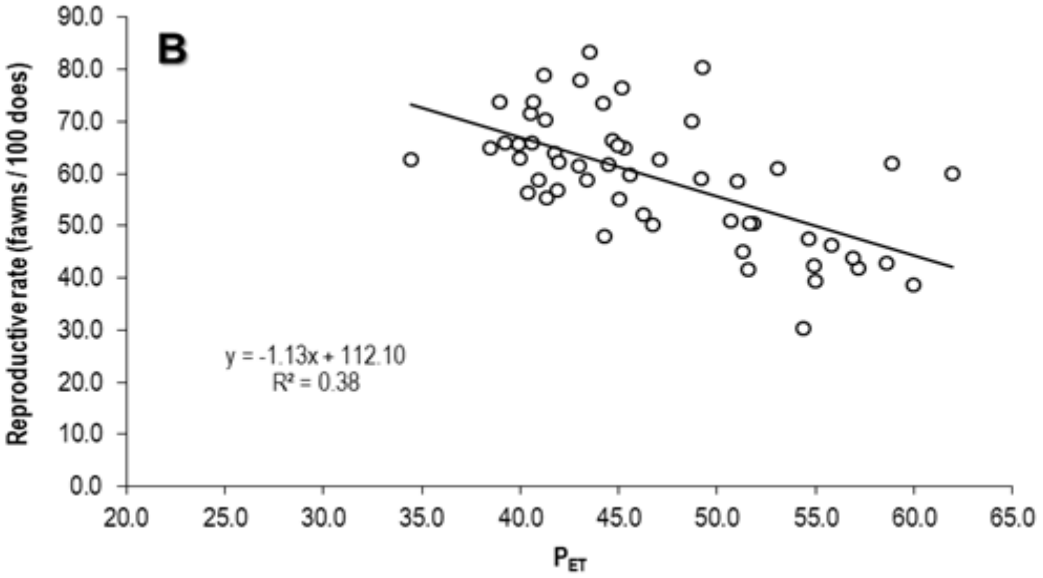


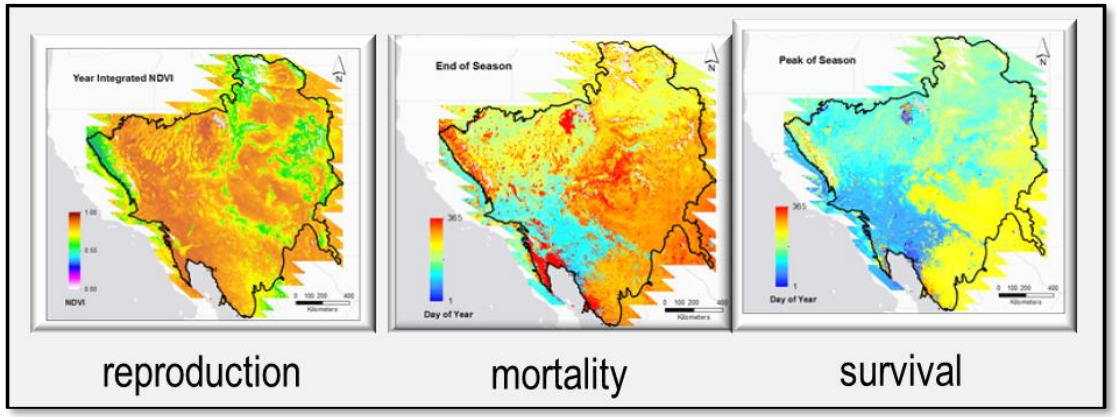


Goal: develop spatial models of animal demography and habitat use across gradients of vegetation structure and water stress using GEDI and ECOSTRESS

Landscape of fitness

- Food / water / cover availability; connectivity, and thermal landscape characteristics for wildlife
- Changing distribution of resources and threats;
- Consequences for animal populations, human-wildlife conflict, harvest, biodiversity, economics





Workflow

Objective 1:
Develop Covariates

Remote Sensing
Vegetation Structure (GEDI)
Water Stress (ECOSTRESS)

Objective 2:
Derive Responses

In Situ Animal Data
Demographics (agencies)
Behaviors (GPS)

Objective 3:
Model and Test Fitness Benefits & Costs

Demographics
Mortality
Natality
Survival

Behaviors
Habitat Selection
Home Range Area
Functional Behaviors
Movement Types

DELIVERABLES

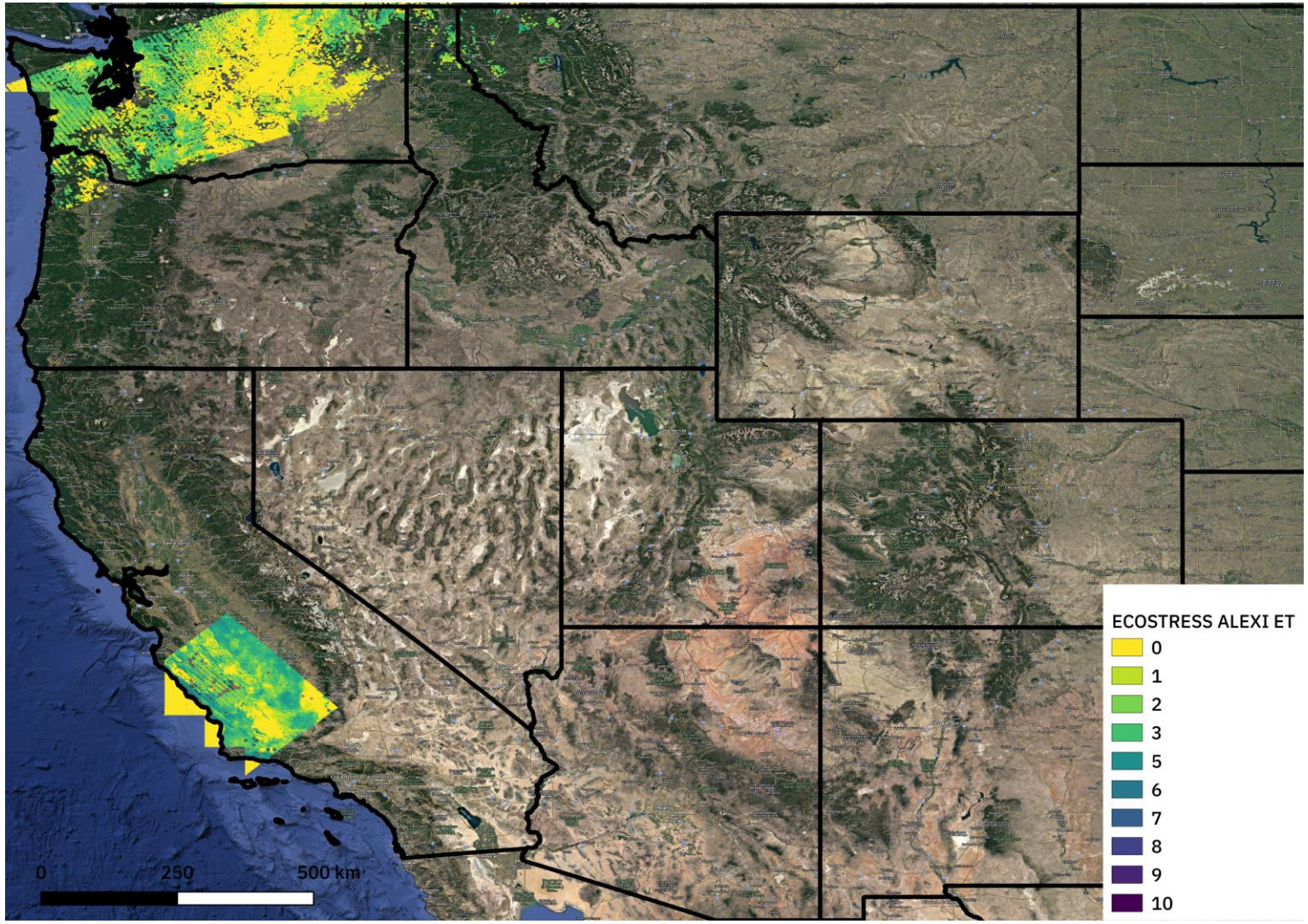
Better Mechanistic Understanding of Species Fitness Responses to Landscapes

Assessed Improvements to Fitness Response Models using GEDI and ECOSTRESS

New Remote Sensing Data Products

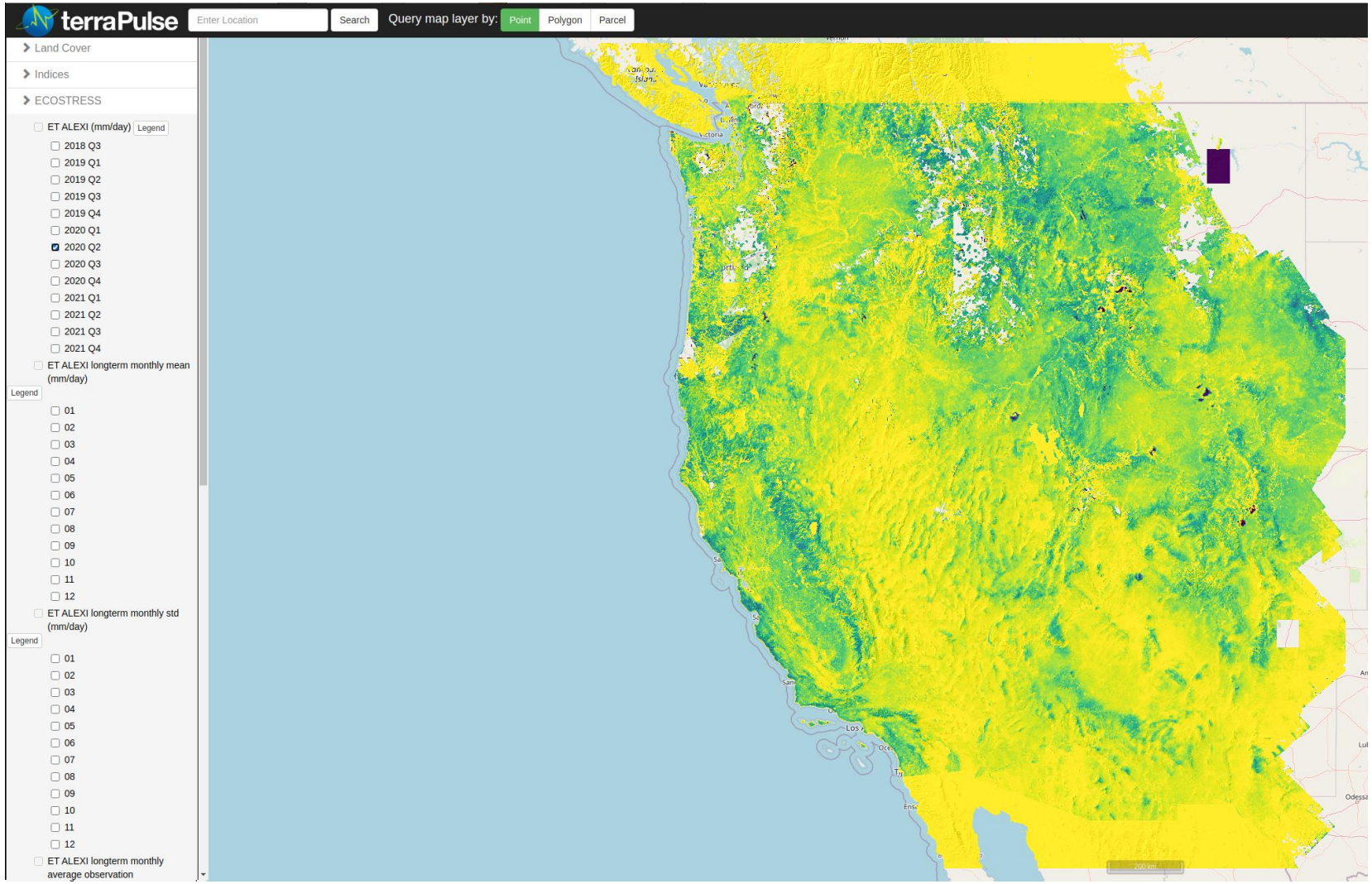
Identified Critical Habitats for Survival and Reproduction (Fitness)

ECOSTRESS ALEXI ET
(daily)



2021-08-18

ECOSTRESS ALEXI ET
(quarterly composite)

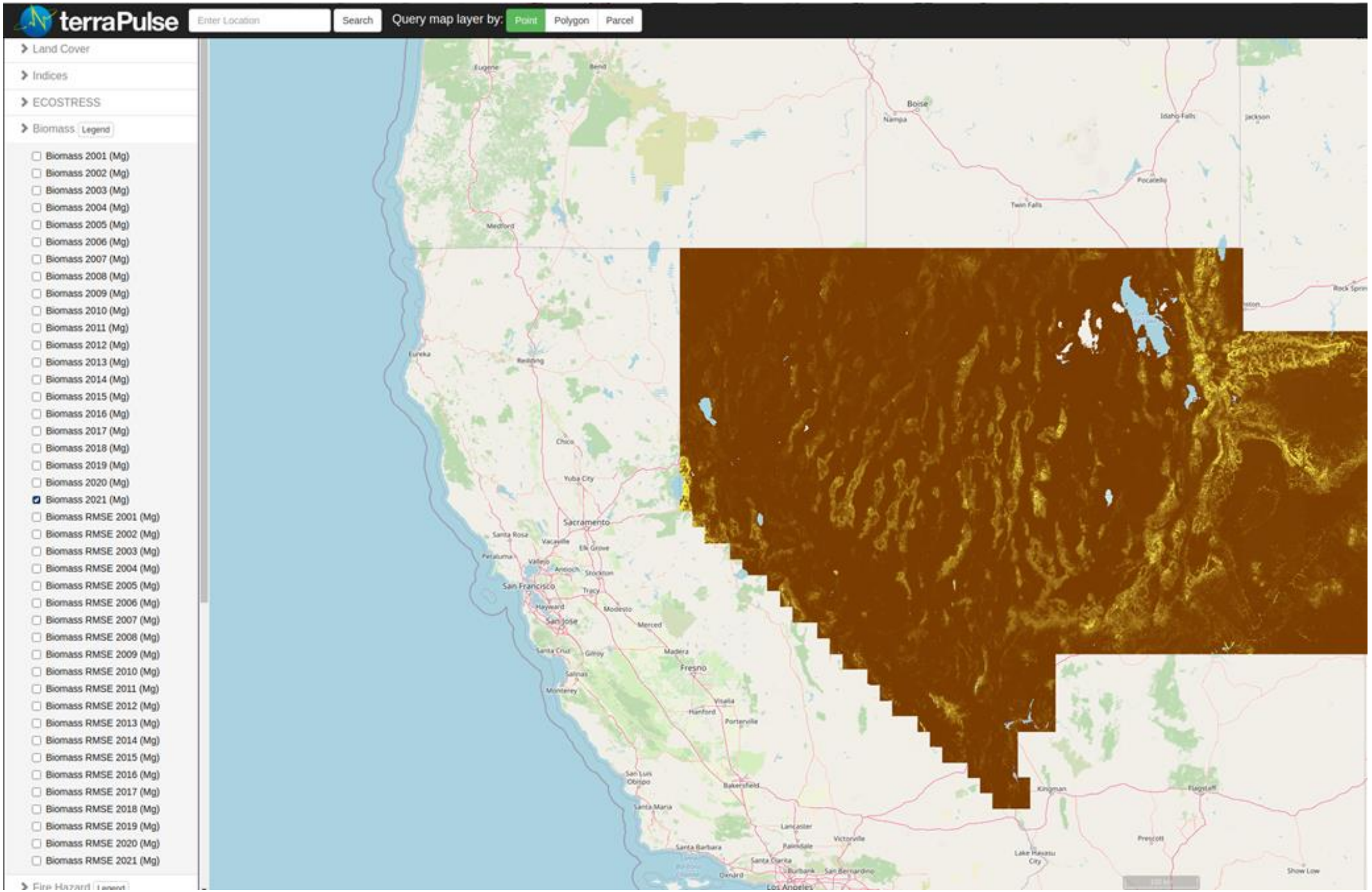


2020 Q3

2020 Q2

Problems:

- Data gaps
- Artifacts


terraPulse
Enter Location
Search
Query map layer by:
Point
Polygon
Parcel
Land Cover
Indices
ECOSTRESS
Biomass
Legend
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Biomass RMSE 2021 (Mg)
Fire Hazard
Legend
Eugene
Bend
Boise
Nampa
Idaho Falls
Jackson
Pocatello
Twin Falls
Medford
Eureka
Redding
Chico
Yuba City
Sacramento
Santa Rosa
Vacaville
Elk Grove
Petaluma
Vallejo
Antioch
Stockton
San Francisco
Tracy
Hayward
Modesto
San Jose
Merced
Santa Cruz
Gilroy
Madera
Fresno
Salinas
Monterey
Visalia
Hanford
Porterville
San Luis Obispo
Bakersfield
Santa Maria
Lancaster
Victorville
Palmdale
Santa Barbara
Santa Clarita
Burbank
San Bernardino
Oxnard
Los Angeles
Kingman
Flagstaff
Prescott
Lake Havasu City
Show Low

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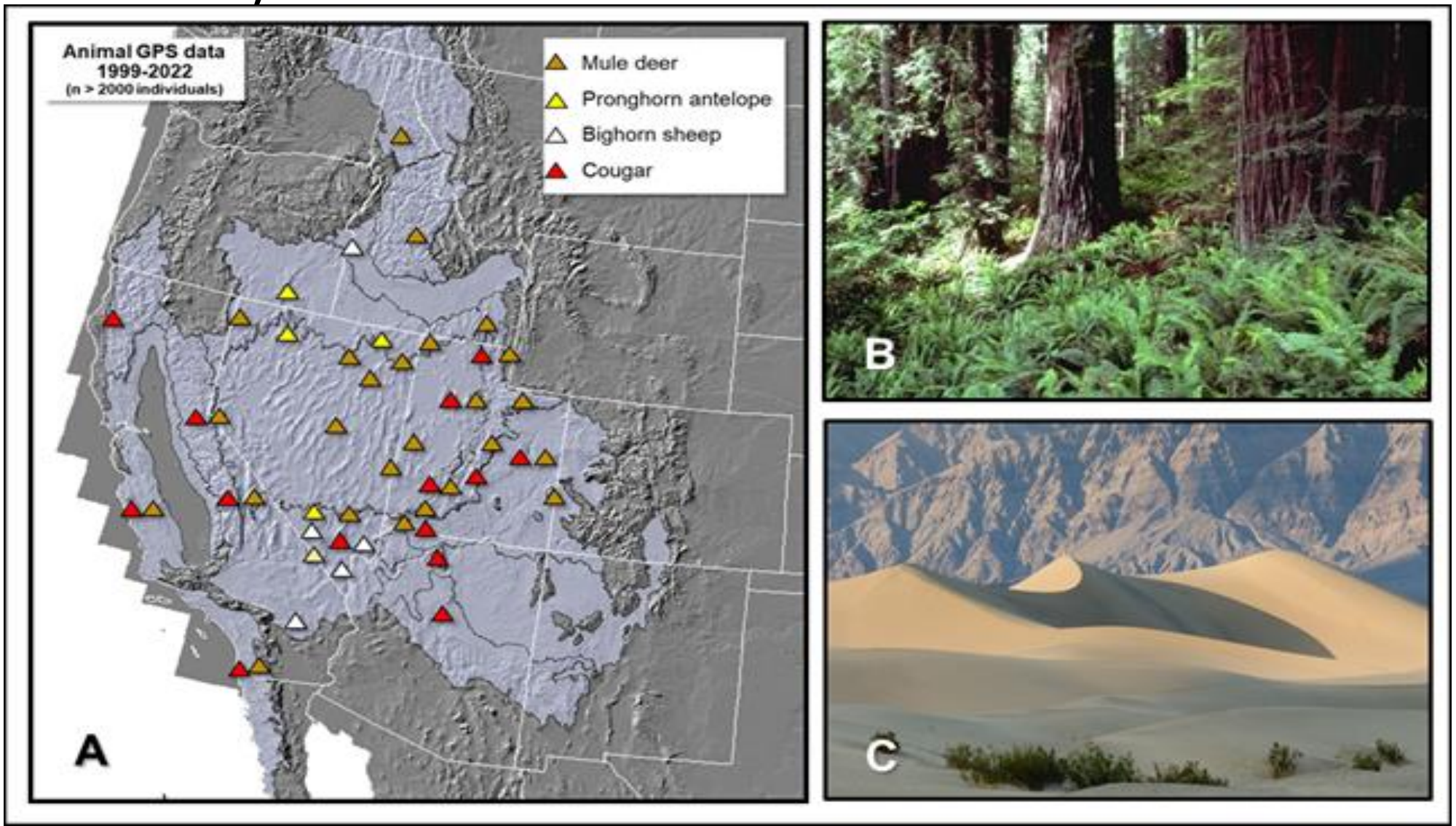
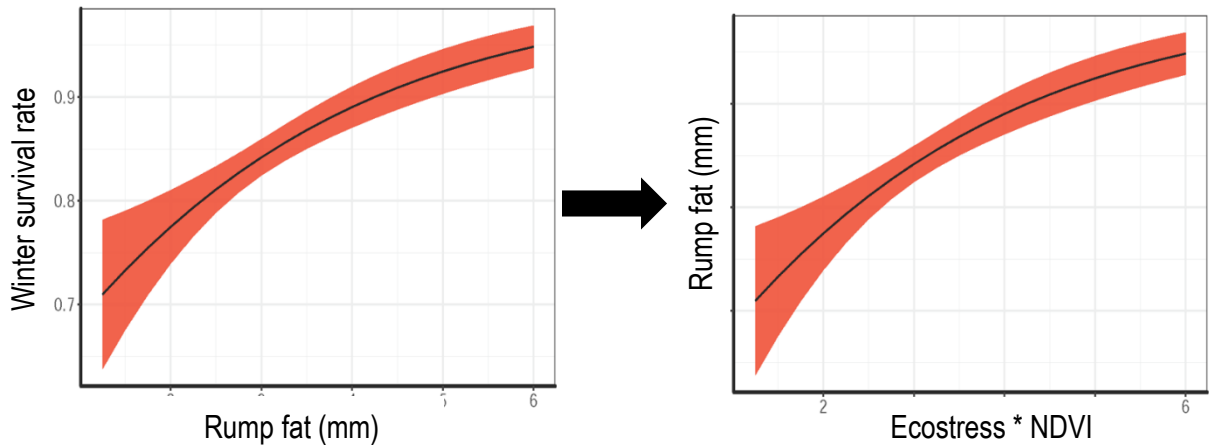
In situ data: animal locations
(GPS collars)



In situ data: measures of animal physiology

(pregnancy / rump fat / heartrate / cortisol)




Conifer-751
2.5
0.0
-2.5
value
Feb-01-2019
May-01-2019
Aug-01-2019
Nov-01-2019
Feb-01-2020
May-01-2020
Aug-01-2020
Nov-01-2020
Feb-01-2021
May-01-2021
Aug-01-2021
Nov-01-2021
Date
variable
ET
NDVI

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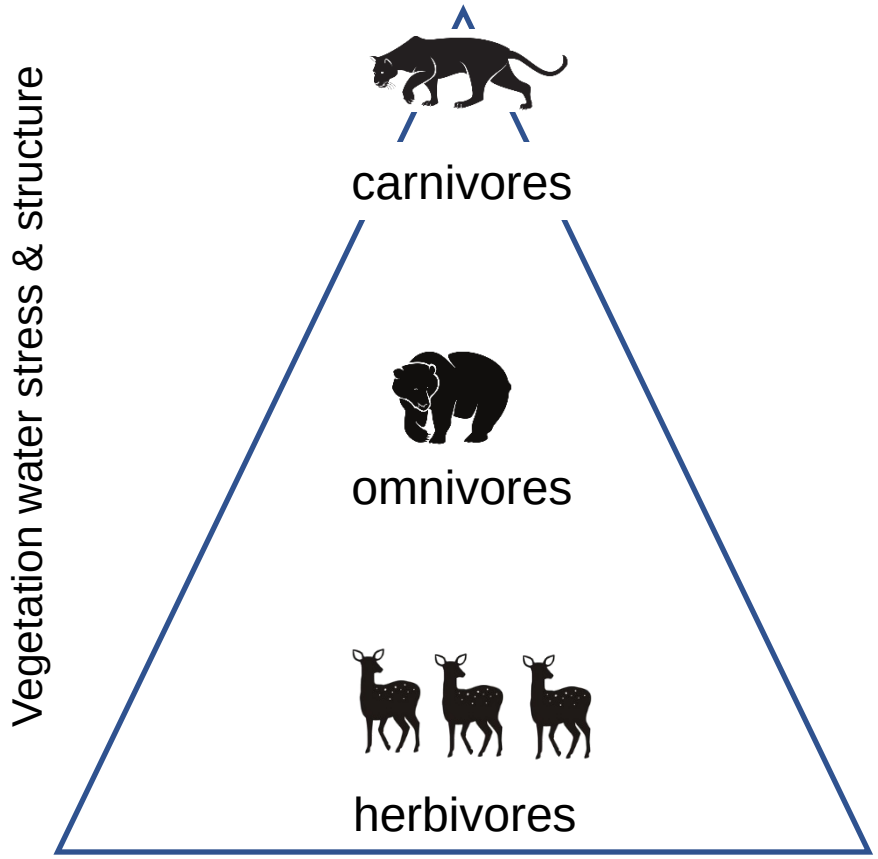
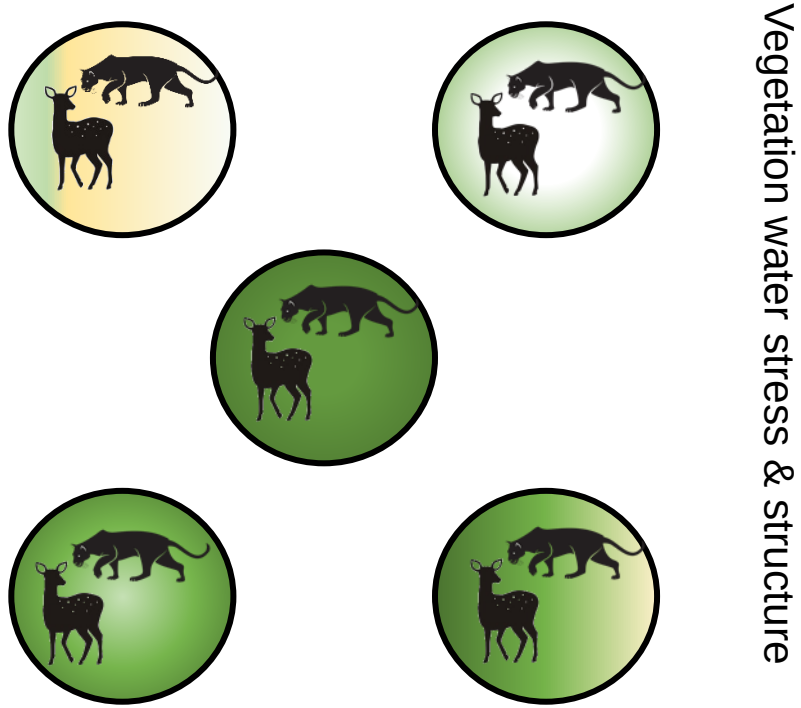
Next Steps: modeling demographics and behavior

Multiple trophic levels on one study site



Two interacting species on multiple sites representing different conditions



Acknowledgments