Predicted Grizzly Bear Habitat in the Bitterroot & North Cascades Ecosystems

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Photo: G. Smith

Motivation

- **Understand spatial behavior**
  - Habitat use
  - Range expansion
  - Potential for connectivity

Jim Peaco

Approach

- **Develop movement models**
  - Integrated step selection functions (iSSFs)
  - Model for each individual
- **Test hypotheses**
- **Identify predictive models**
- **Simulate movements**

NCDE Data

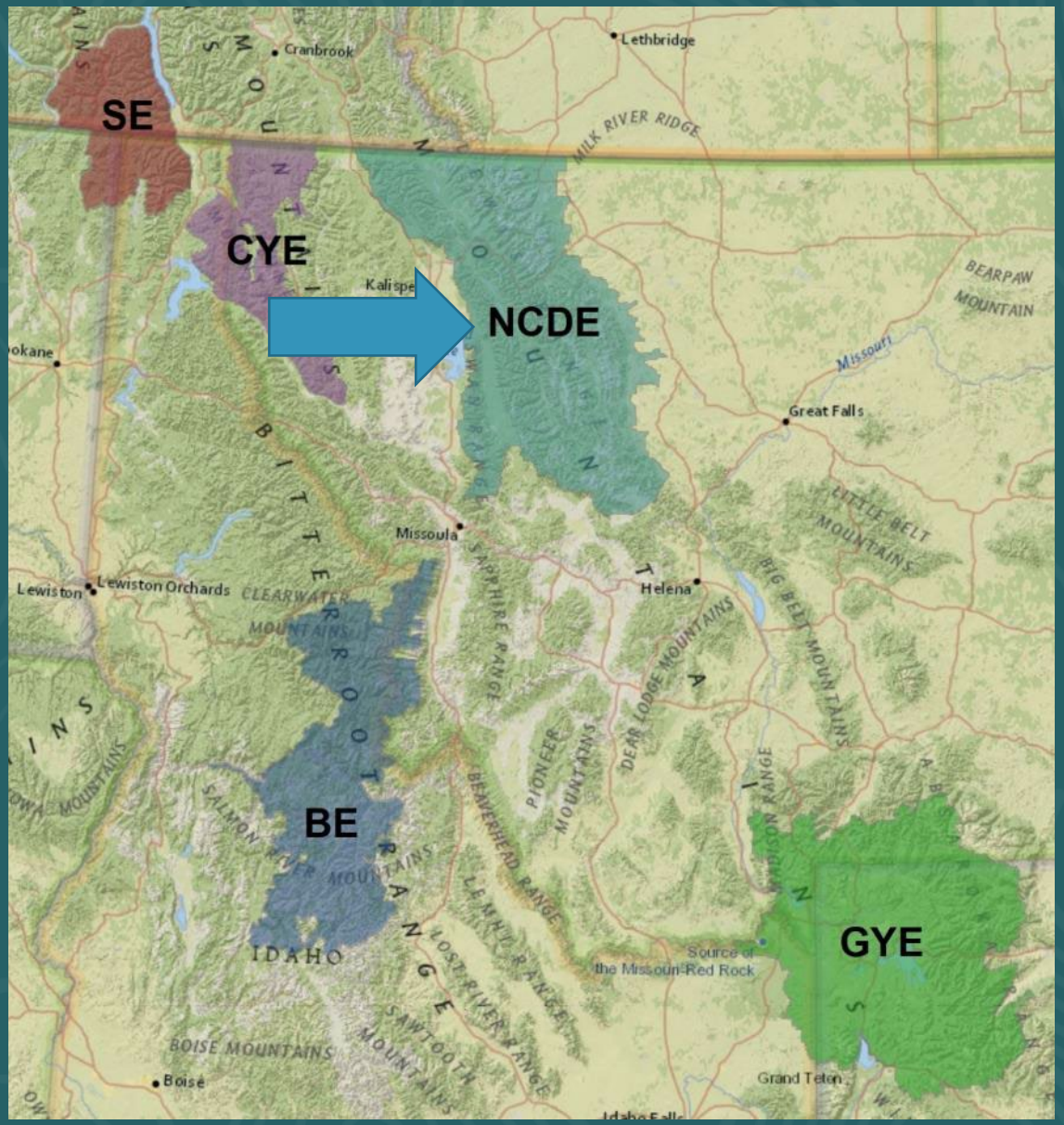
- **GPS collars, 2003 – 2021**
  - May – Nov
  - 3-hour fix rate
  - 47 females
    - >59,000 fixes
  - 20 males
    - >16,000 fixes

Hypotheses

- **Grizzly bears select habitat with:**
  - > food availability to maximize fitness
  - < ruggedness to reduce energy expenditure
  - > forest & riparian areas for security, thermal regulation, & food
  - < building density to avoid humans
  - < distance to secure habitat* to avoid humans
- **Generally true, with extensive individual variation**

* USFWS: areas > 500 m from roads on federal, state, & tribal lands

Model Application: Phase 1



- Simulate for NCDE
- Evaluate predictive accuracy

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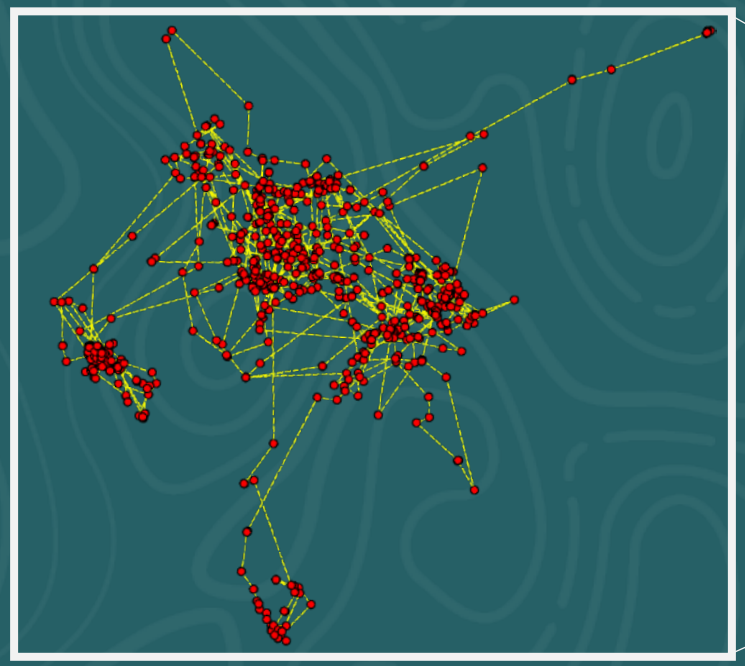
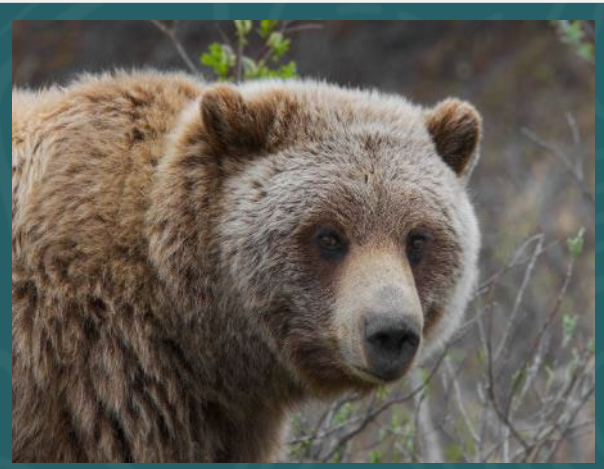
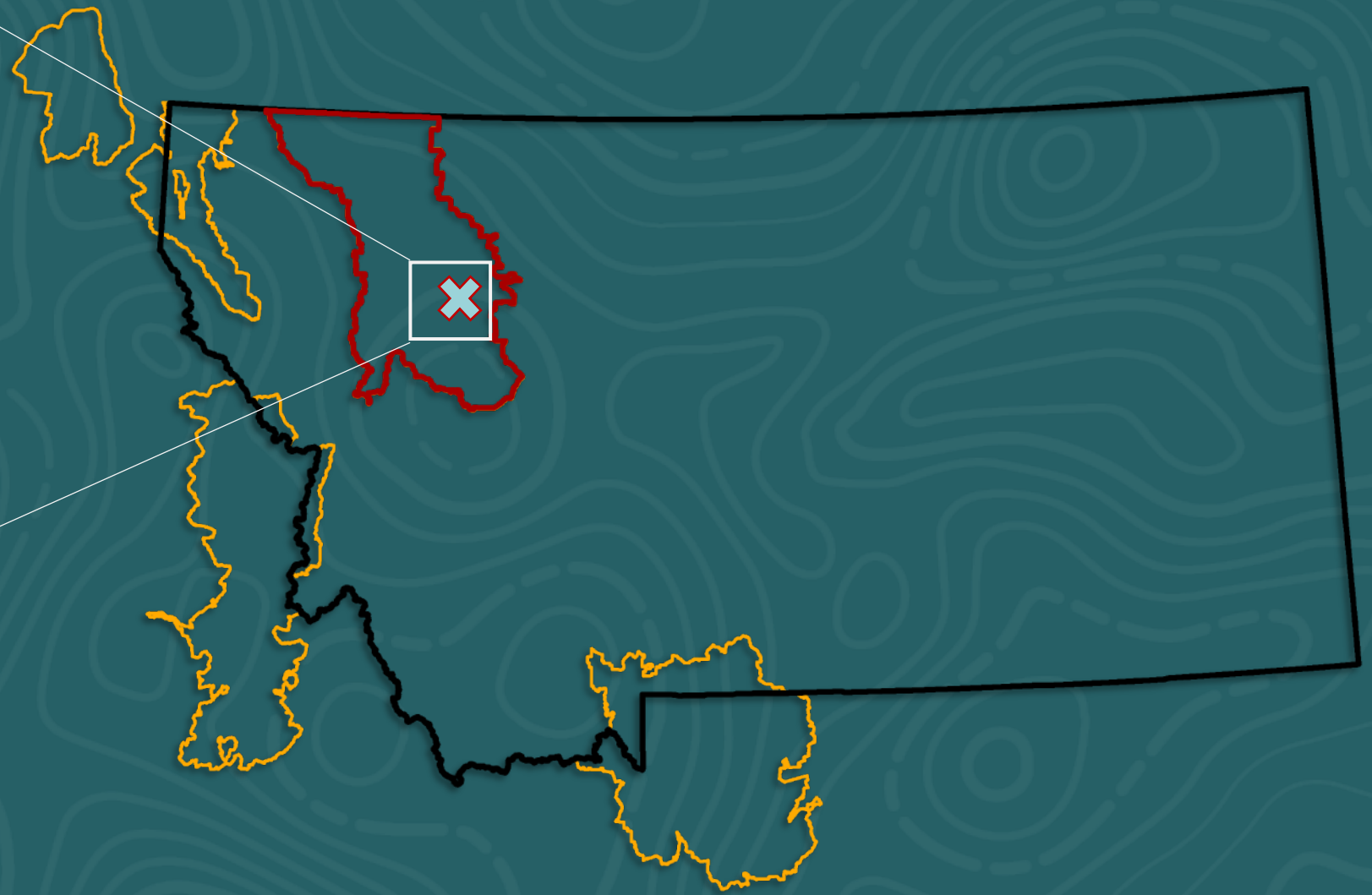
Simulating Spatial Behavior

- Simulate individual's movements

Simulating Spatial Behavior

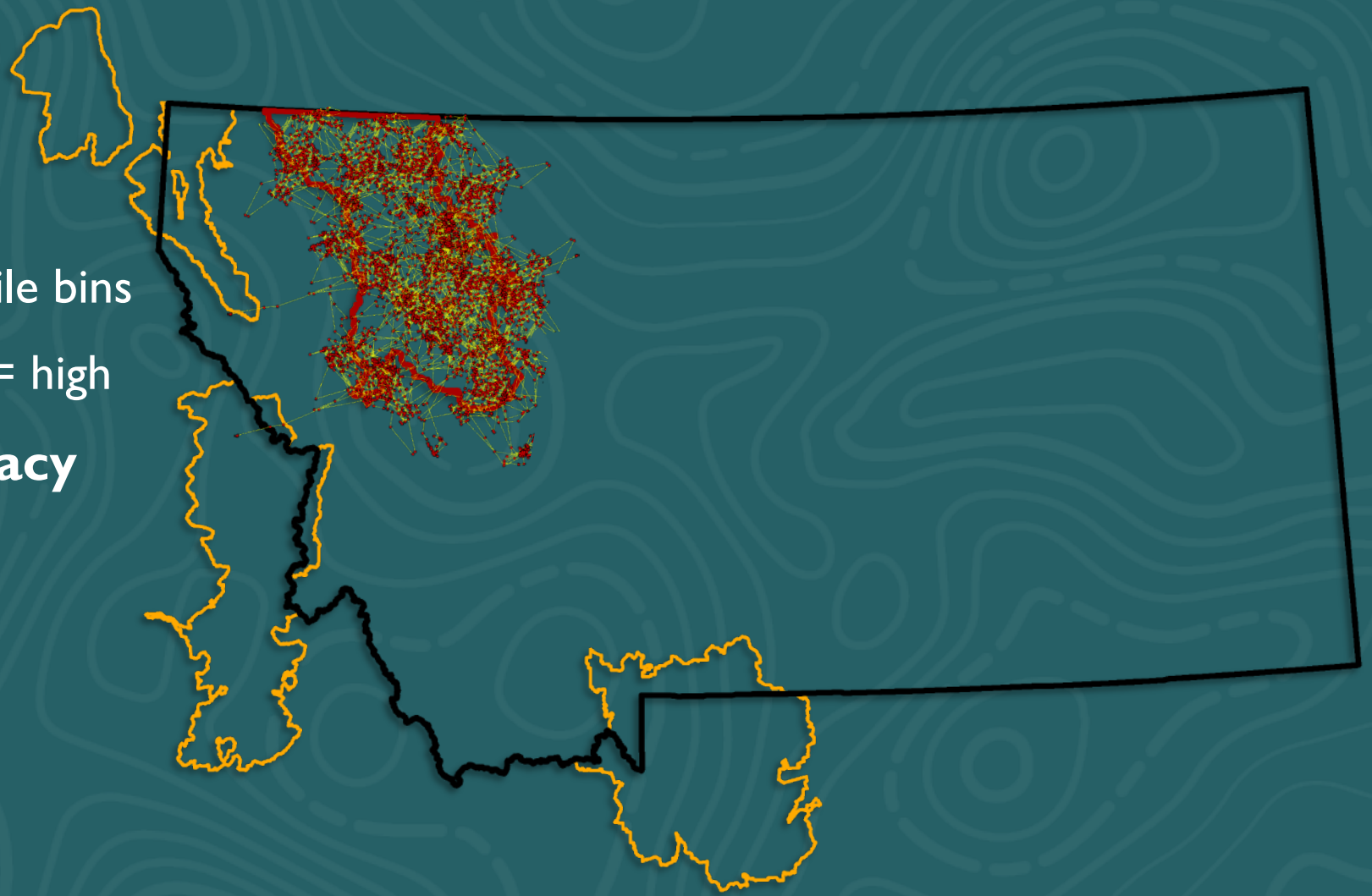






Simulating Spatial Behavior

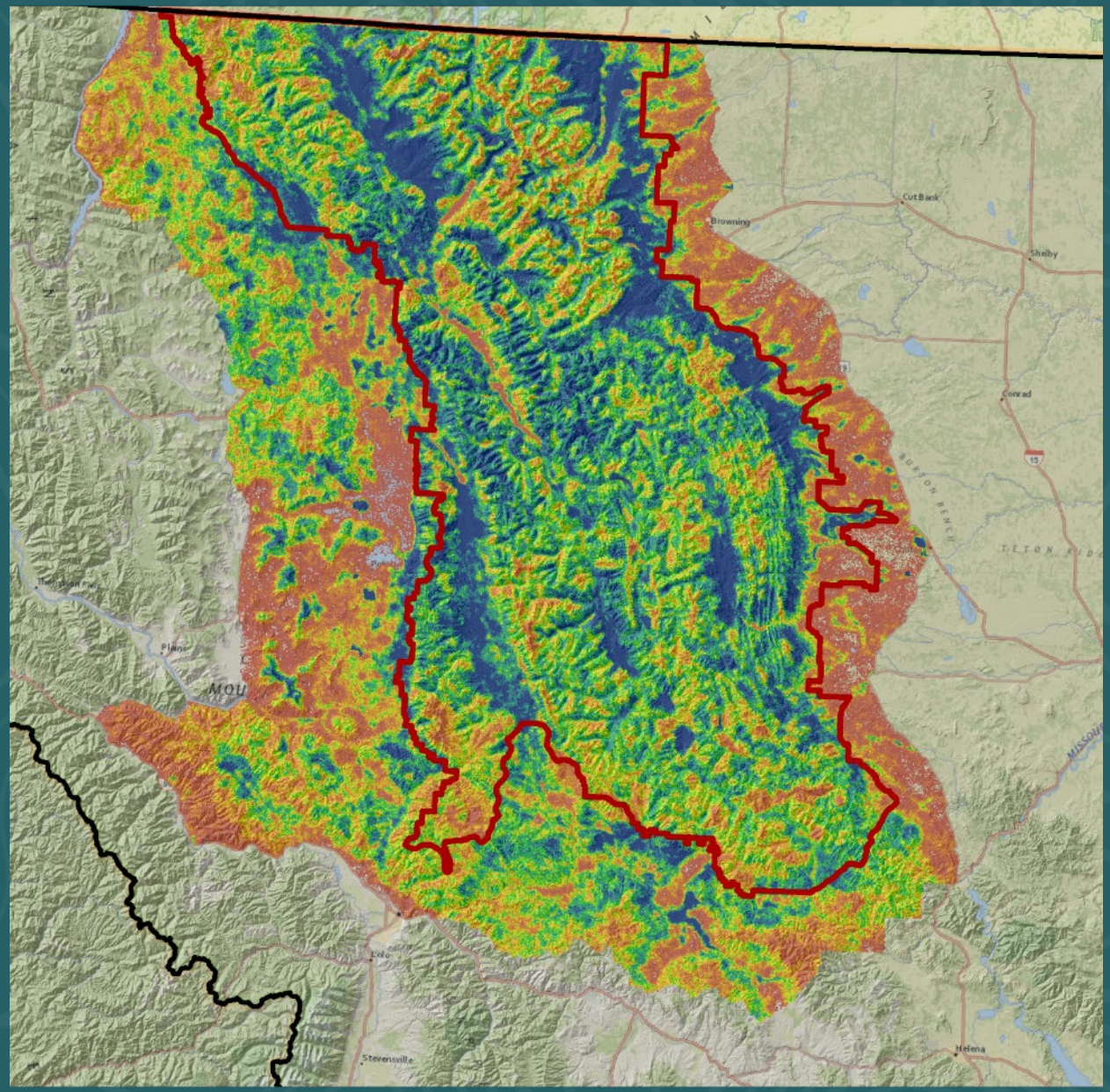
- **Repeat**
- **Summarize results**
  - # of steps/cell → 10 quantile bins
  - iSSF class: 1 = low use, 10 = high
- **Assess predictive accuracy**

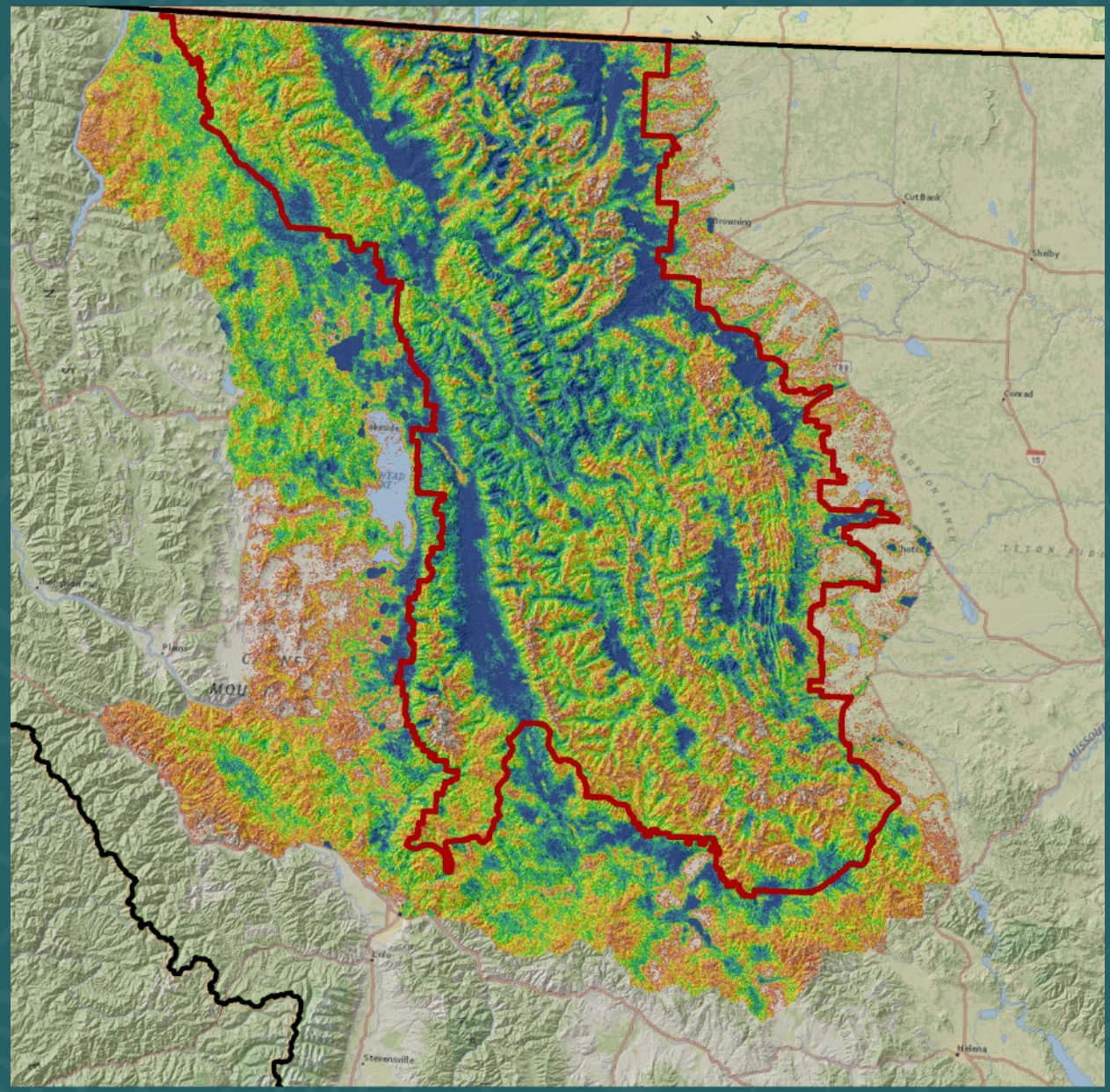


Females

Low iSSF Class *High*

Males





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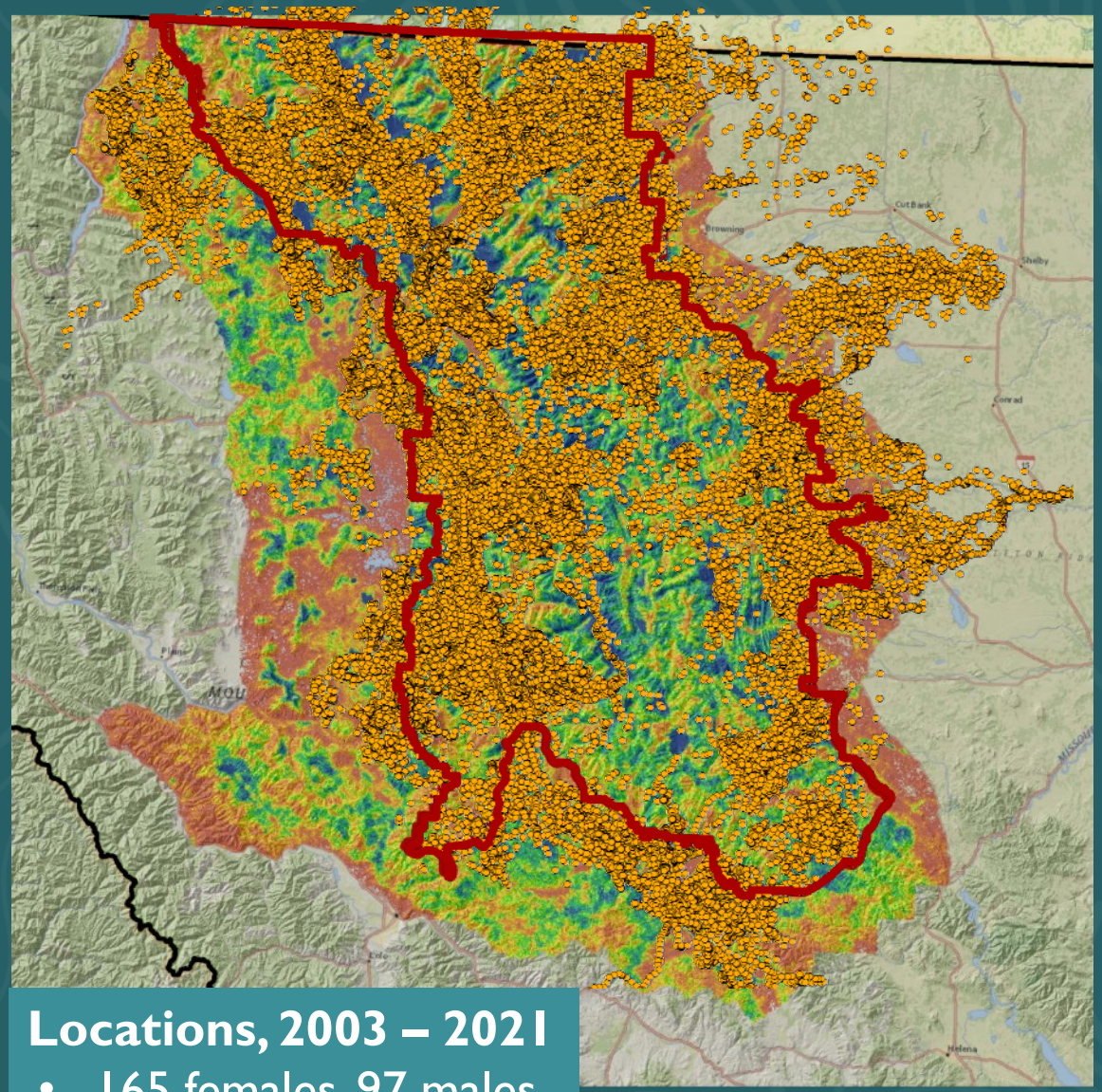
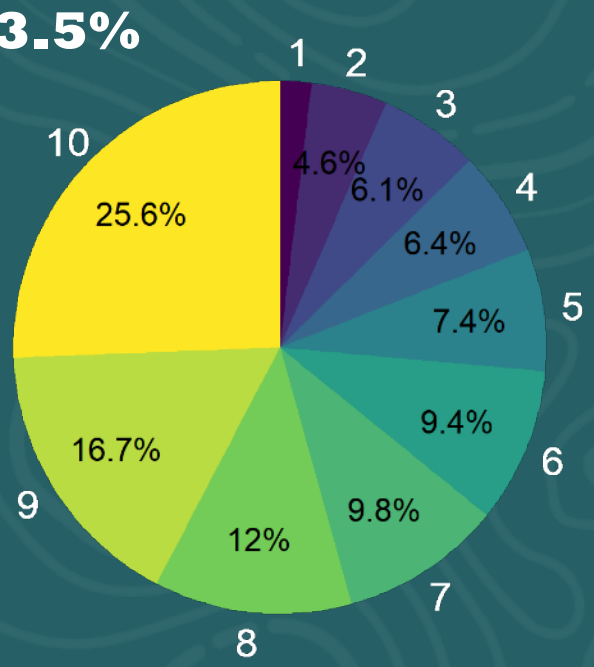


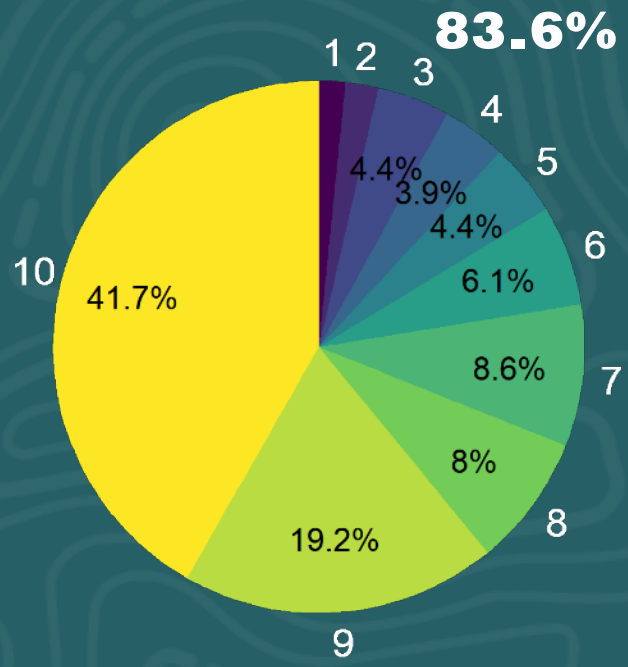
Locations, 2003 – 2021

- 165 females, 97 males
- >377,000 fixes

Females:
% fixes per class



Males:
% fixes per class



Highly predictive across season & years

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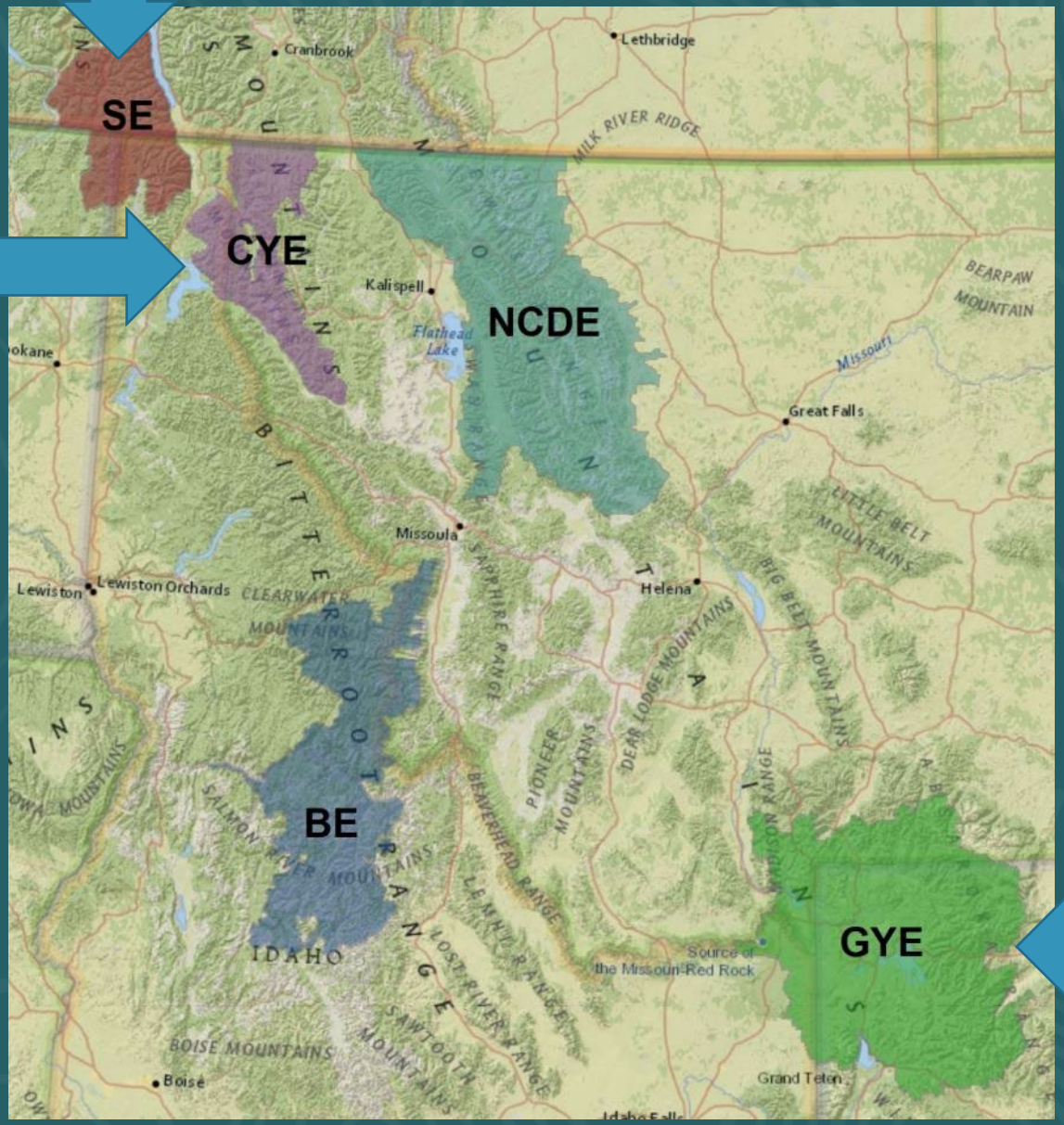
Model Application: Phase 2



- Simulate for other populations
- Evaluate transferability of results

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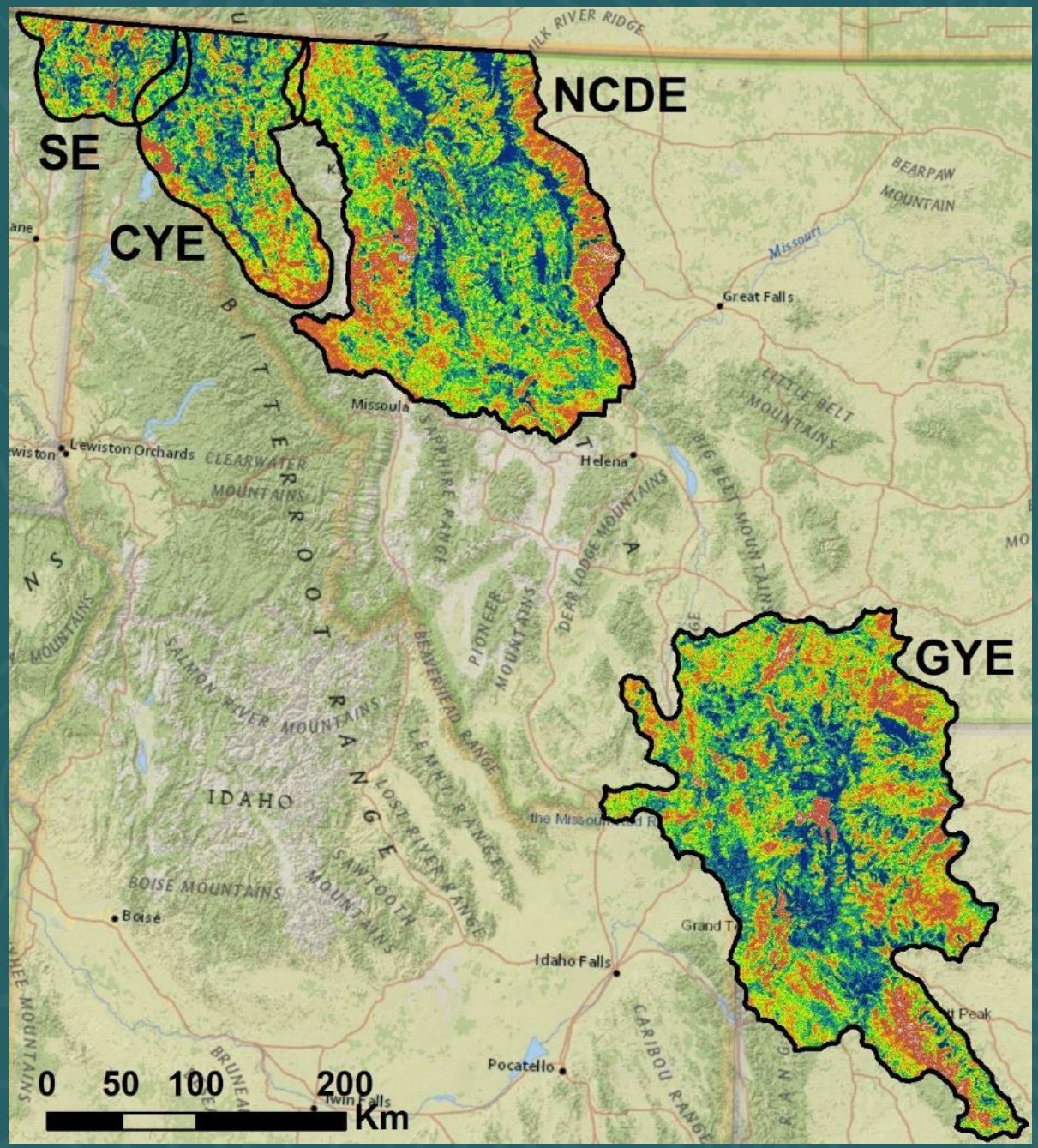
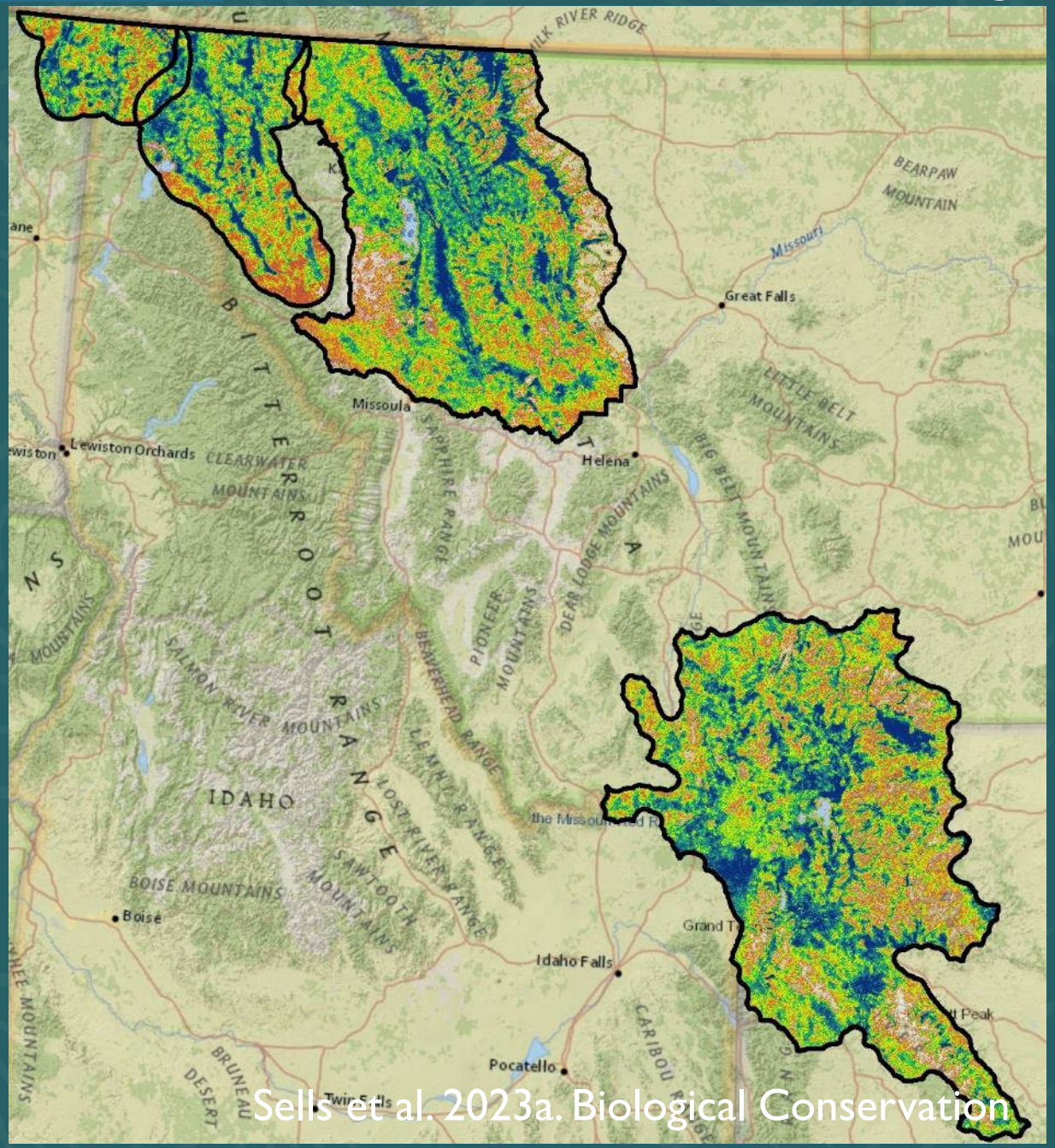
Females

Low iSSF Class *High*

Males





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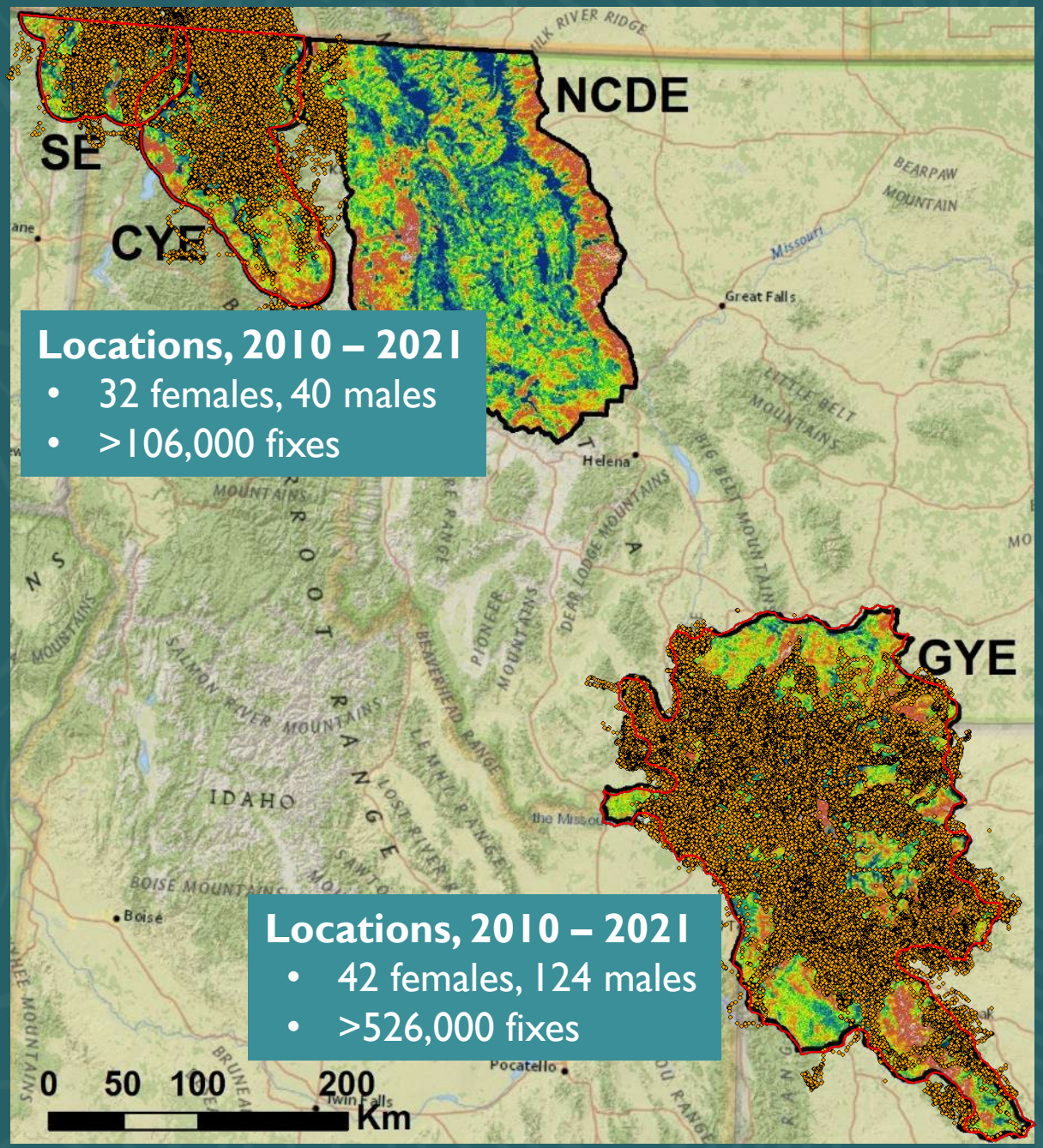
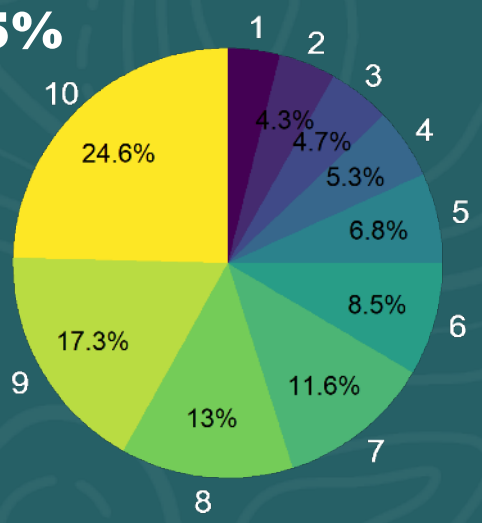
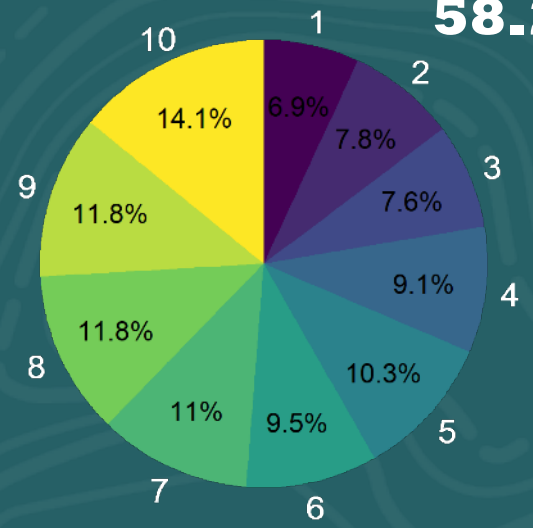


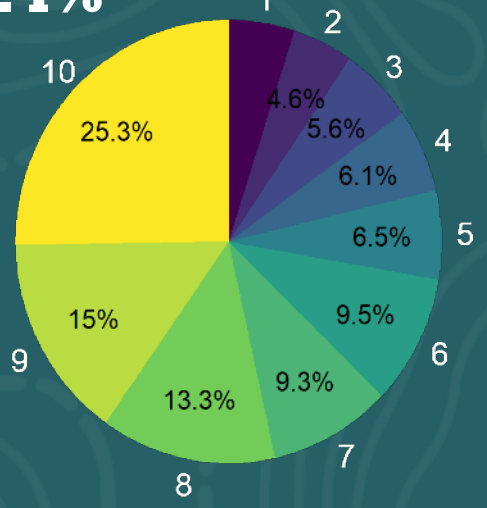
SE/CYE Females: 75%



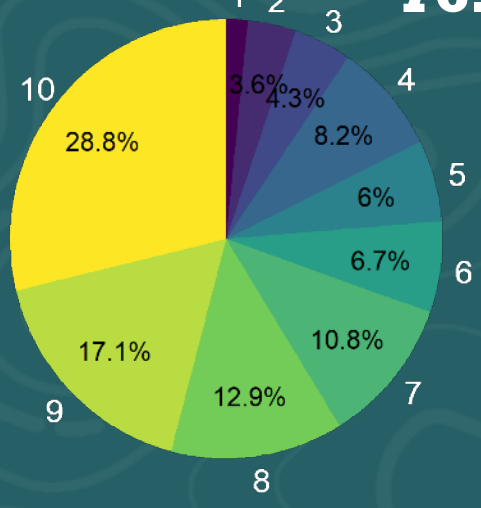
SE/CYE Males: 58.2%



GYE Females: 72.4%



GYE Males: 76.3%



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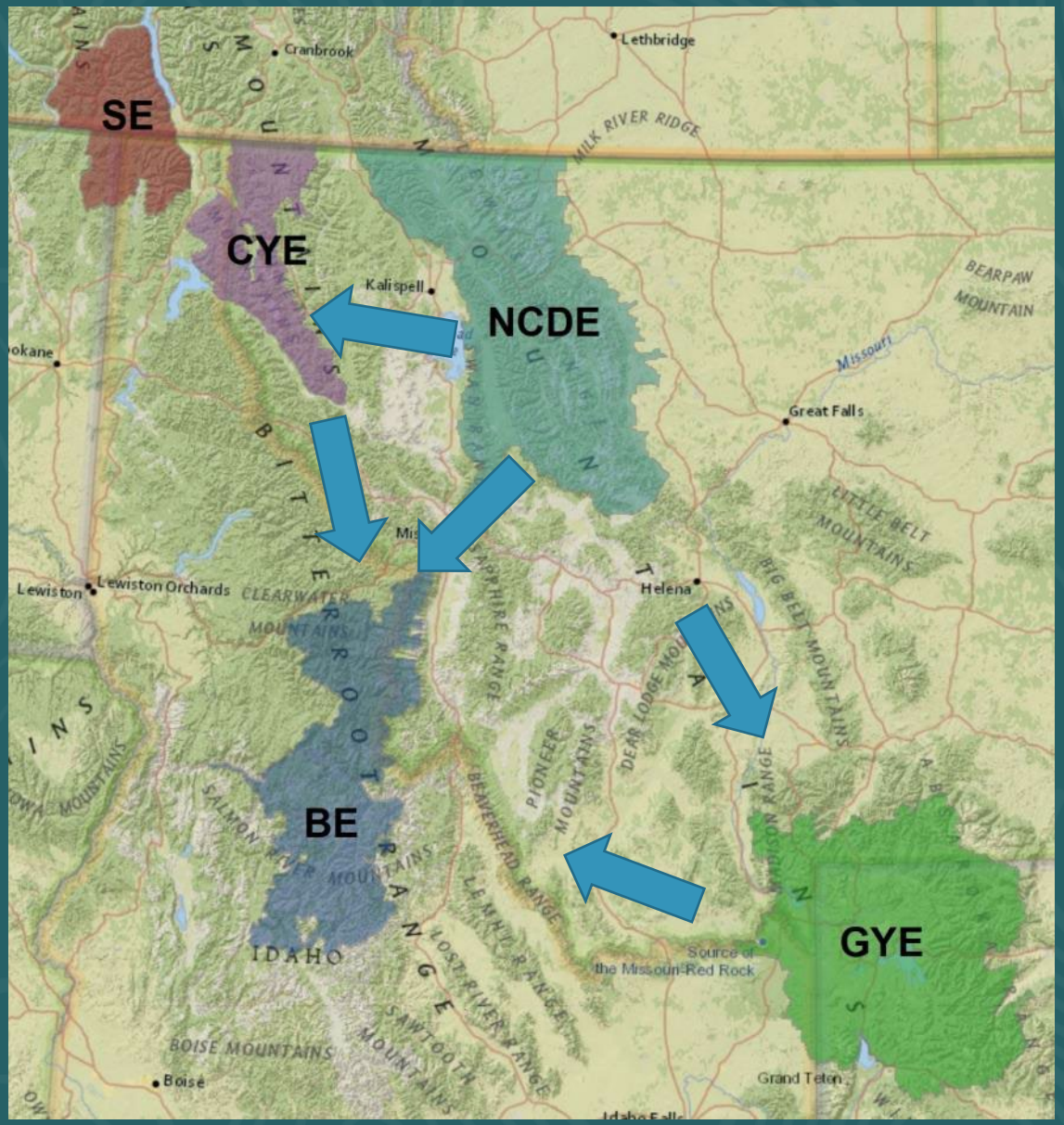
Model Application: Phase 3



- **Simulate connectivity paths**
  - Start & end nodes
  - Randomized shortest paths

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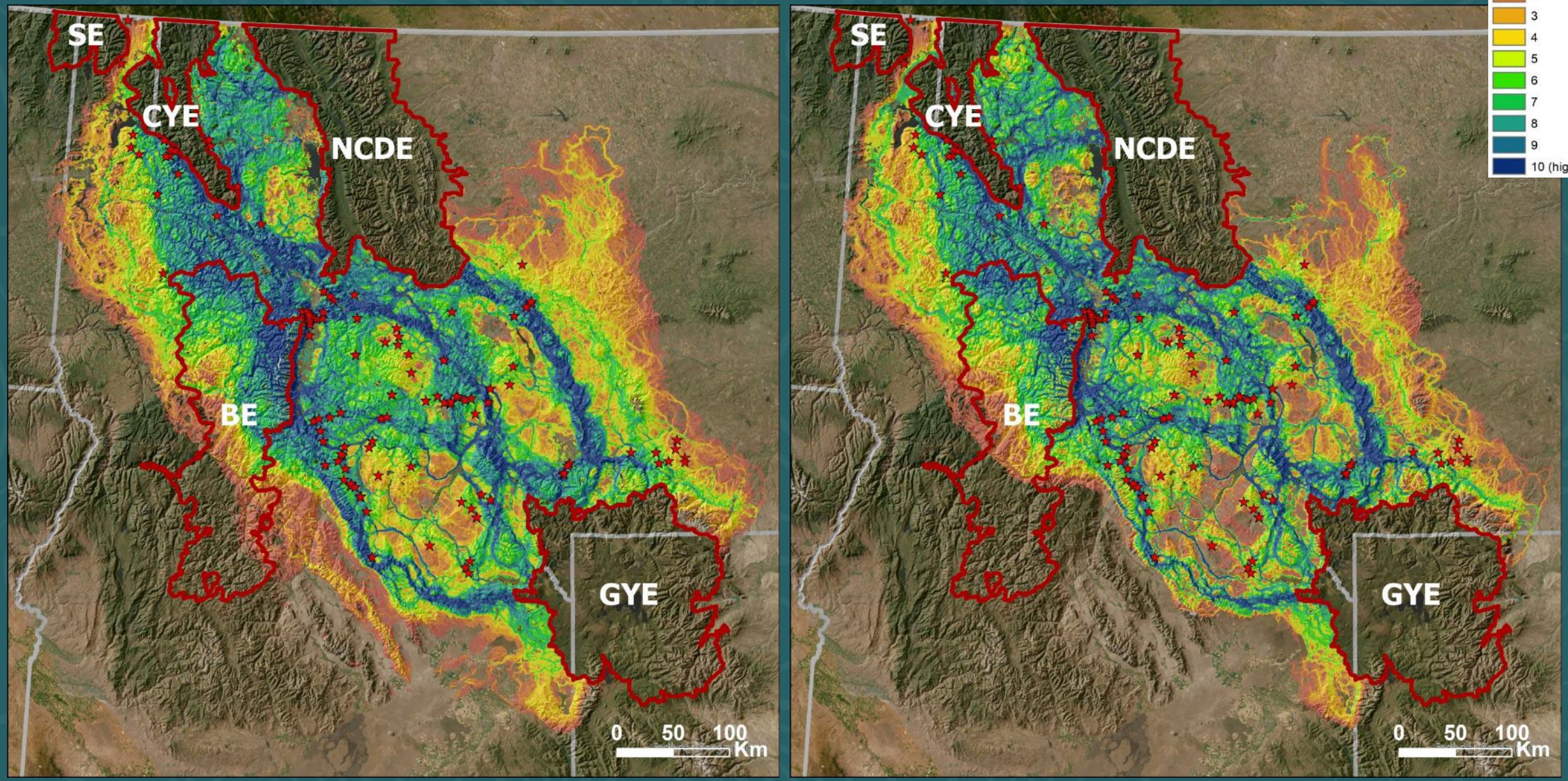
Females

Males



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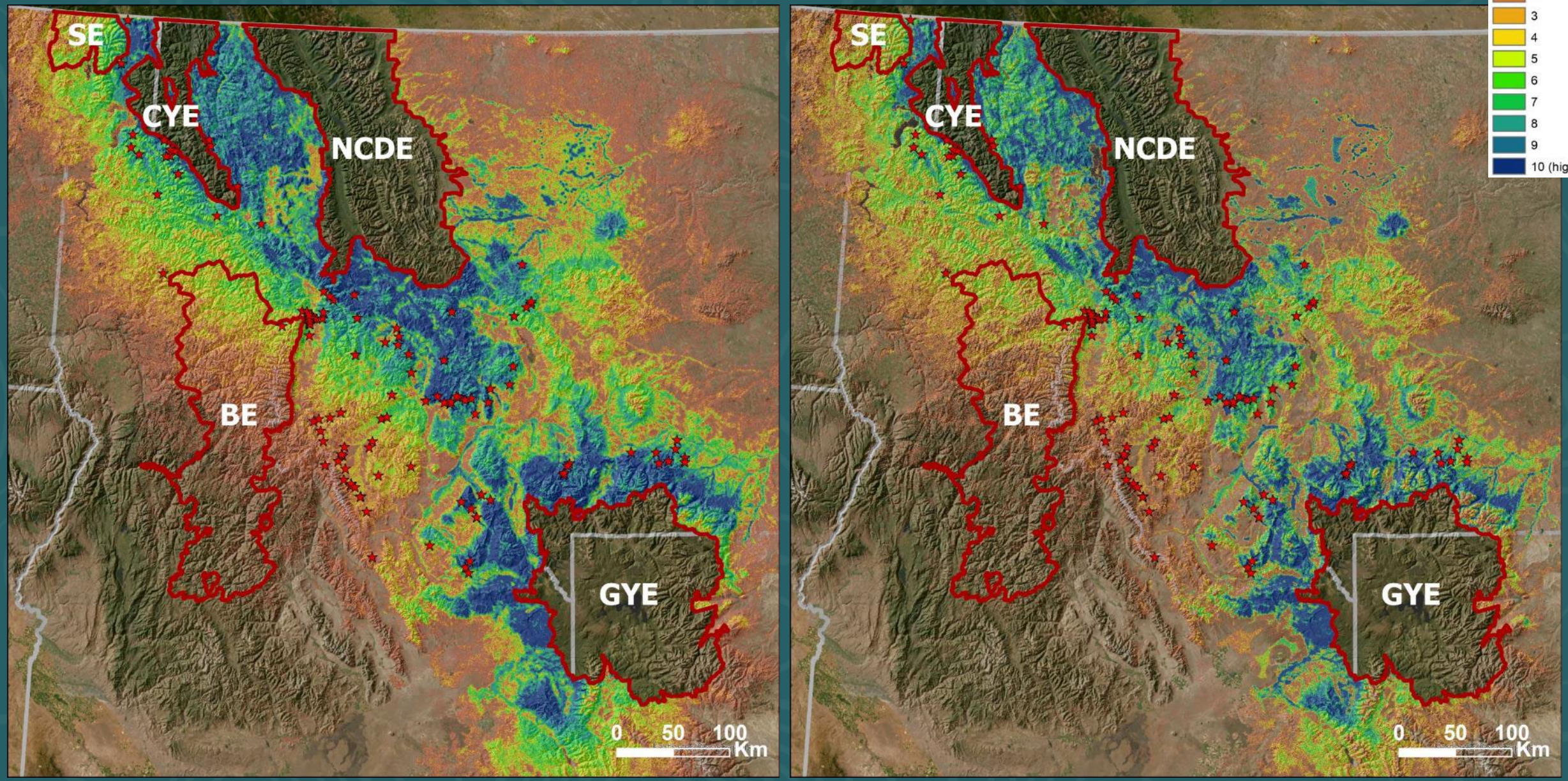
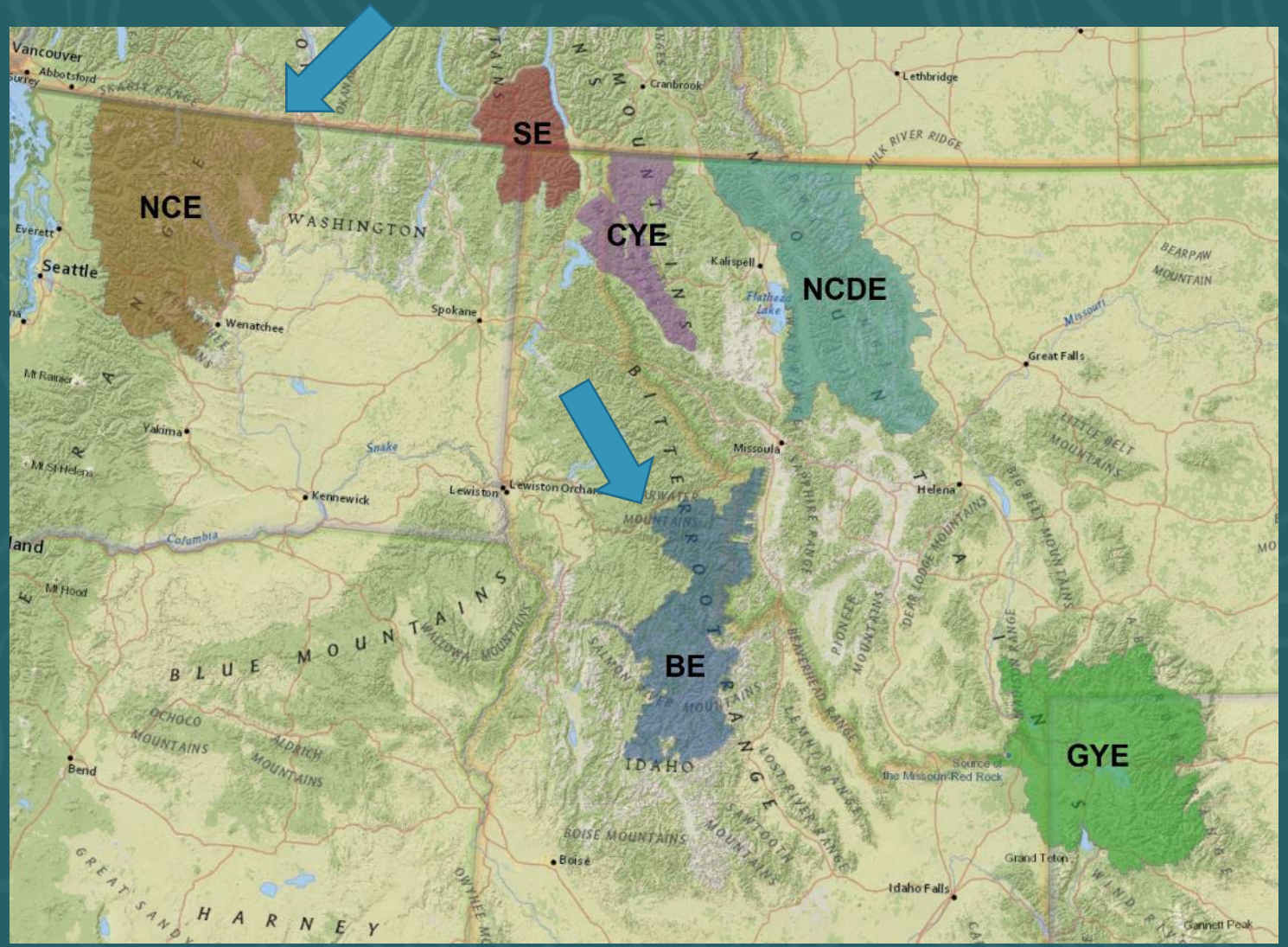
Females

Males



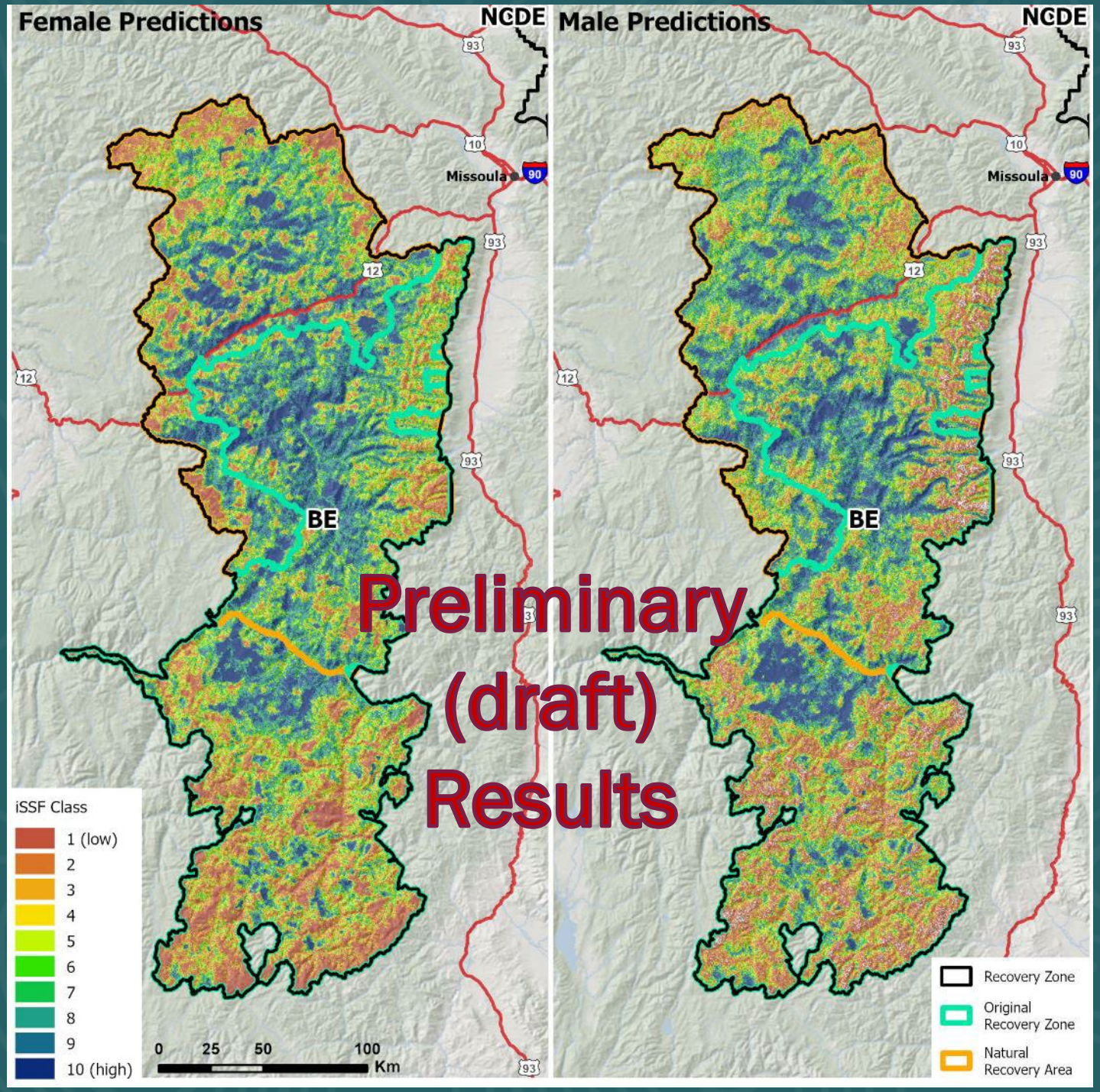
Sells et al. 2023b. Biological Conservation

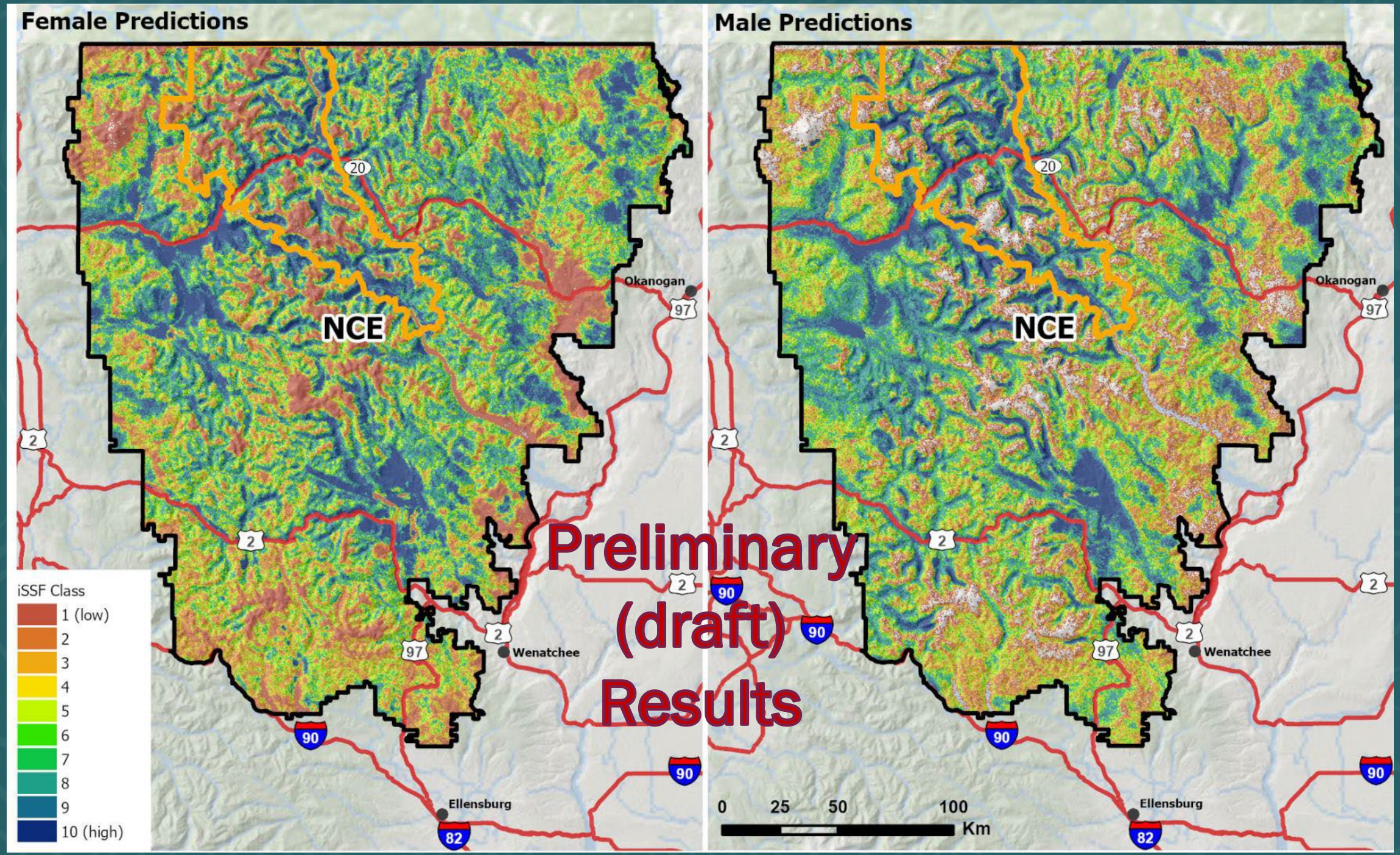
Model Application: Phase 4



- Simulate habitat use in remaining ecosystems
  - NCE & BE

Sells et al. In Prep.


Female Predictions
NCDE
Missoula
BE
Male Predictions
NCDE
Missoula
BE
Preliminary
(draft)
Results
iSSF Class
1 (low)
2
3
4
5
6
7
8
9
10 (high)
0 25 50 100
Km
Recovery Zone
Original Recovery Zone
Natural Recovery Area


Female Predictions
Male Predictions
NCE
NCE
Okanogan
Wenatchee
Ellensburg
Preliminary
(draft)
Results
iSSF Class
1 (low)
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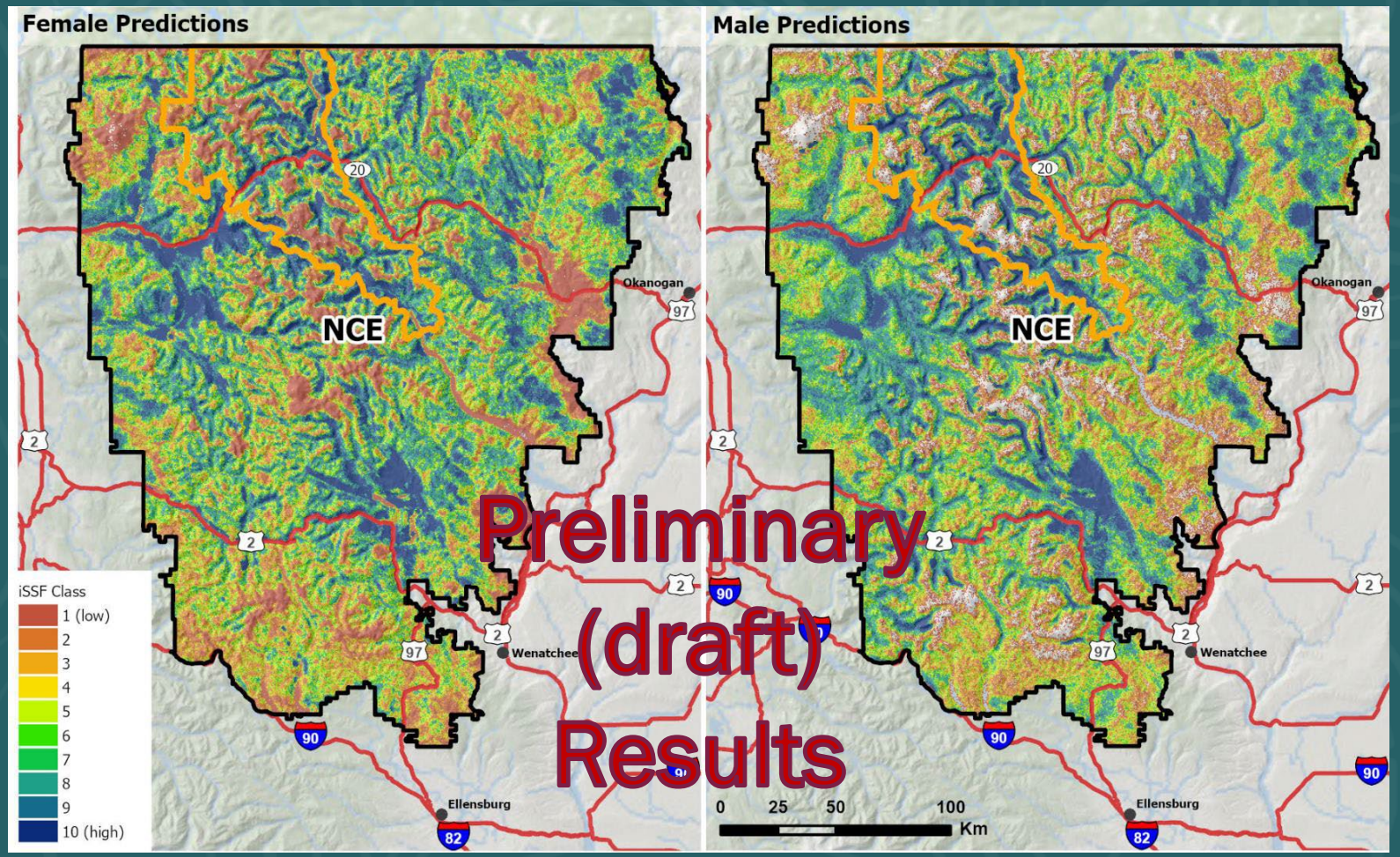
3
4
5
6
7
8
9
10 (high)
0 25 50 100
Km



- **Next:**
  - Summarize by land ownership in each class (NPS, USFS, private, etc.)
  - Summarize by wilderness status
  - By Zones 1 – 3 (Proposed 10(j) Rule)
  - Other requests or recommendations?

Application

- **Decision-making, e.g.,**
  - Conservation strategies
  - Habitat management
  - Monitoring design

Next Steps

- **Complete NCE & BE manuscripts**
- **Model home ranges**
  - Understand range expansion

Phase 1

Biological Conservation 276 (2022) 109813

Contents lists available at ScienceDirect

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journal homepage: www.elsevier.com/locate/biocon

Grizzly bear habitat selection across the Northern Continental Divide Ecosystem

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[c] Wildlife Biology Program, W.A. Franke College of Forestry and Conservation, University of M

Phase 2

Biological Conservation 279 (2023) 109940

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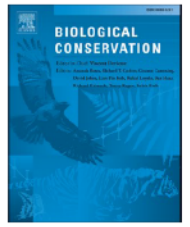

Grizzly bear movement models predict habitat use for nearby populations

Sarah N. Sells [a,*], Cecily M. Costello [b], Paul M. Lukacs [c], Frank T. van Manen [d], Mark Haroldson [d], Wayne Kasworm [e], Justin Teisberg [e], Milan A. Vinks [b], Dan Bjornlie [f]

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Phase 3

Biological Conservation xxx (xxxx) 110199

Contents lists available at ScienceDirect

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Predicted connectivity pathways between grizzly bear ecosystems in Western Montana

Sarah N. Sells [a, *], Cecily M. Costello [b], Paul M. Lukacs [c],

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Grizzly Bear Space Use in the US Northern Rocky Mountains

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Dates

Publication Date : 2023-06-30
Start Date : 2003-05-01
End Date : 2023-07-15

Citation

Sarah N. Sells, and Cecily M. Costello, 20230630, Grizzly Bear Space Use in the US Northern Rocky Mountains: , https://doi.org/10.5066/P91EWUO8.

Summary

Over the past two centuries, persecution and habitat loss caused grizzly bears (Ursus arctos) to decline from a population of approximately 50,000 individuals to only 4 fragmented populations within the continental United States. In recent decades, these populations have increased and expanded in size and range due to collaborative conservation efforts and protections under the Endangered Species Act. Today, population estimates exceed 1000 animals each in the Northern Continental Divide Ecosystem (NCDE) and Greater Yellowstone Ecosystem (GYE). The Selkirk Ecosystem (SE) has approximately 50 grizzly bears, and augmentations into the Cabinet-Yaak Ecosystem (CYE) helped boost the population to an estimated 50 – 60 animals. To date, the Bitterroot (BE) and North Cascades Ecosystems (NCE) lack any known permanent residents. Eventual connectivity between populations is a conservation goal, as is establishment of populations in currently unoccupied recovery areas. An understanding of habitat selection by grizzly bears within existing populations is crucial for predicting potential linkage zones and suitable habitat. A

Map »

Spatial Services

ScienceBase WMS : https://www.sciencebase.gov/catal

Communities

• Cooperative Fish and Wildlife Research Units

https://www.usgs.gov

Data Release

umt.edu/coop-unit/sellslab

Funding

MFWP & USGS

Acknowledgements

We thank researchers and managers who contributed to making this work possible, including biologists and technicians whose effort to collar grizzly bears provided the data for this work over the past 20 years.

Special thanks also to Paul Lukacs, Lori Roberts, Milan Vinks, Justin Gude, Hilary Cooley, Jennifer Fortin-Noreus, Wayne Kasworm, Justin Teisberg, Tom Radandt, Frank van Manen, Mark Haroldson, Dan Bjornlie, Cas Waters, & Mike Mitchell.