Comparing habitat use and travel corridors of range-edge Canada lynx (*Lynx candensis*) and bobcat (*Lynx rufus*) and Canada lynx response to habitat fragmentation

Arthur Scully

Range-Edge Populations

- Characteristics

  - Occupy suboptimal fragmented habitats

  - Abiotic conditions reaching their physiological limits

  - Contrasting behavior and genetic makeup from core populations

Continuous range

Hampe and Petit 2005

Range-Edge Populations

- Importance

  - Traits adaptive to changing conditions

  - Differential extinction risks

  - Distinct Conservation Status

Range-Edge Populations

- Trailing and leading range edges

  - Populations on trailing edge receding

  - Populations on leading edge expanding

  - Contrasting responses and processes
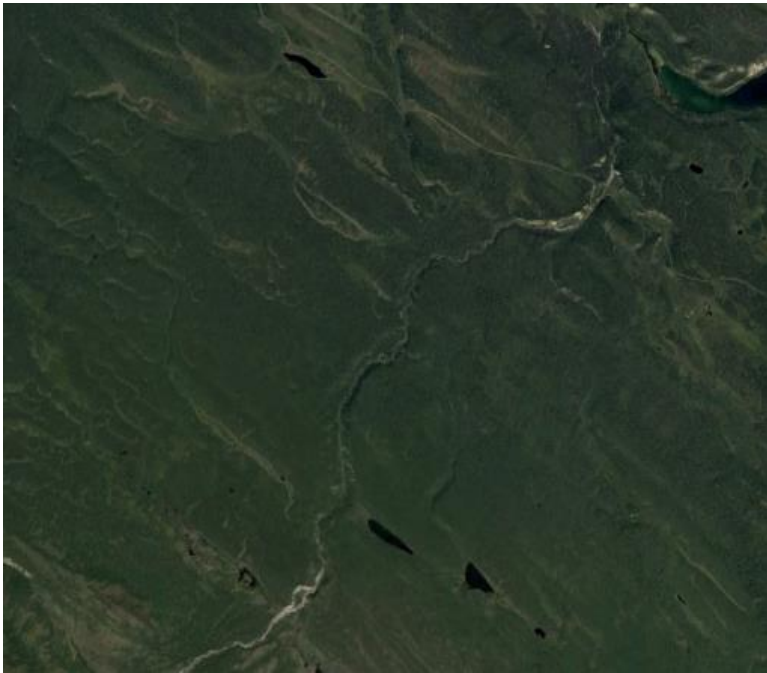
Study System

- Canada Lynx (*Lynx canadenis*)

  - Mesocarnivore felid

  - Specializes on snowshoe hare

  - Boreal forests of North America

  - Cold/snow adaptations

Study System

- Habitat Fragmentation

Core Northern Landscape

Kluane, YT, Boreal Forest Habitat

Southern Range Edge Landscape

Okanagan, BC, Boreal Forest Habitat
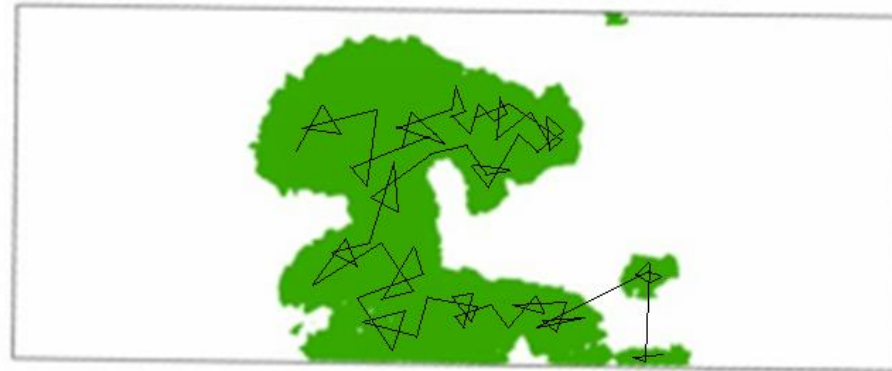
Trailing Edge Lynx Habitat

- Low densities of preferred prey

- High Levels of Fragmentation

- Low available habitat

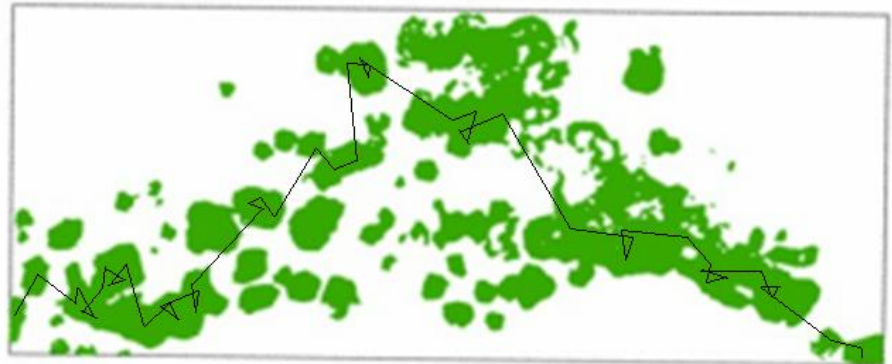- Behavioral Flexibility? (Hornseth et al. 2014)

Hypothesis

1) If lynx are able to persist in heavily fragmented landscapes, then they must exhibit different movement patterns, because they have to travel between many small patches.

Core

Range Edge

Study System

- Bobcat (*Lynx rufus*)
- Canada Lynx (*Lynx canadensis*)

Study System

- Bobcat (*Lynx rufus*)

- Canada Lynx (*Lynx canadensis*)

Study System

- Bobcat (*Lynx rufus*)
- Canada Lynx (*Lynx canadensis*)

Study System

- Bobcat (*Lynx rufus*)

- Northern leading-edge

- Canada Lynx (*Lynx canadensis*)

- Southern trailing-edge

Landscape and climatic heterogeneity due to geographic features

- Sustained by northward dispersals

- Sustained by southward dispersals

Hypothesis

2) If higher foot-loads restrict long range movements through deep snow, then bobcat will use corridors with low snow-depth and lynx corridor use will not be affected by snow-depth, because bobcat have a higher foot-load than lynx.

Hypothesis

3a) If bobcat movement is restricted by snow, then their selection of habitat at their northern range edge will interact with season, because they will avoid areas of high snow accumulation.

Hypothesis

3b) If lynx movement is not restricted by snow, then their selection of habitat along their southern range edge will not interact with season, because they will not avoid areas of high snow accumulation.

Questions

1) Do lynx exhibit differential patterns in movement along a latitudinal gradient in response to habitat fragmentation?

2) Is snow depth a major resistance to range edge dispersals for bobcat, but not for lynx because of their differential footloads?

3) Where sympatric, is bobcat's habitat selection mediated by season while lynx's isn't due to their contrasting ability to move through snow.
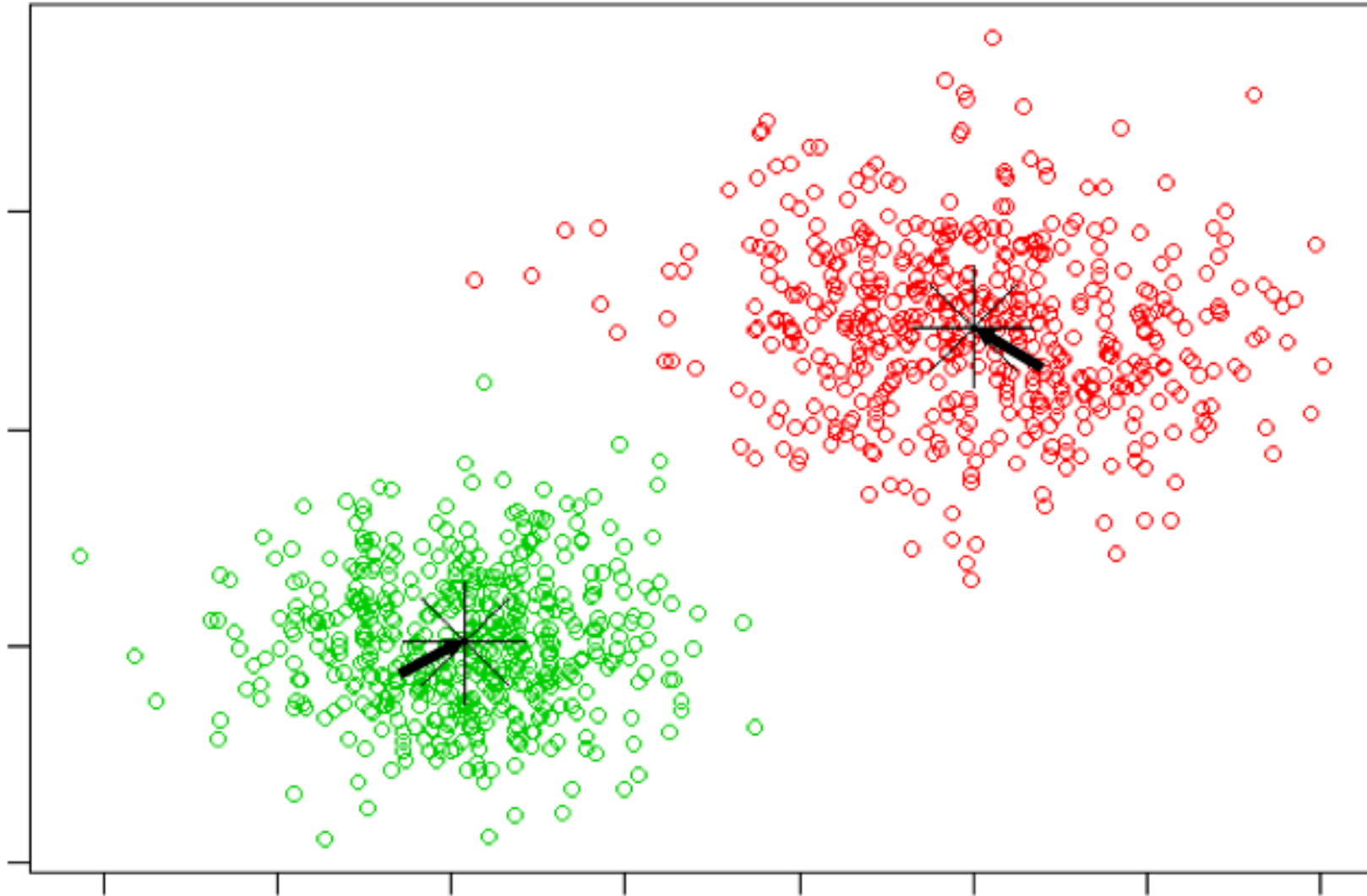
Data

- Collar Data from 10 Provinces/States
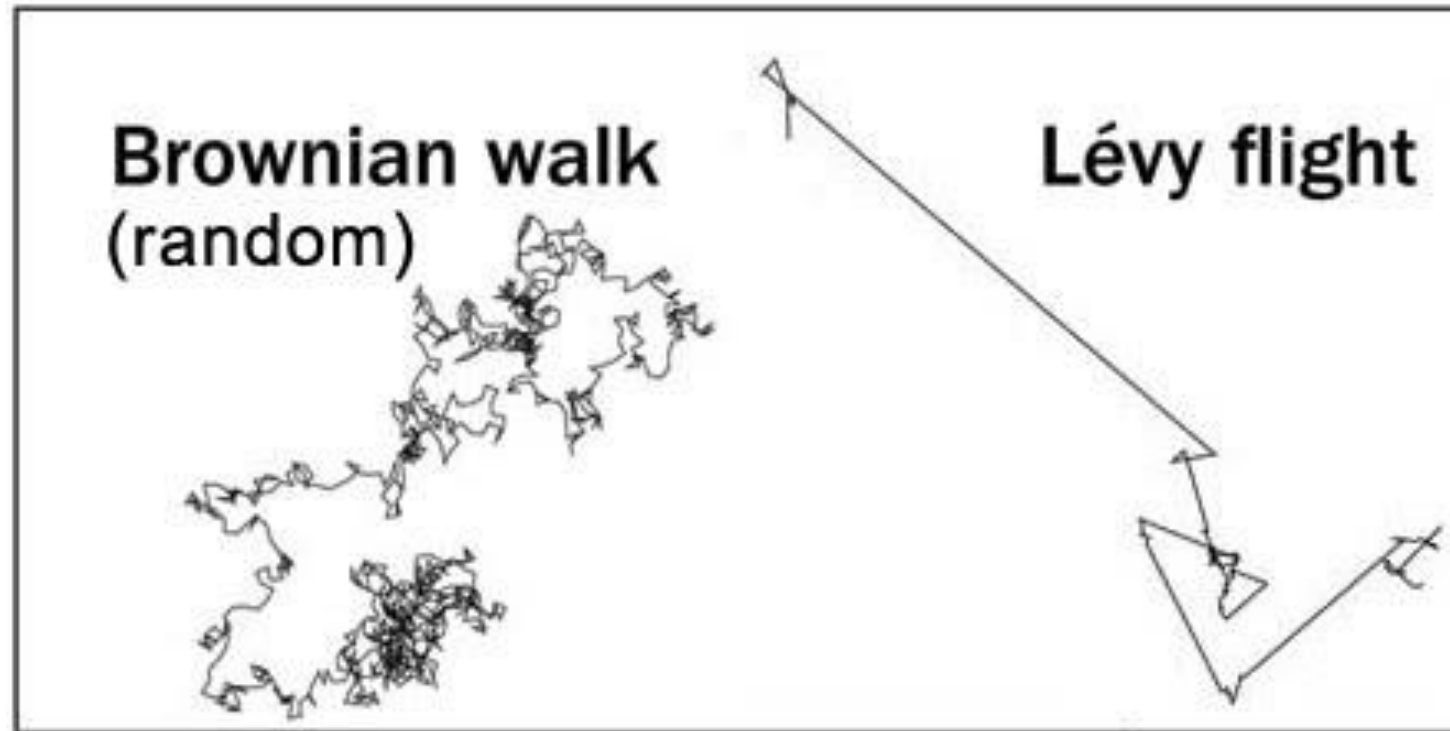
- Along a Latitudinal Gradient

K-Means Clustering

Predictions

1) Lynx movement will change from Lévy to Brownian movement patterns from their range edge to their range core.

Brownian walk (random)   Lévy flight

Continentwide lynx/bobcat corridor comparison

- Heterogeneous landscapes

- Potential dispersal limitations

  - The Great Lakes

  - North American Mountain Ranges

Continentwide lynx/bobcat corridor comparison
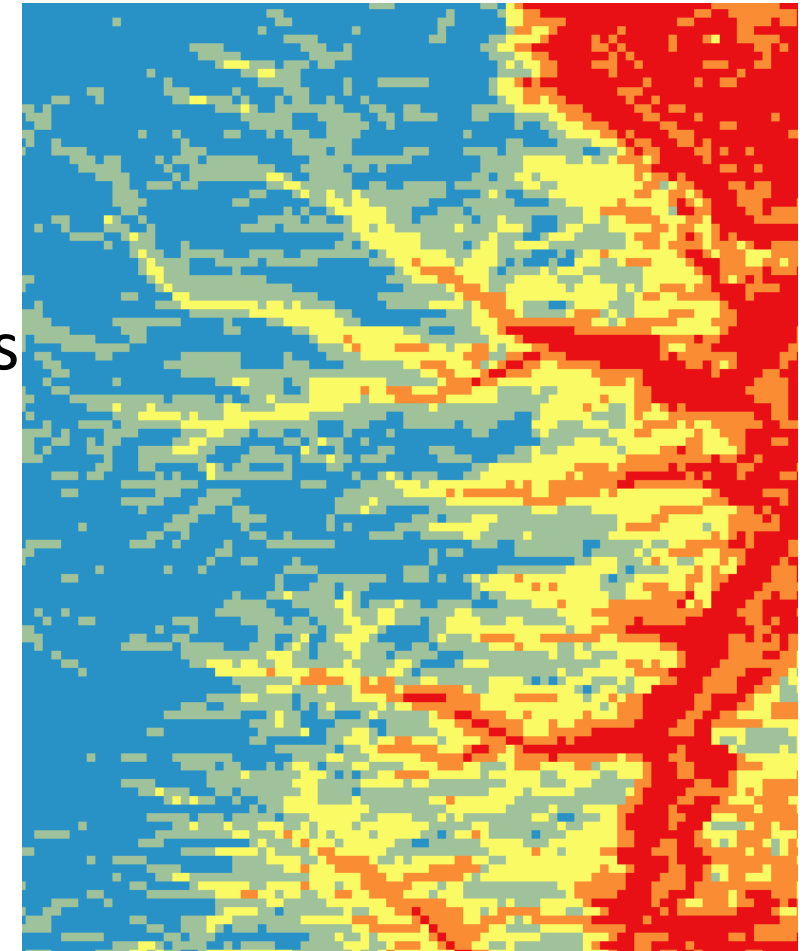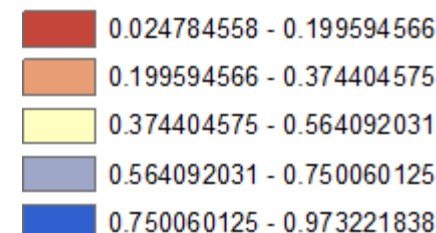
- Lynx and bobcat locations from harvest

Continentwide lynx/bobcat corridor comparison

- Coarse use/available RSF from location Data
  - Covariates: topography and snow

- Resistance layer calculated from parameter estimates
  - $$\frac{\exp(\beta_1 x_1 + \beta_2 x_2 \ldots + \beta_n x_n)}{1 + \exp(\beta_1 x_1 + \beta_2 x_2 \ldots + \beta_n x_n)}$$
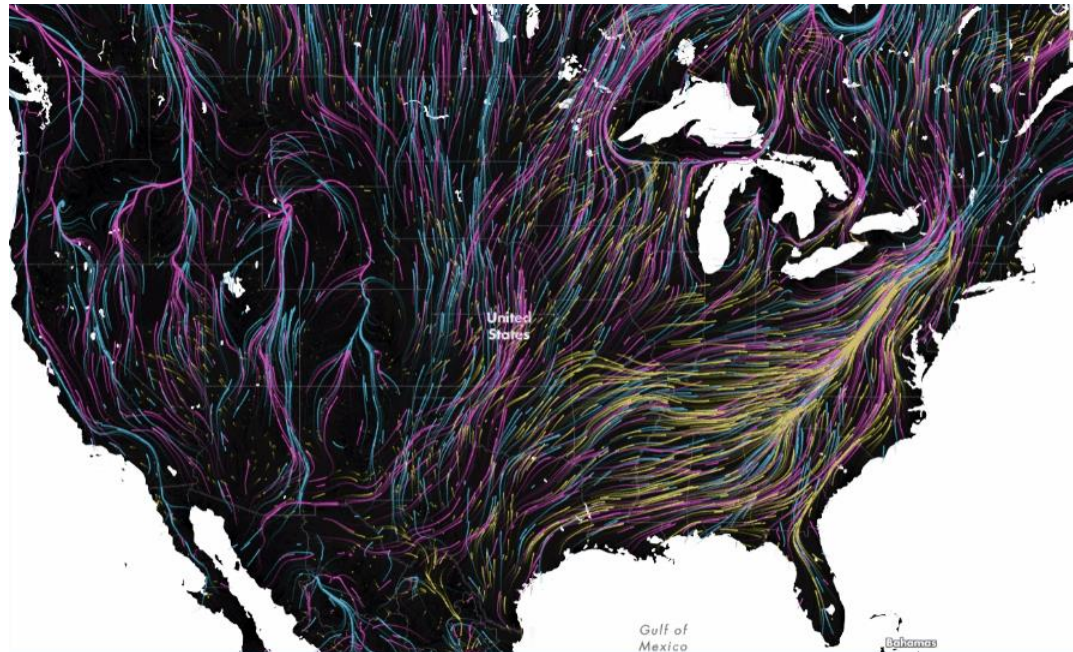

Legend

Resistance

🟥	0.024784558 - 0.199594566
🟧	0.199594566 - 0.374404575
🟨	0.374404575 - 0.564092031
🟦	0.564092031 - 0.750060125
🟦	0.750060125 - 0.973221838

Continentwide lynx/bobcat corridor comparison

- Identify and compare corridors for lynx and bobcat
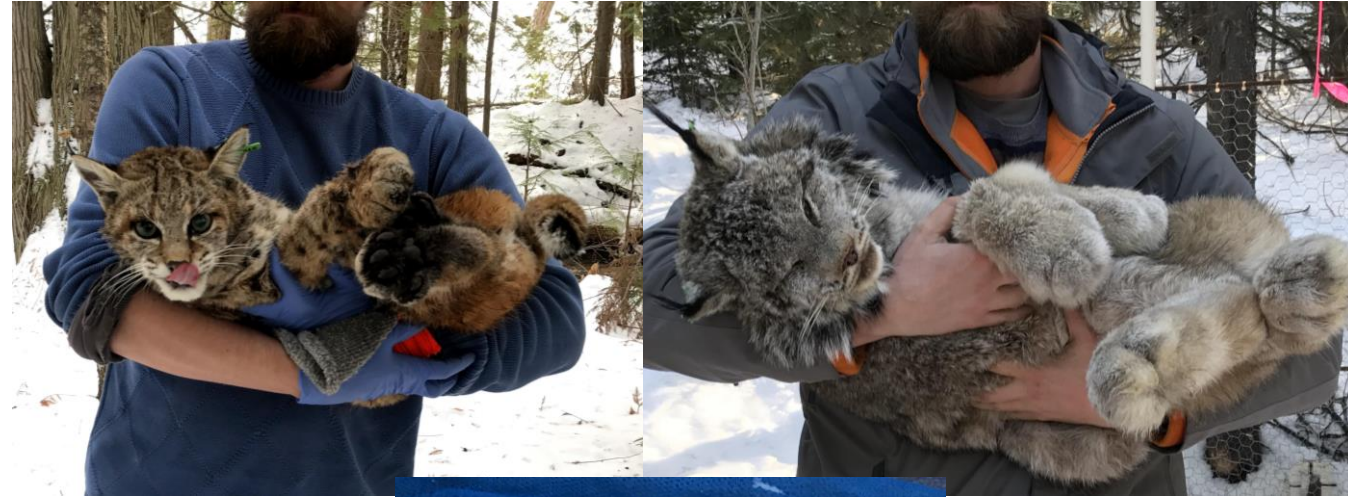
- Circuitscape resistance mapping

Predictions

2) Snow-depth will correlate with resistance to bobcat dispersal to range edge populations but it will not impact lynx dispersal.

Lynx/bobcat seasonal habitat selection comparison

- Bobcat and lynx in southern BC

- High Probability of Sympatry

- GPS radio Collars

Heterogeneous Landscape

- Elevation Range
  - 350 m – 1500 m

- Habitat types
  - Forest diversity, scree, farmlands

- Snow
  - High accumulation and retention in the mountains
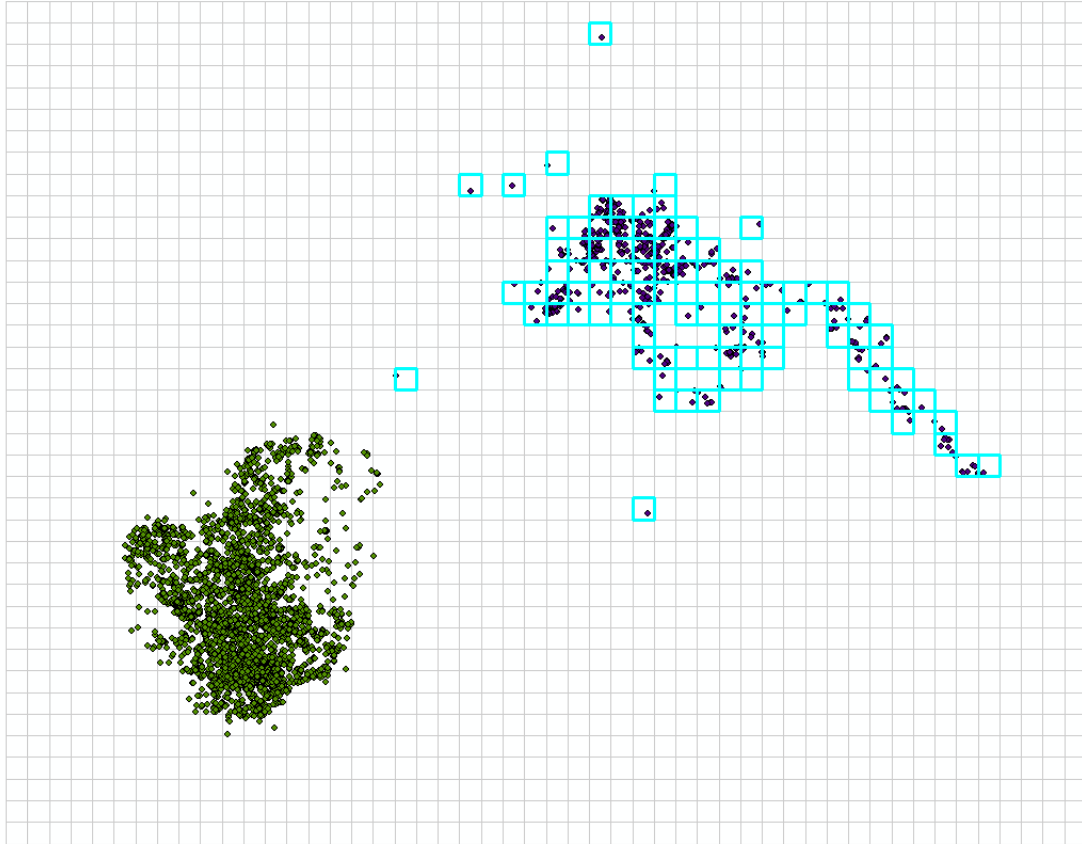 - Low in the valley

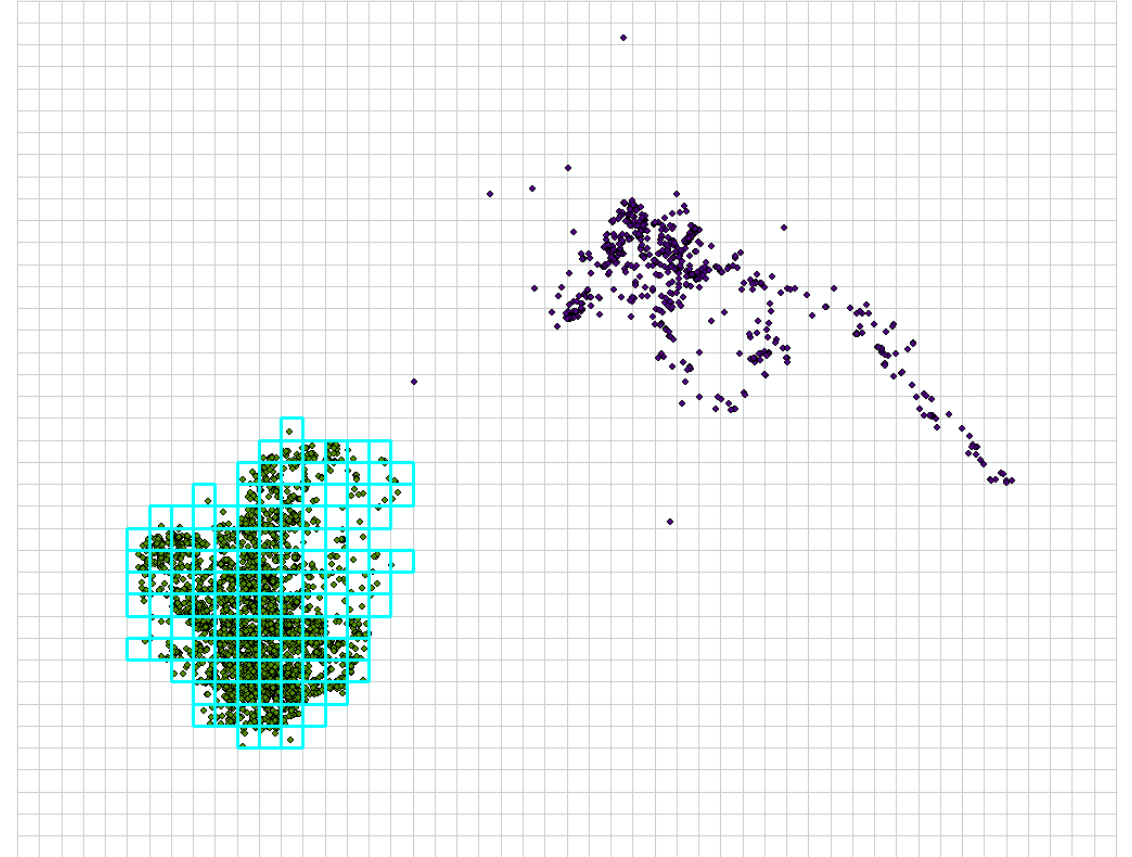# Resource Selection Function

- Use/Availability

- Overlay grid of available
  - Encompass home ranges

- Environmental covariates
  - Elevation
  - Slope
  - Aspect
  - Season's interaction
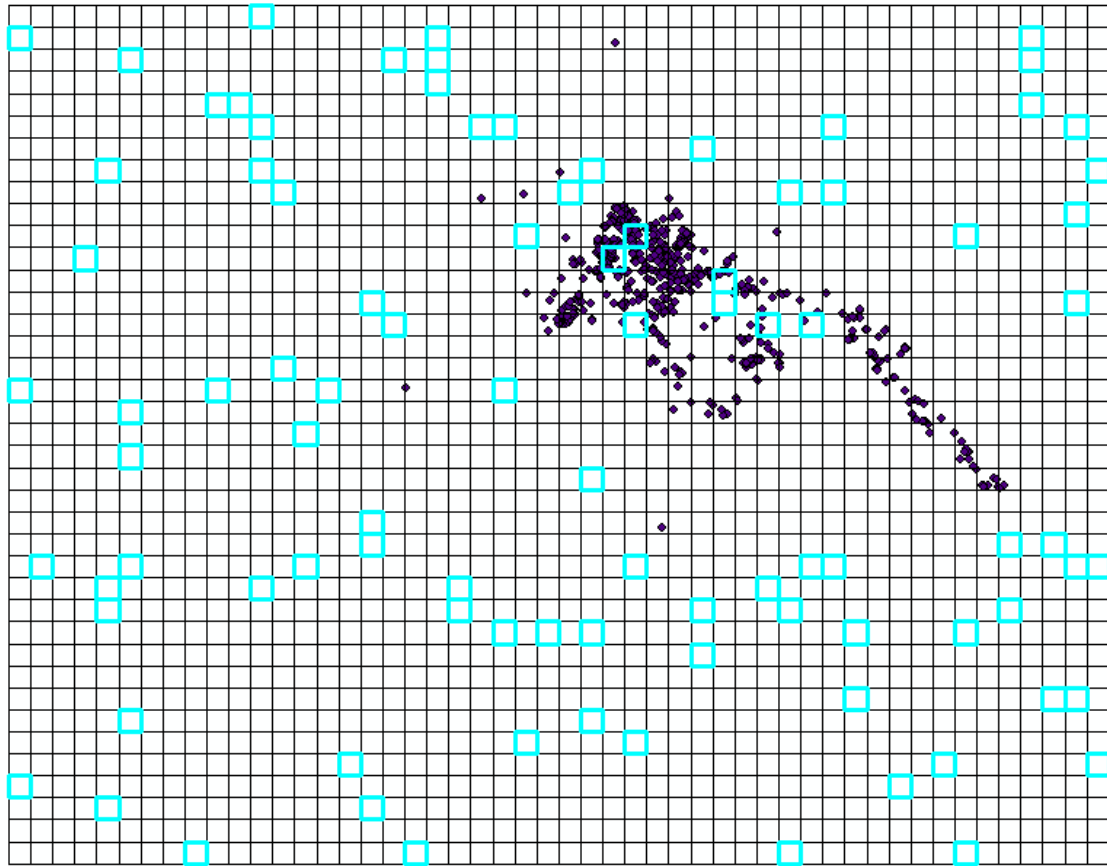   - Snow-on vs. Snow-off
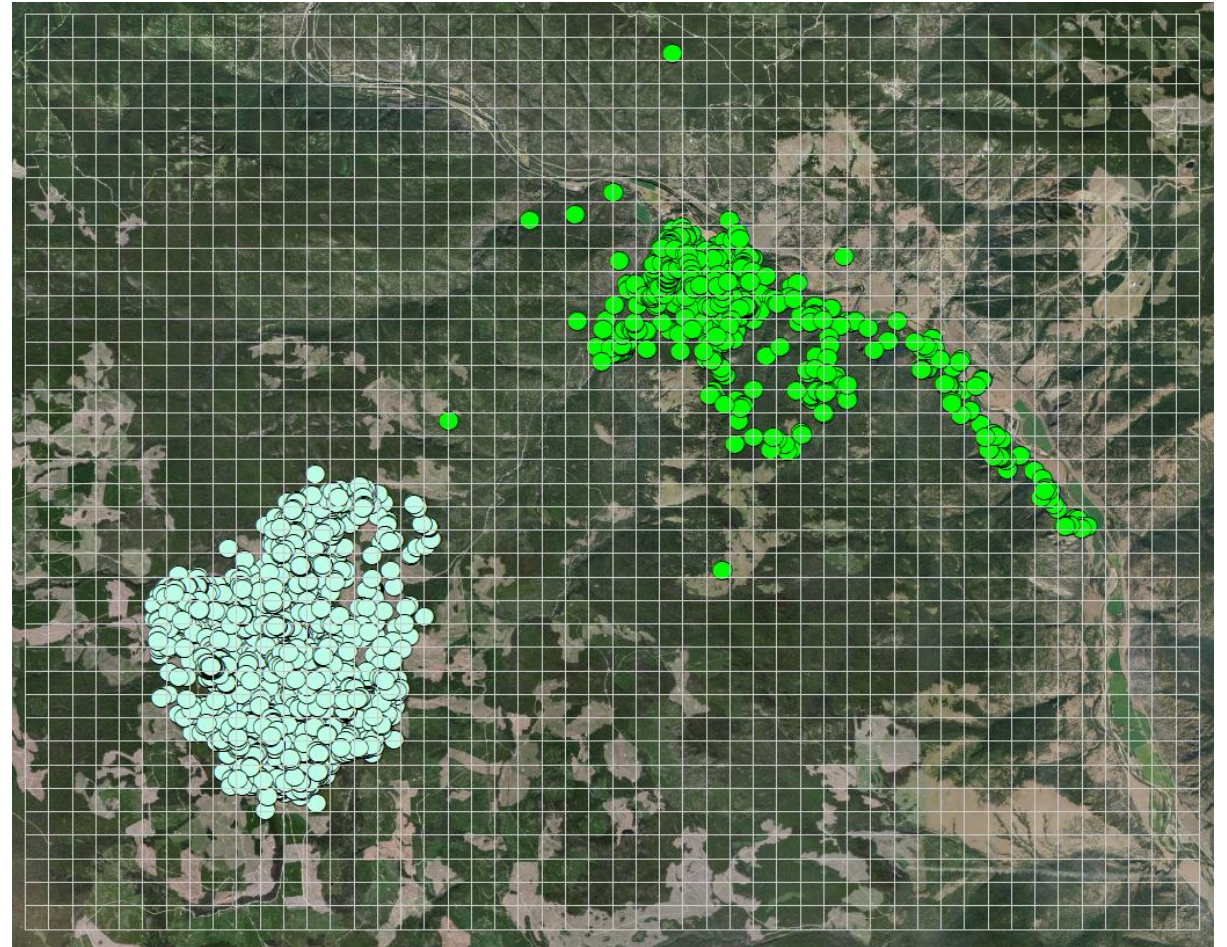
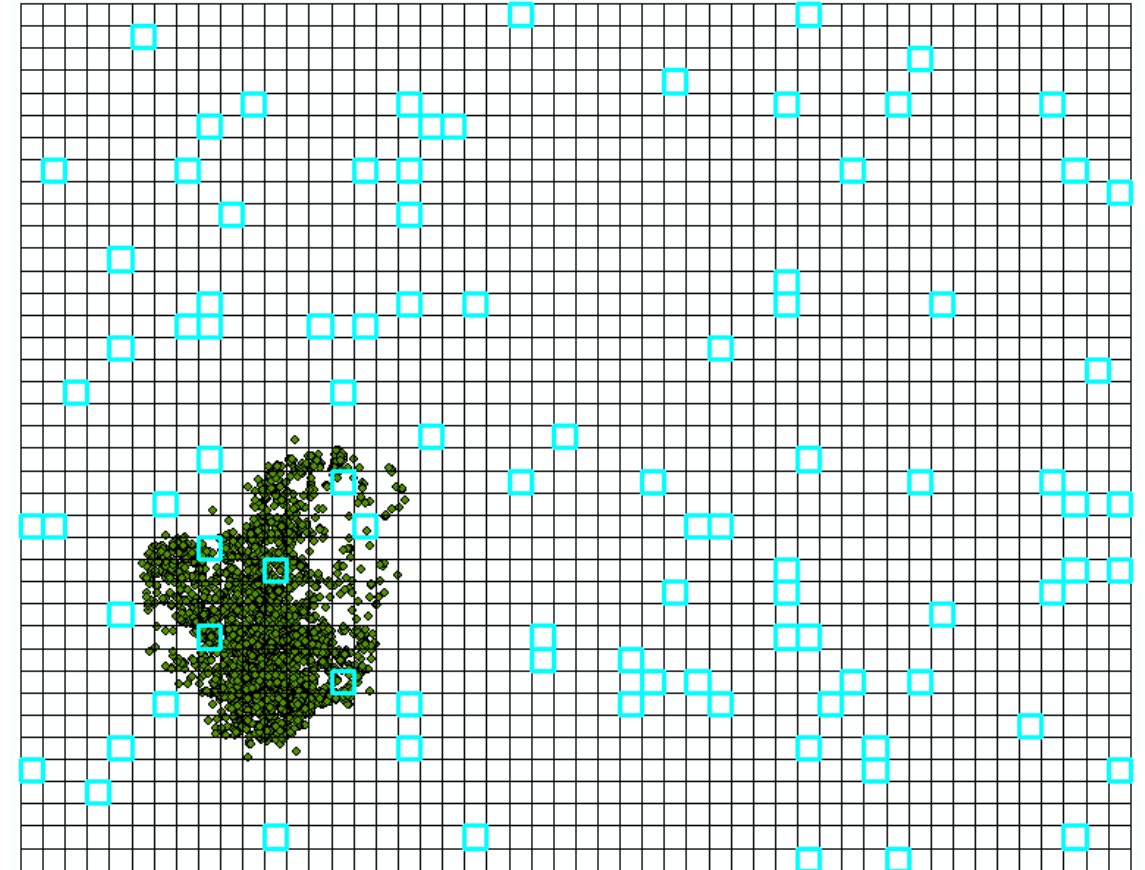# Resource Selection Function

Bobcat Used = 99 Cells
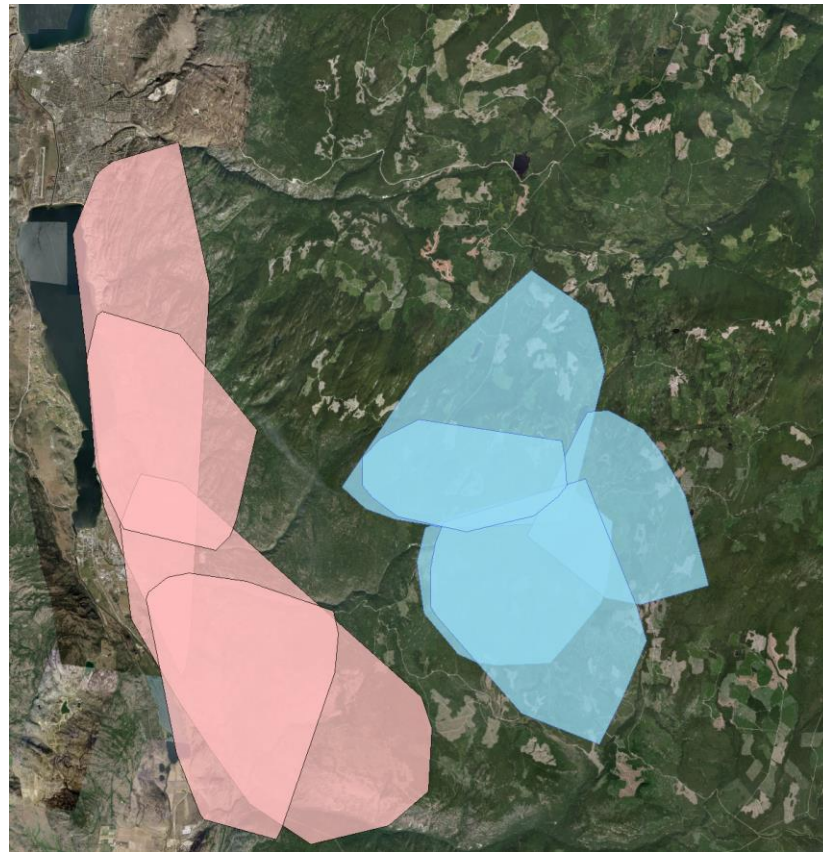
Lynx Used = 127

Resource Selection Function
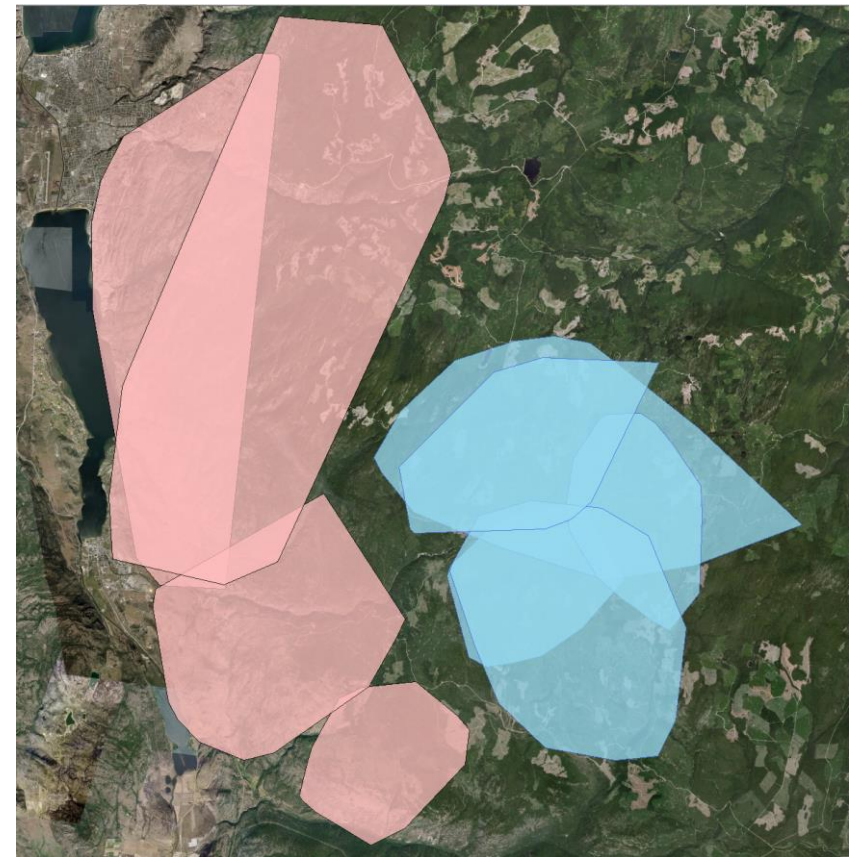

Bobcat Available = 99 Cells

Lynx Available = 127

Data Collection

- Three years of Collaring Lynx and Bobcat with proximate home ranges

Canada Lynx

Bobcat

Winter Home Ranges

Summer Home Ranges

Predictions

3) At their range edge contact zone, environmental covariates' interaction with season will influence bobcat but not lynx.

Data Collection

- Crucial direction and oversight from local stake-holders

Ross Everatt
Local Trapper

Alan Peatt
Local Biologist

Acknowledgements

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  - Dr. Dennis Murray
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  - Dr. Daniel Thornton
    - Washington State University
- Field Work Supervisors
  - Alan Peatt
    - Biologist
  - Ross Everatt
    - Trapper

Thank You

Questions?