From pikas to grizzly bears
Wildlife population trends in Banff National Park

Jesse Whittington
Ecological Integrity Monitoring
Parks Canada, Banff Field Unit

Our work!

- Long-term monitoring
  - State of the Park & Ecosystem Health
- Park Management Plan
- Species at Risk
  - Monitoring
  - MultiSpecies Action Plans
- Applied science, monitoring, & management
  - Collaboration: universities and other organizations.
  - Local, Regional, & Global trends

Ecological Integrity Monitoring Team

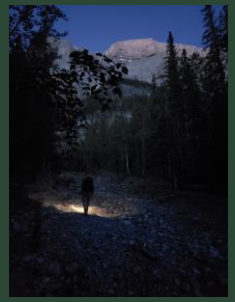
Robin Baron
Cathy Gill
Jaime Hood
Sara Jaward
Petah Low
Geoff Prophet
Adam Zier-vogel
Students
Horses











Collaborators

- Mountain Parks Resource Conservation Teams:
  - Banff, Kootenay, Yoho, Jasper, Waterton, Revelstoke, & Glacier National Parks
  - Anne Forshner, Barb Johnston, Bryan Macbeth, Karsten Heuer, Seth Cherry, Saundi Norris, Tony Einfeldt, Brenda Shepherd, Helena Mahony, Jennifer Greenwood, & Teams!
- Government of Alberta:
  - John Paczkowski - Alberta Parks
- Universities & graduate students!
- University of Montana:
  - Mark Hebblewhite
  - Connor Meyer, Jonathan Farr, Tara Meyer, Birch Gano.

State of the Park & Ecosystem Health

Banff National Park of Canada

Ecosystems

- 5 Forest ↔
- 5 Freshwater ↔
- 5 Tundra ↔

→ BNP State of the Park Report
National trends in Ecological Integrity

Integrated program:
- Aquatics
- Fire & Vegetation
- Wildlife
- Ecological Integrity Monitoring

5 Forest ↔

- Non-Native Vegetation ✱
- Area Burned by Condition Class ↔
- Multi-species Mammal Occupancy ↔
- Avian Species Relative Abundance ↔
- Winter Wildlife Corridor Function ↔

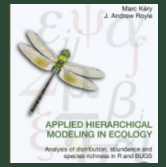
5 Freshwater ↔

- Lake Fish Index ↔
- Water Connectivity ↔
- Water Quality ↔
- River/Stream Index of Biotic Integrity ✱
- Amphibian Occupancy ↔

5 Tundra ↔ Alpine

- Alpine Extent ✱
- Sensitive Large Mammal Species - Goats ↑
- Non-Native Vegetation ↑
- Alpine Terrestrial Birds ↔
- Small Mammal Alpine Obligate - Pika ↔

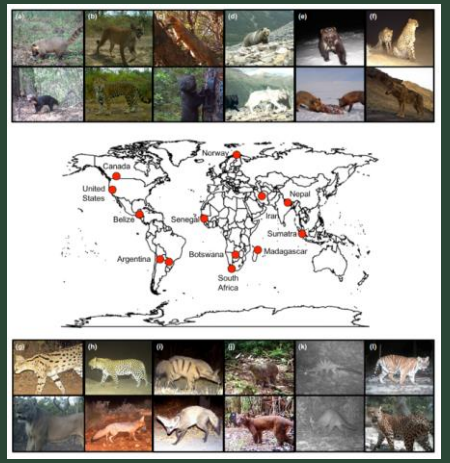
Remote Cameras: Open Frontier



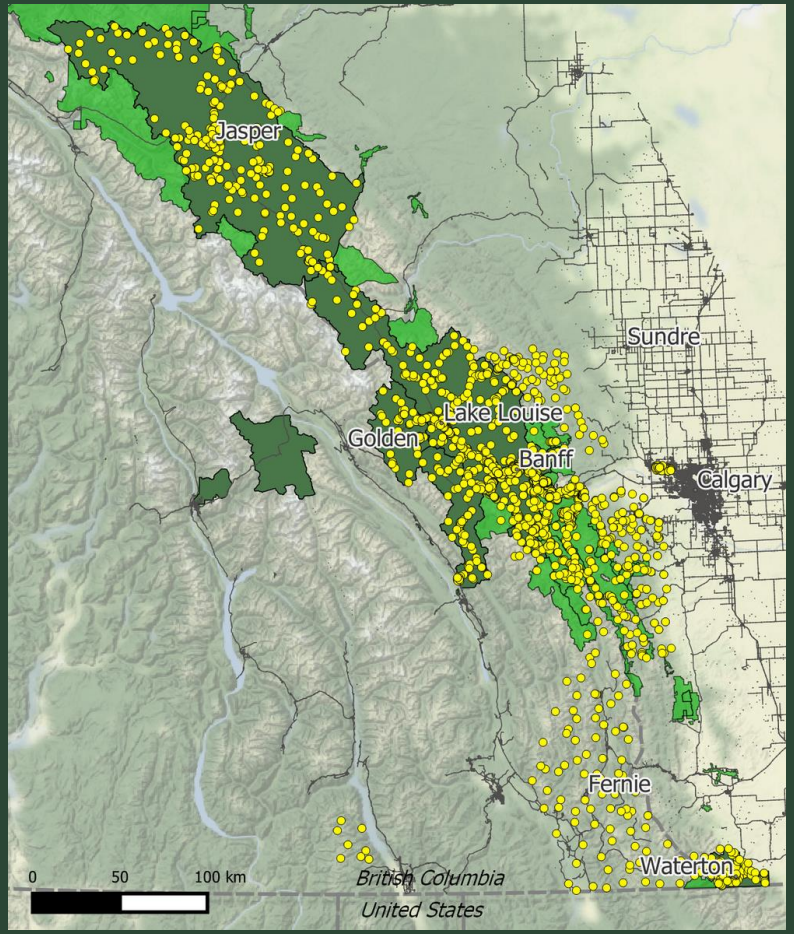
- Rapidly developing methods: detections -> abundance

- Efficient image classification:
  - TimeLapse – Saul Greenberg
  - MegaDetector
    - Microsoft AI for Earth, Google, Wildlife Insights
    - Banff contributed 7 million images

- Global Collaboration
  - e.g. >13 publications with university researchers



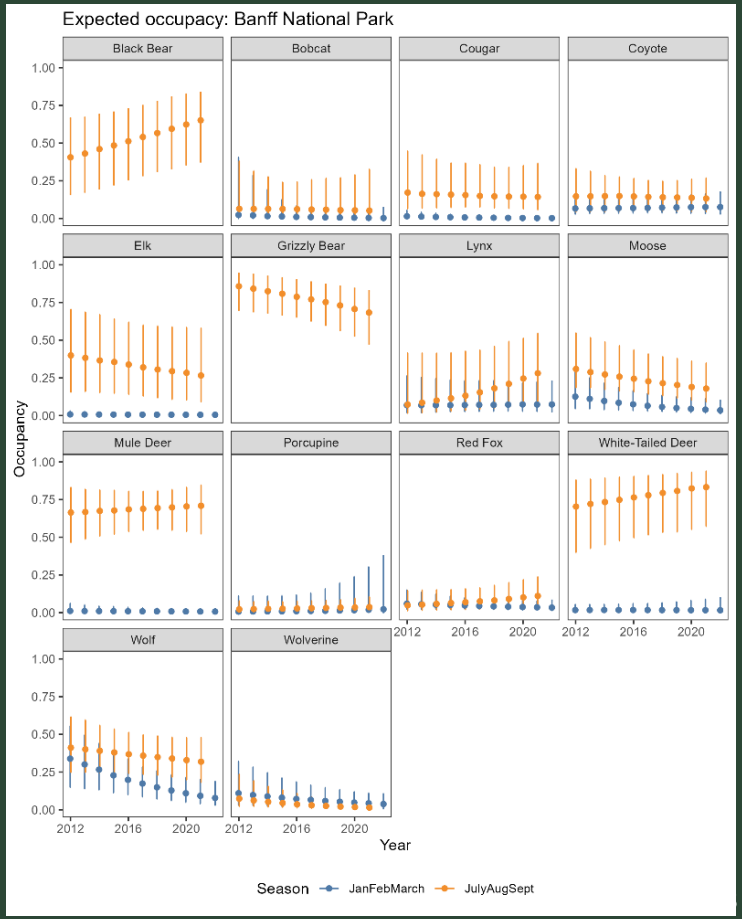
Remote Cameras: 2012 - 2023



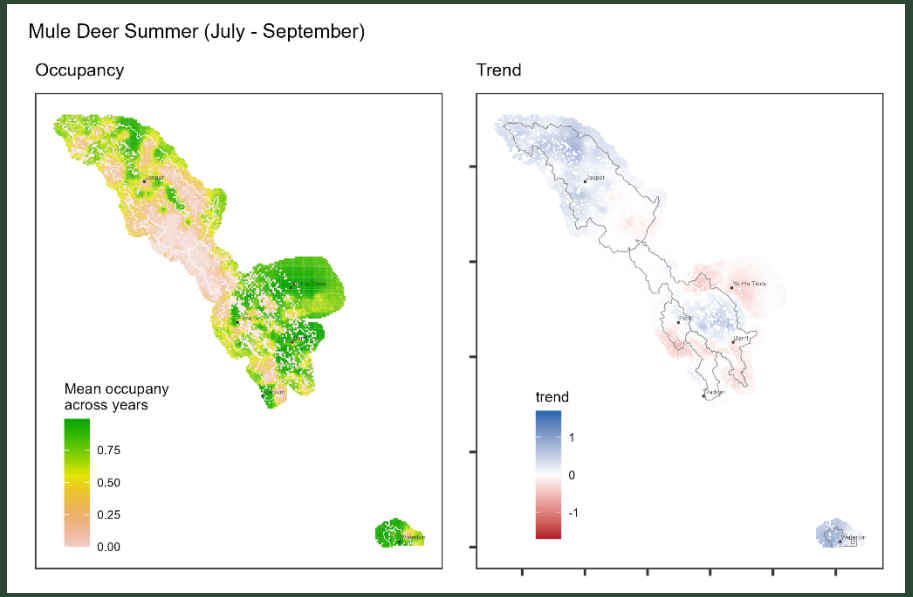
Trends in occupancy

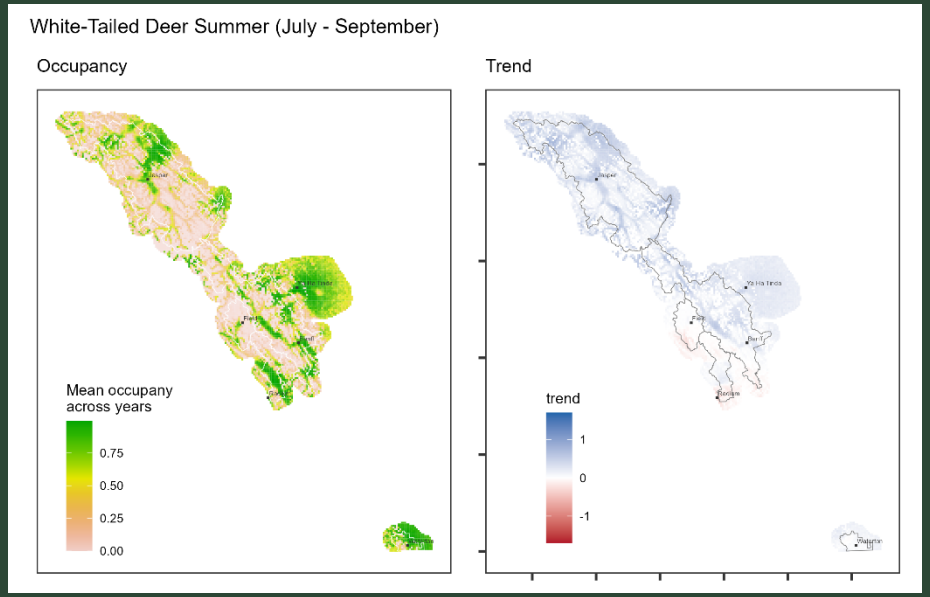
Occupancy:

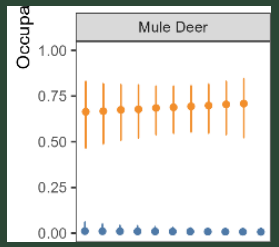
- Presence-Absence
- Species range
- Index of abundance

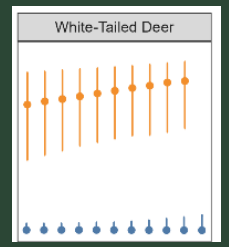


Deer







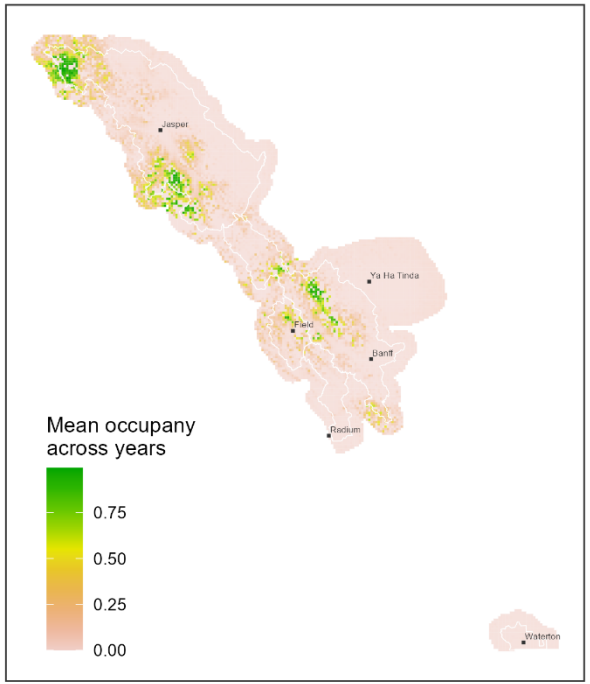


Chronic wasting disease?

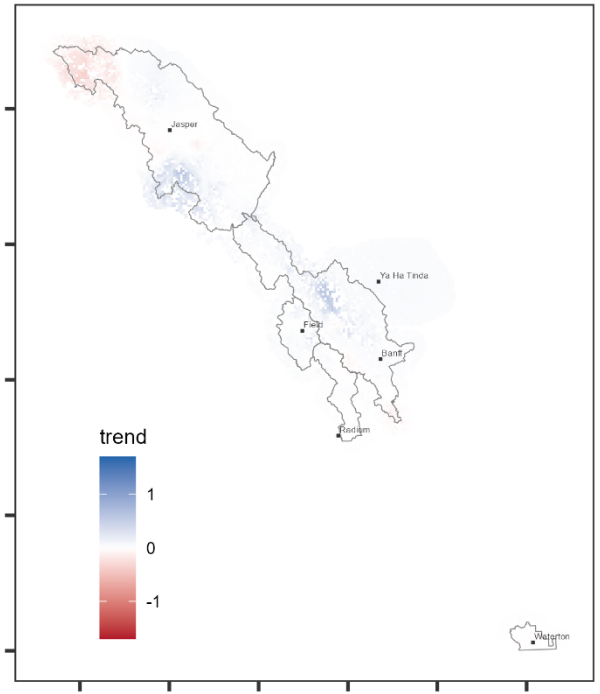
Porcupine

Porcupine Summer (July - September)

Occupancy

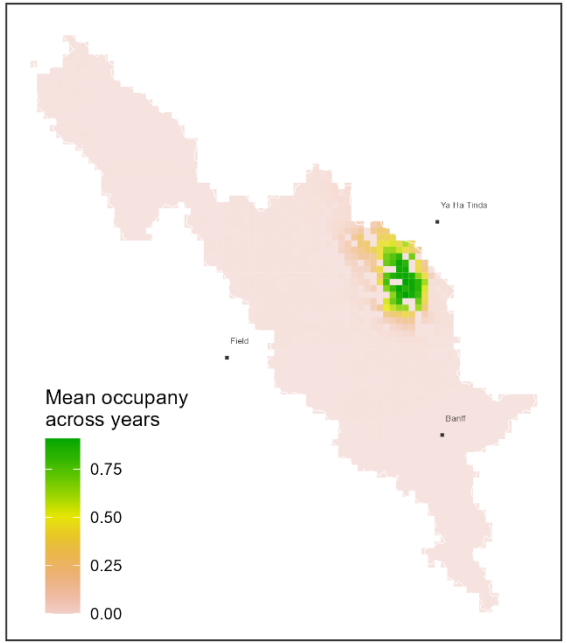


Trend

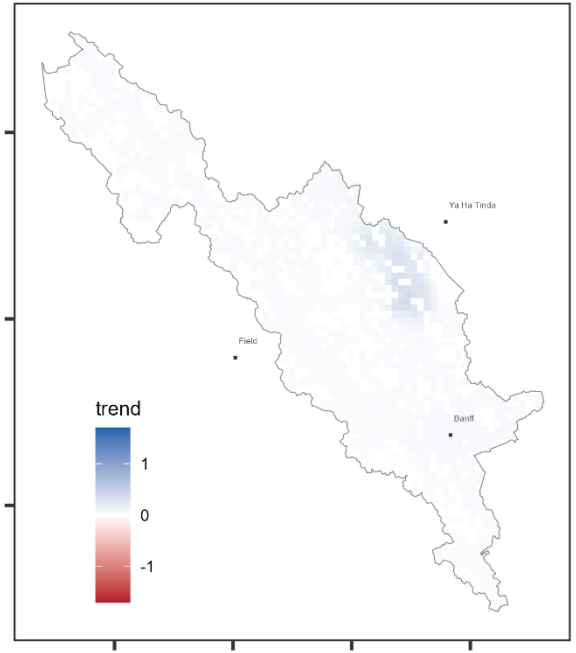


Bison

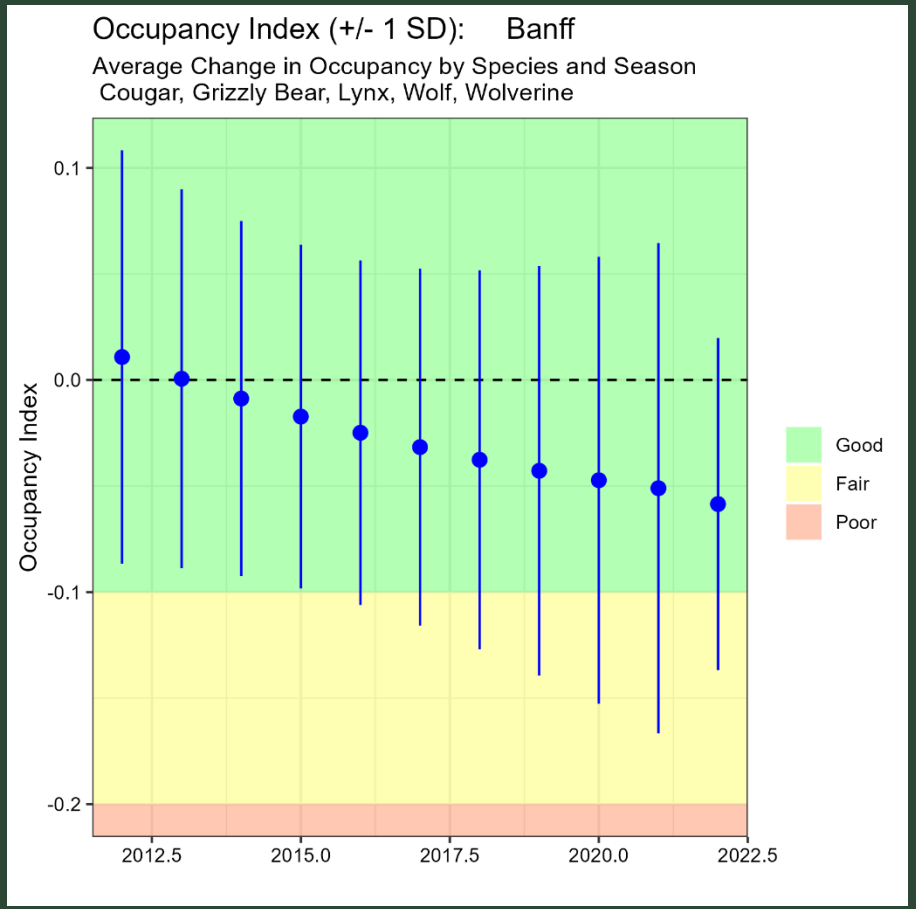
Occupancy



Trend



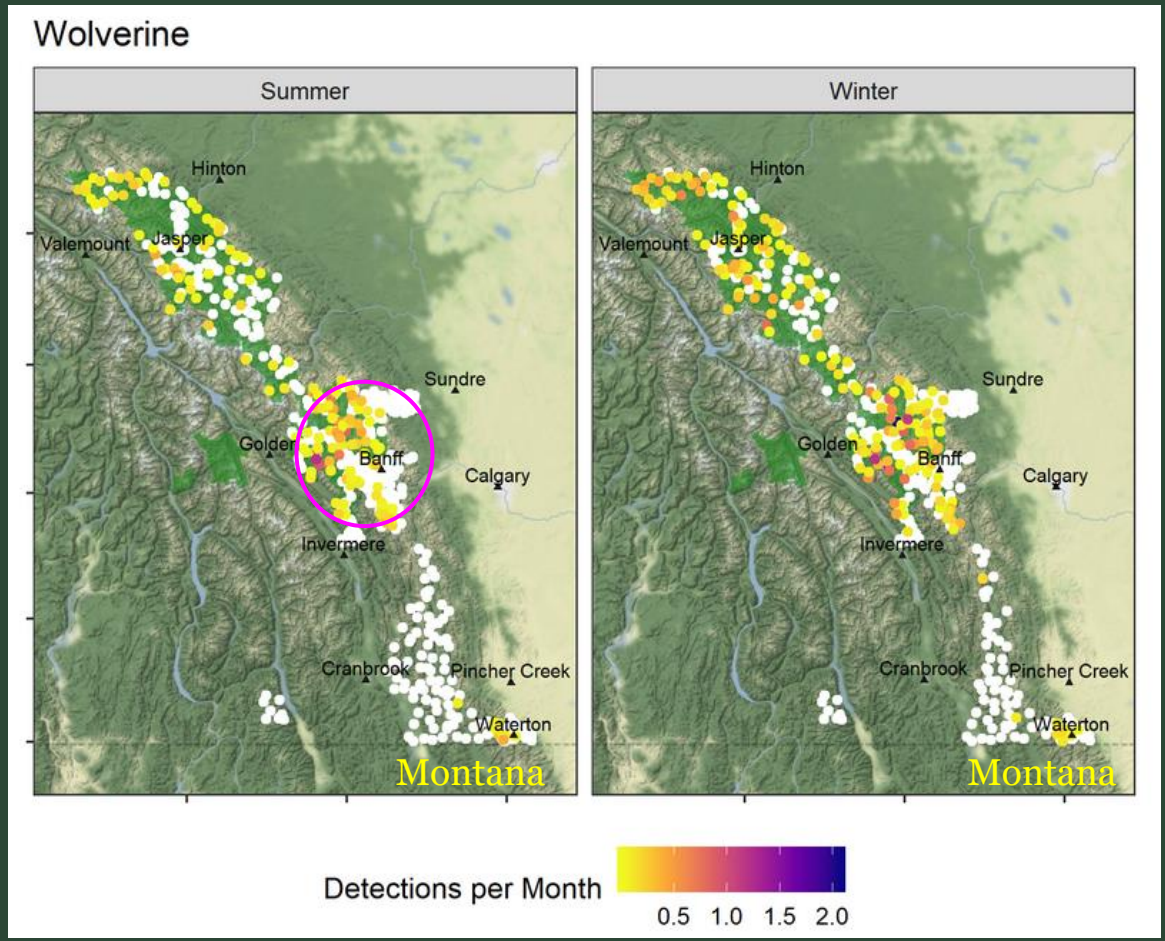
Multi-Species Occupancy



Wolverine

Wolverine: Remote Cameras

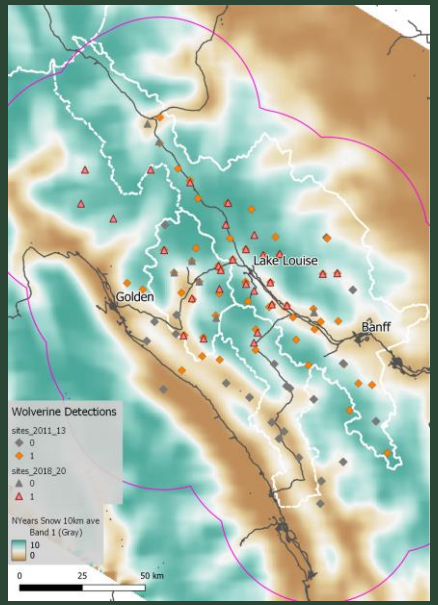
- Spring Snow Cover
- Protected Areas



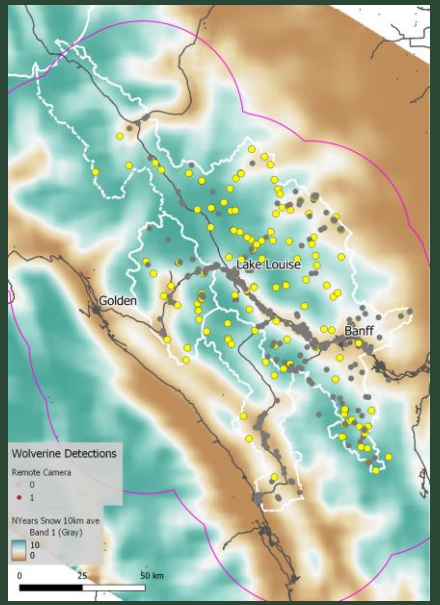
How many wolverine? Trends?

Mirjam Barrueto, PhD candidate, University of Calgary
Anne Forshner (Parks Canada) and Teams!

DNA & camera ID
2011 – 2013
2018 - 2020



Remote camera
2011 – 2020



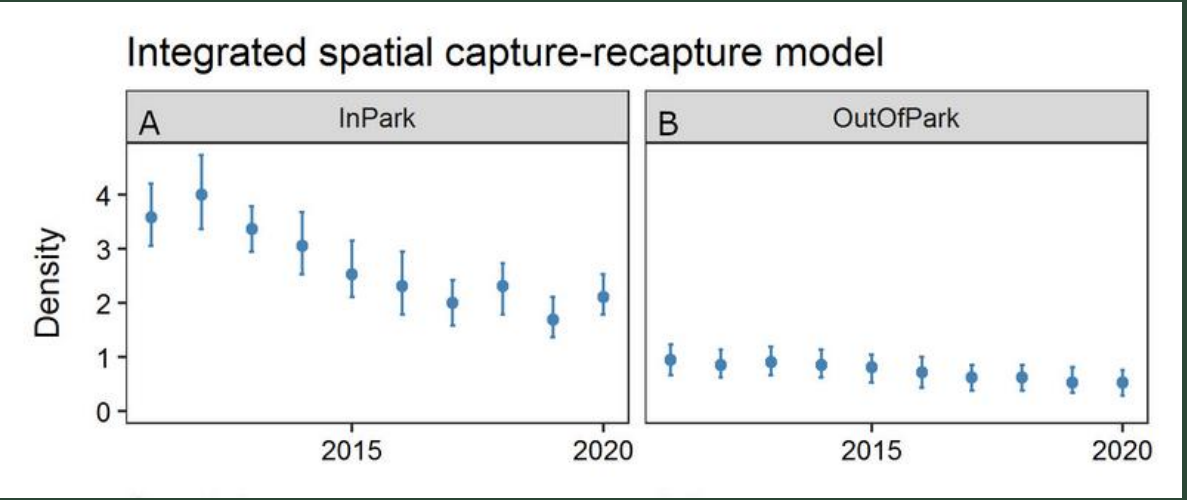
Wapta wolverine video

Wolverine Trends

39% decline in 10 years

Realized abundance estimate 2020: 13 females & 17 males within 15,000 km^2

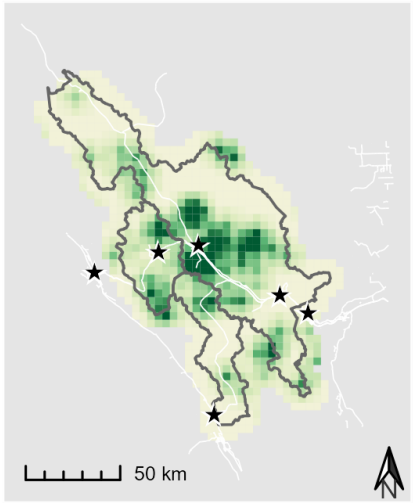
United States listed as *Threatened* this fall

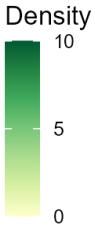


Barrueto, M., A. Forshner, J. Whittington, A. P. Clevenger, and M. Musiani. 2022. *Protection status, human disturbance, snow cover and trapping drive density of a declining wolverine population in the Canadian Rocky Mountains*. Scientific reports **12:17412.**

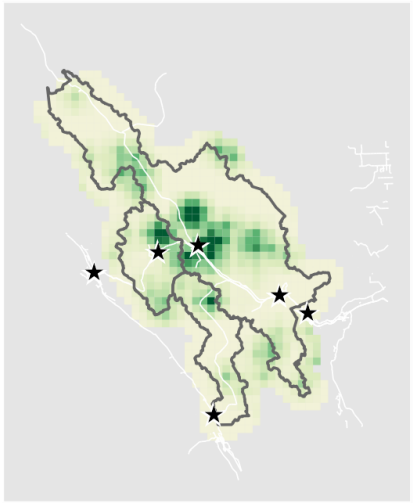
Wolverine Trends

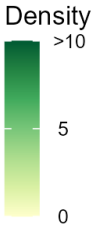
Average density 2011 - 2015



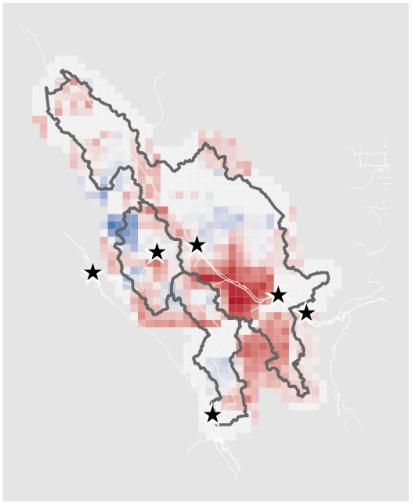


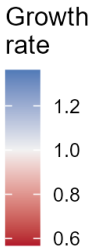
Density 2016 - 2020





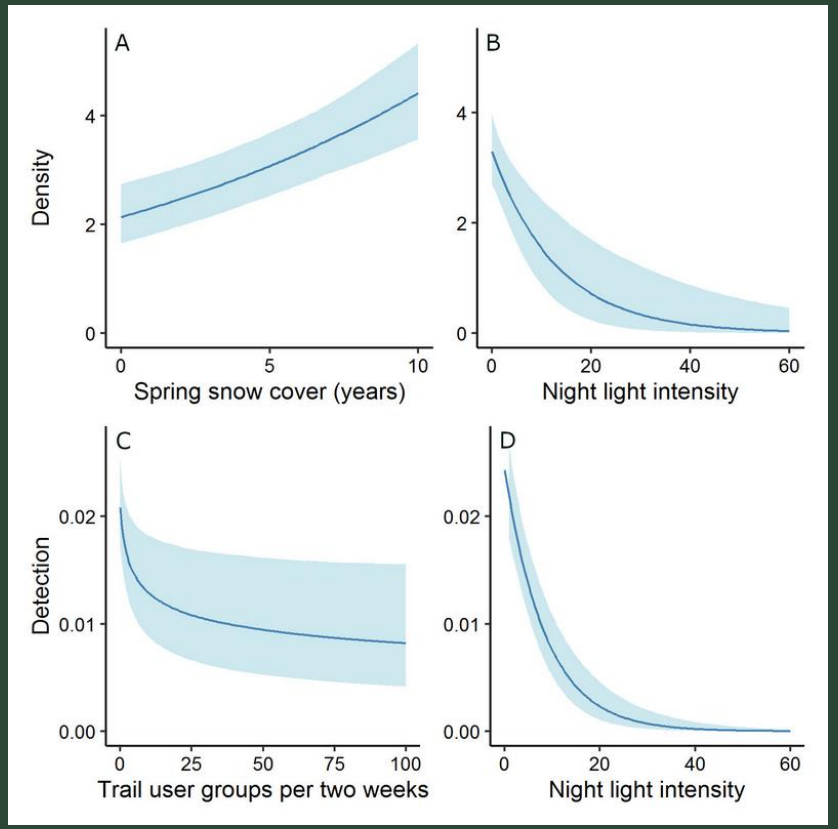
Growth rate 2011 - 2020





Why decline?

- Trapping: 34 wolverine over 10 years
- Habitat loss from human activity
- Climate change
- Connectivity
- Small population effects



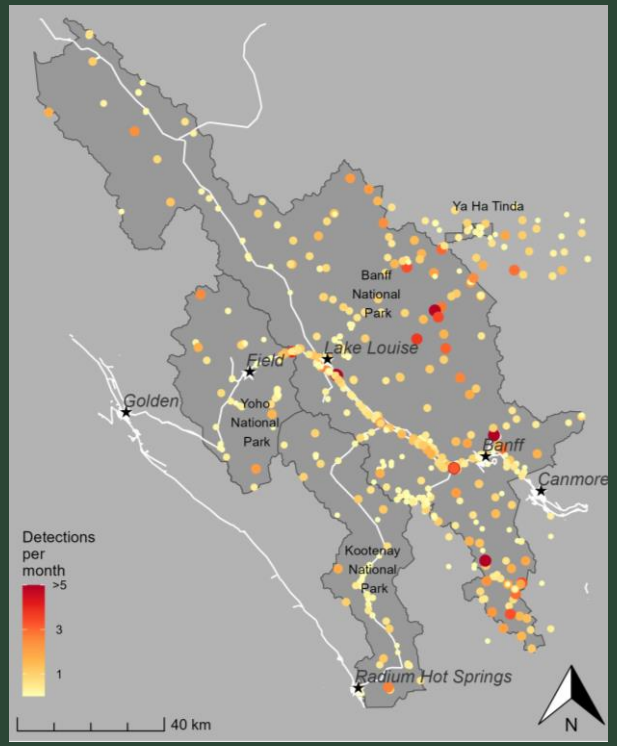
How many grizzly bears? Trends?

J. Whittington, M. Hebblewhite, C. Meyer, Johnston, A. Forshner, B. Macbeth, T. Einfeldt, S. Cherry, *in review*

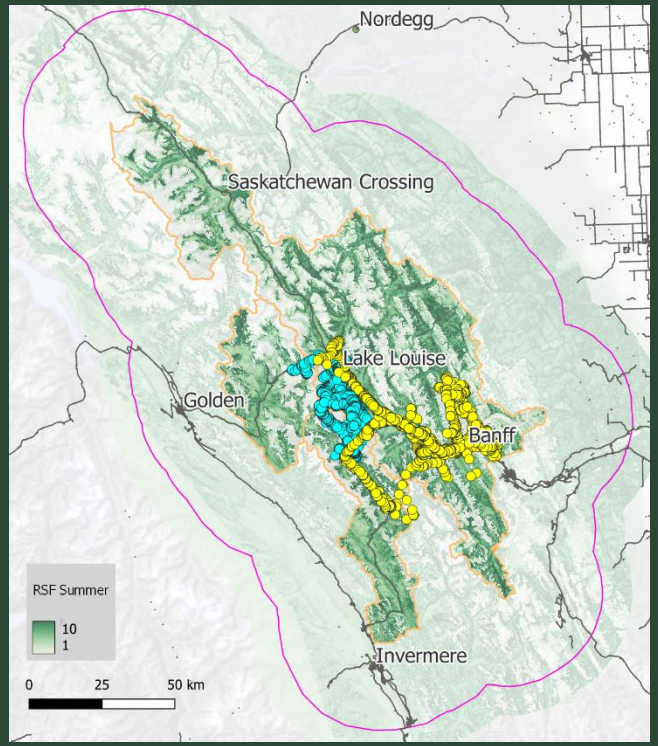
Marked animals → Detection → Abundance

$$Abundance = \frac{Number\ Observed}{Detection\ Probability}$$

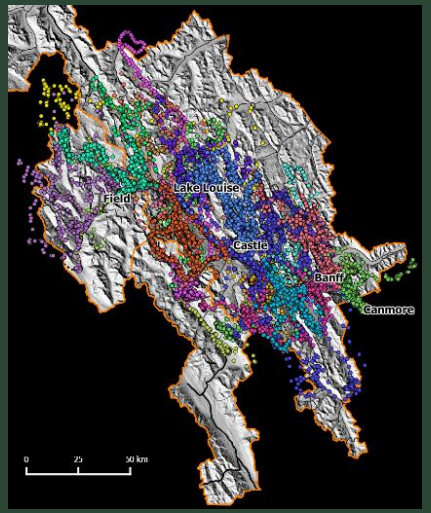
Remote Camera



RSF + GPS

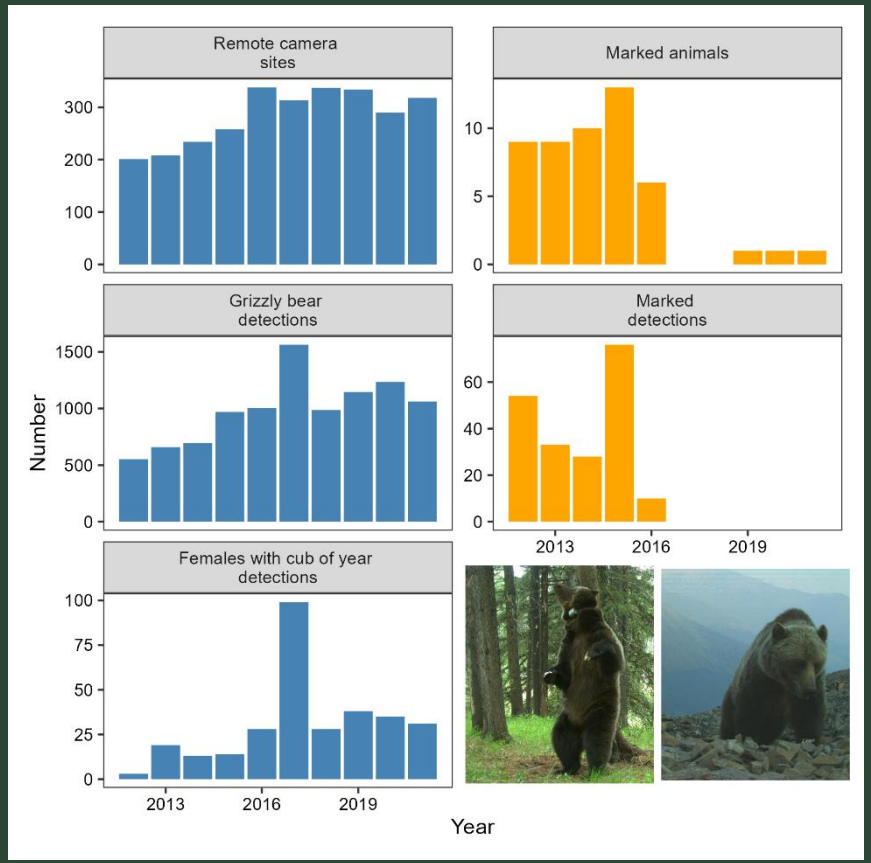


GPS data: 22 bears

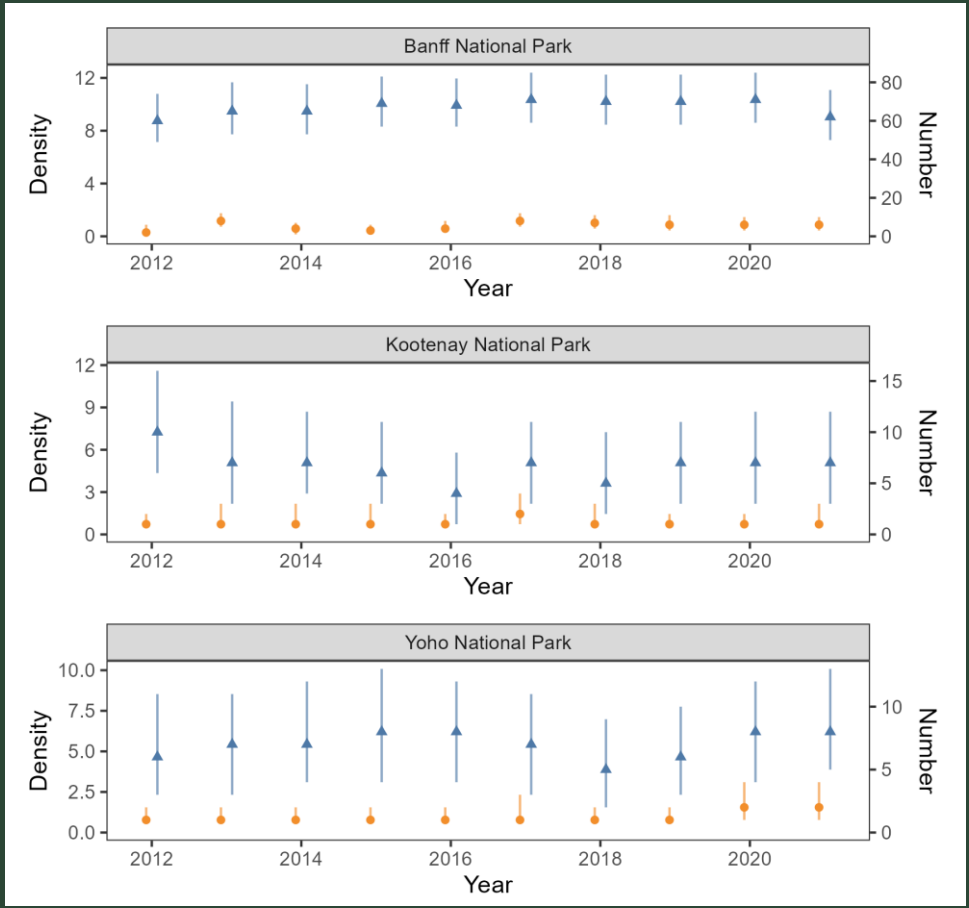


e.g. Female 72 & Male 122 (Boss)

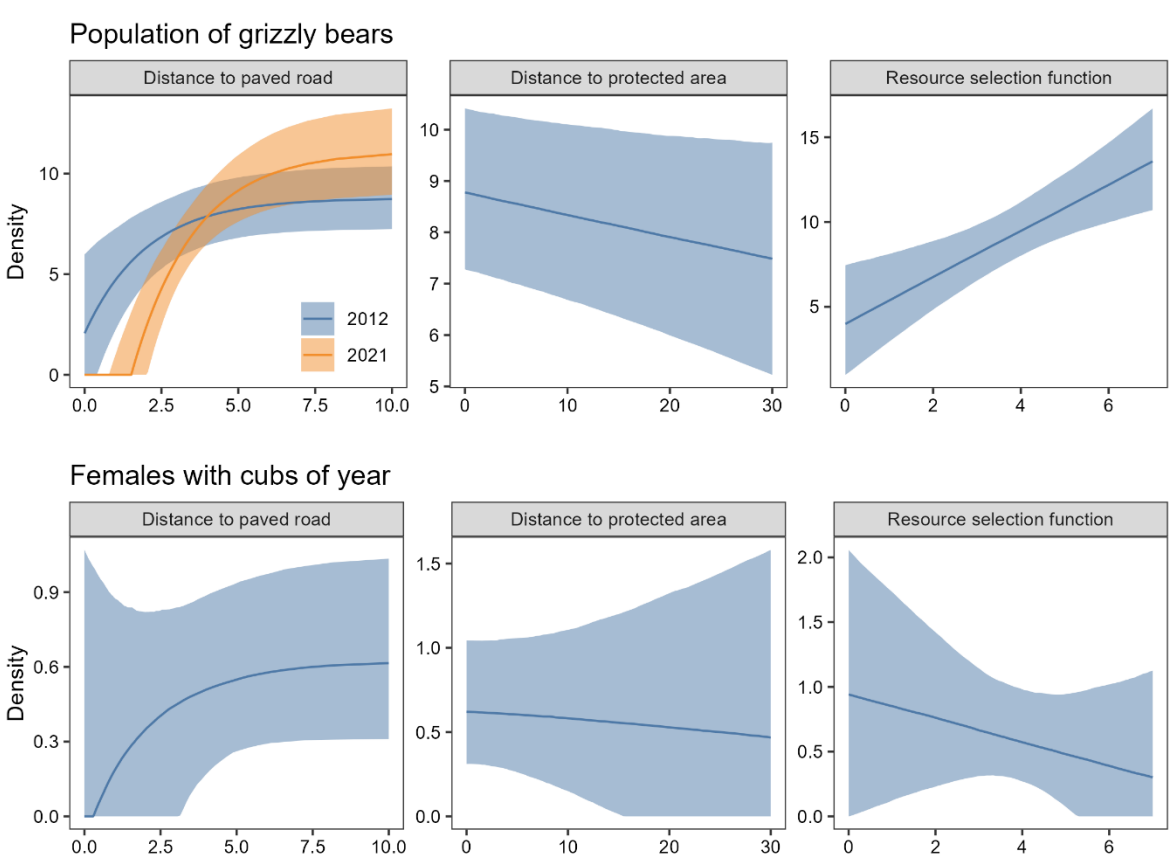
Grizzly bear detections

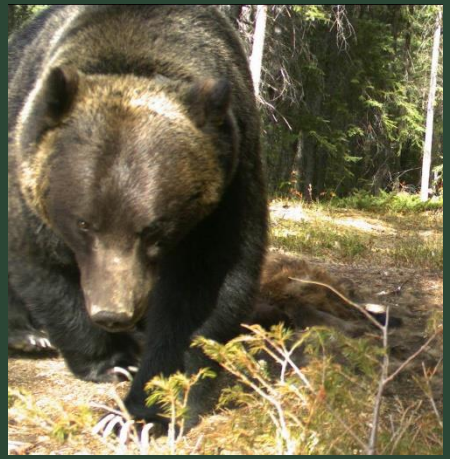


Grizzly bear trends: by Park



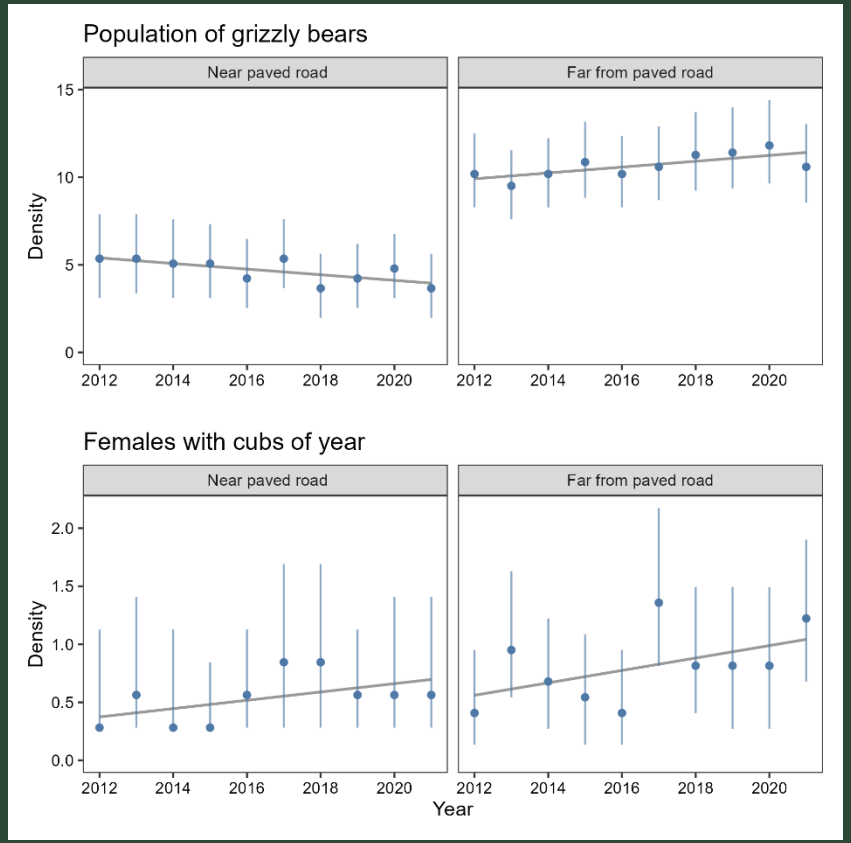
What key factors affected density?





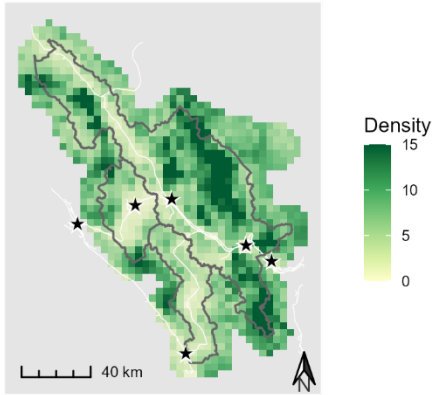
Grizzly bear trends

Within 5 km of paved roads

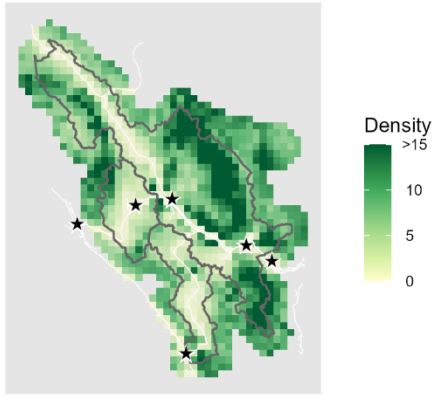


Population of grizzly bears

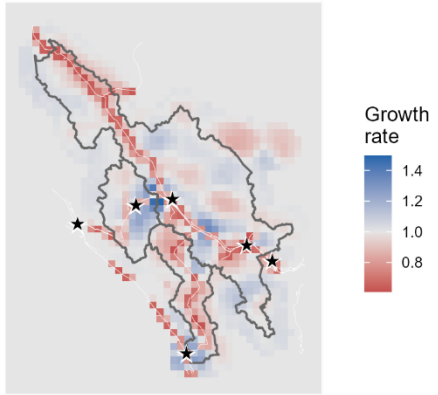
Average density 2012 - 2016



Density 2017 - 2021

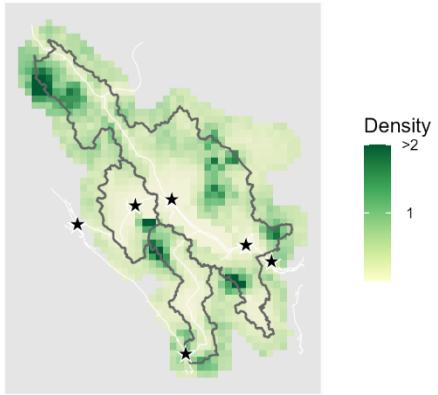


Growth rate 2012 - 2021

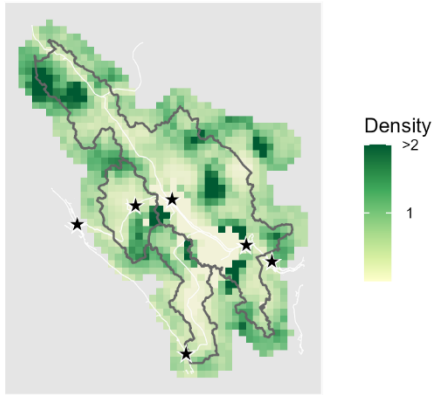


Females with cubs of year

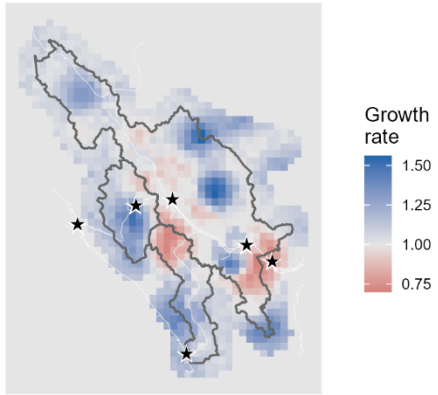
Average density 2012 - 2016



Density 2017 - 2021

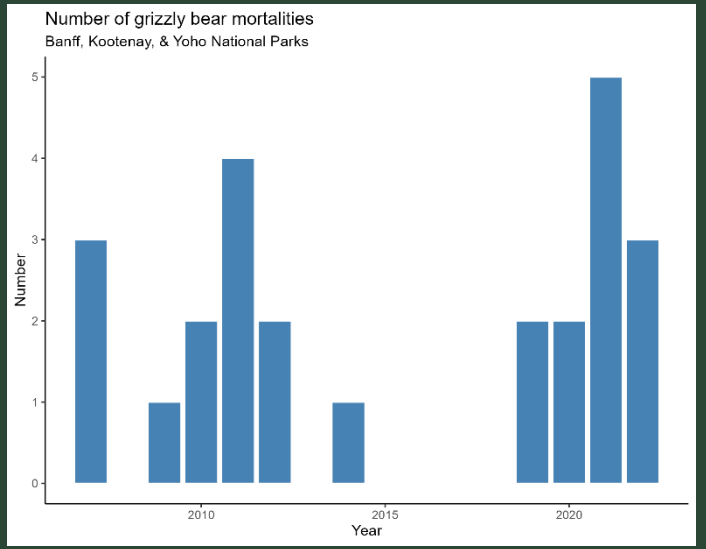


Growth rate 2012 - 2021



Why reduced density near roads?

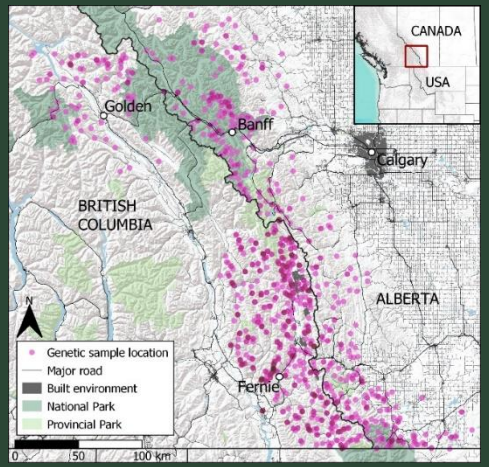
- Increased mortality
- Low recruitment – Garshelis, Gibeau & Herrero 2005
  - Average age of first reproduction: 6.6 years
  - Average age of first successful litter: 8.4 years
  - Average cub of year survival rates 72%
- Avoidance of human activity
- Cumulative effects

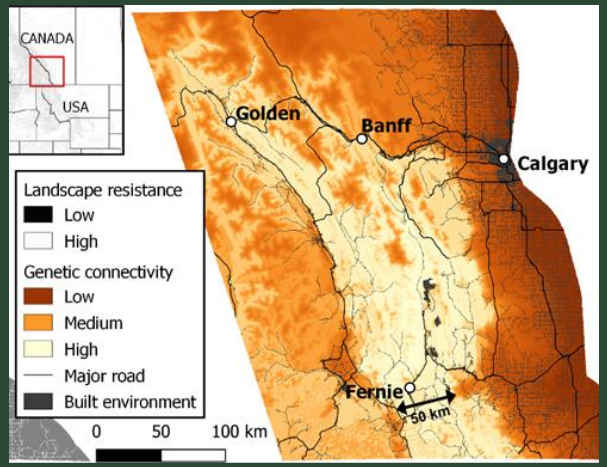


Connectivity Research

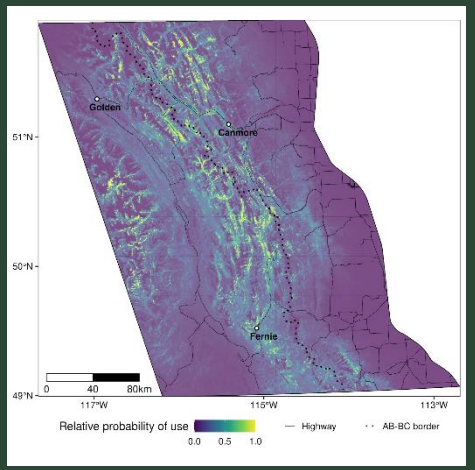
- Genetic (population) connectivity: USA to Banff
  - Palm et al. 2023 - University of Montana
- GPS (movement) connectivity: USA to Banff
- Remote camera connectivity: USA to Jasper (Hebblewhite, University of Montana)

Genetic connectivity





Movement – GPS data



Effects of human activity

- Movement
  - Avoid developed areas: feeding and resting.
  - 86% reduction in connectivity

- Population
  - Higher density in parks!
  - 39% decline in wolverine density
  - Grizzly bear decline near paved roads.
  - Wolves had high mortality outside of parks.

- Genetic (population level) connectivity
  - Female wolverine connectivity fragmented by highways
  - Grizzly bear connectivity reduced by development
    - *DNA study from > 1000 grizzly bears)*

Recent Research

Palm et al. 2023
Barrueto et al. 2023
Tucker et al. 2023
Whittington et al. 2022
Hebblewhite & Whittington 2020
Sawaya et al. 2019
Whittington et al. in review

Multi-species action plan

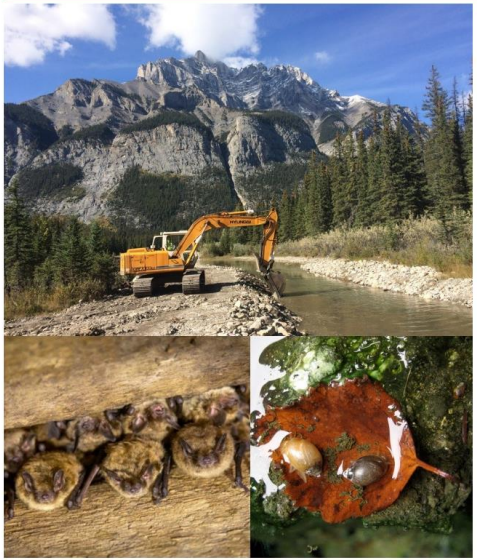
- Barb Johnston, Anne Forshner & interdisciplinary teams
- Amending 2017 plan
- Developing recommendations to address key threats to Endangered, Threatened, Species of Concern

Banff National Park: multi-species action plan

Recommended citation:

Parks Canada Agency. 2017. Multi-species Action Plan for Banff National Park of Canada [Proposed]. Species at Risk Act Action Plan Series. Parks Canada Agency, Ottawa. iv + 30 pp.

Implementation Report: Multi-species Action Plan for Banff National Park of Canada (2017 to 2022)



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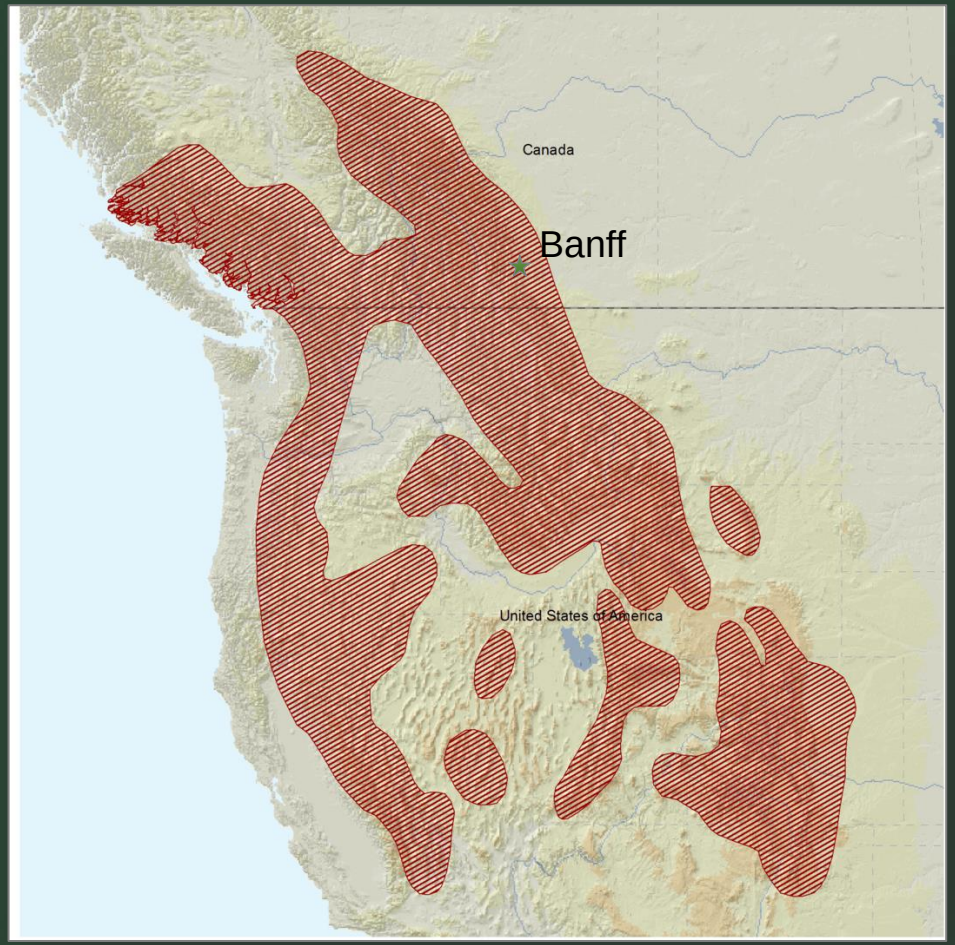
Pika trends

Pika threats

- Climate change
  - Hotter, drier summers
  - Low annual precipitation
  - Warming temperatures
  - Loss of vegetation



Hay pile activity: 2011 - 2023

- *Leads: Jaime Hood & Jocelyn Hirose*
- Metric: proportion of sites with active hay piles

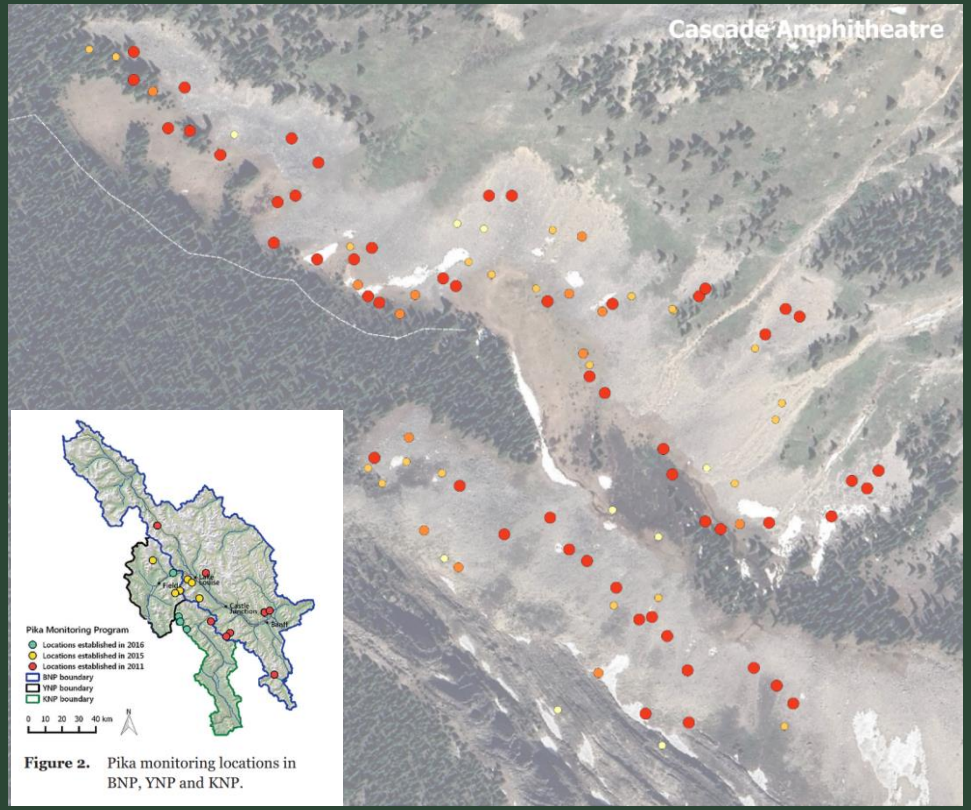
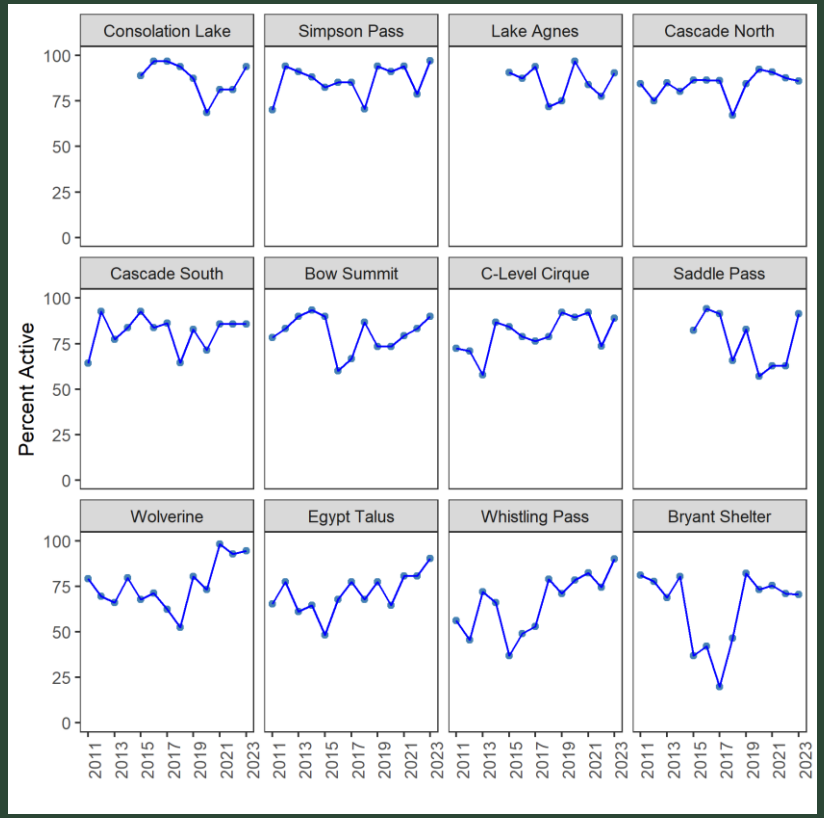
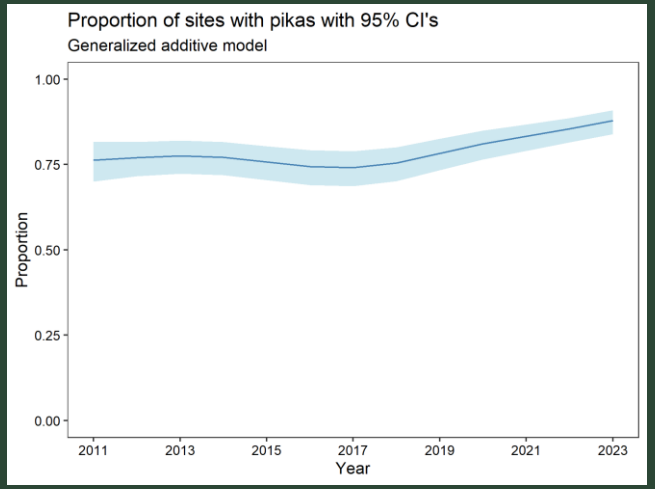


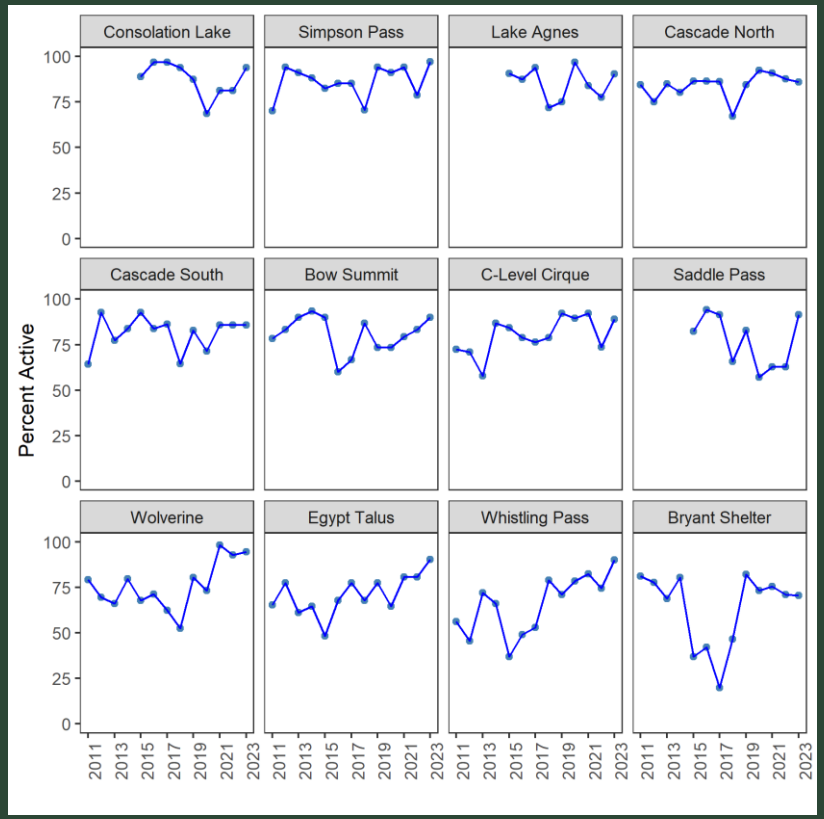
Figure 2. Pika monitoring locations in BNP, YNP and KNP.

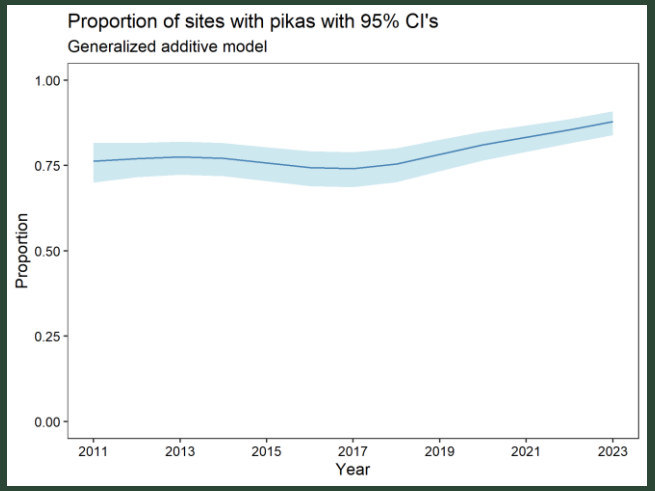
Pika trends – active hay piles





Pika trends – active hay piles





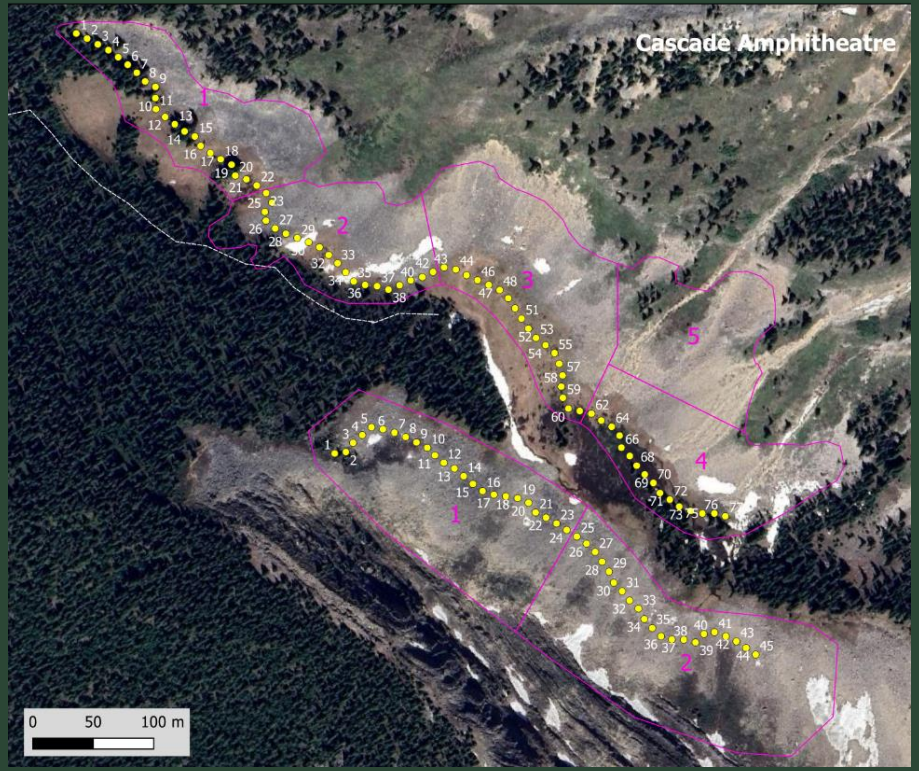
- Power to detect trends?
  - Overlapping home ranges
  - Shifting talus & hay pile sites
- Can we count pikas?

Pika abundance: pilot study

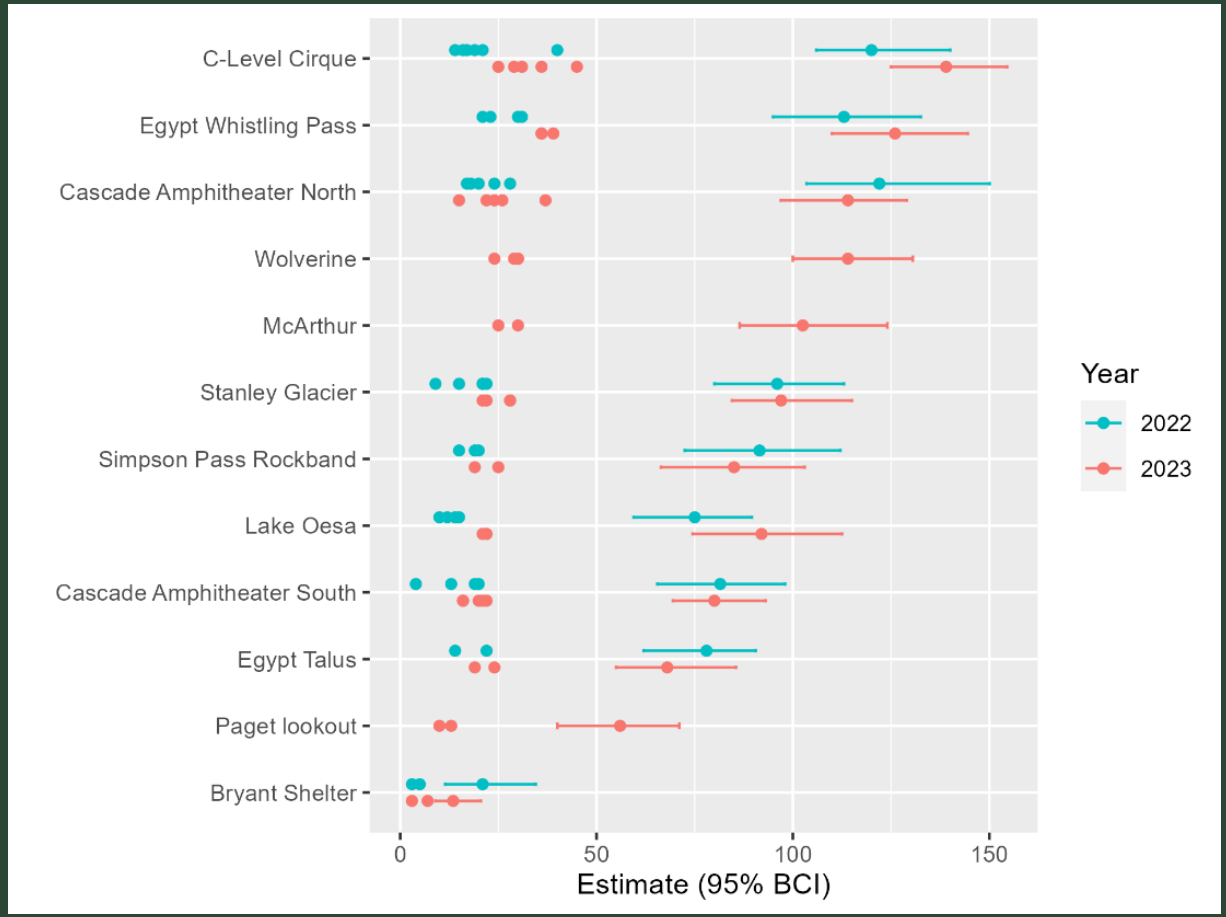
$$Abundance = \frac{Number\ Observed}{Detection\ Probability}$$

Repeat visual surveys

Increased statistical power to detect trends in abundance?

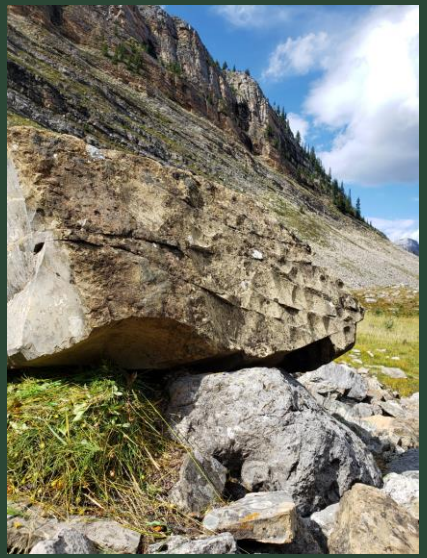


Pika abundance: pilot study



Pika summary

- Visual surveys are promising
- Pikas: Doing well in most of their range
- At risk along edge of their range: low elevations & hot dry climates

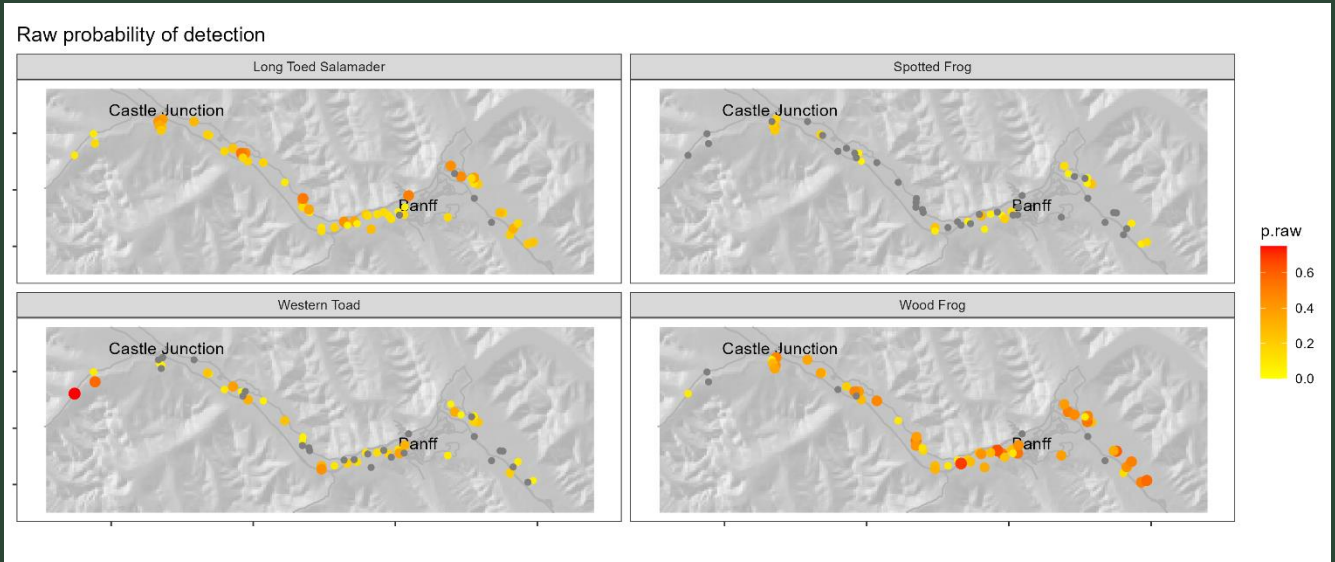


Smith, A. T. 2020. Conservation status of American pikas (*Ochotona princeps*). Journal of Mammalogy.

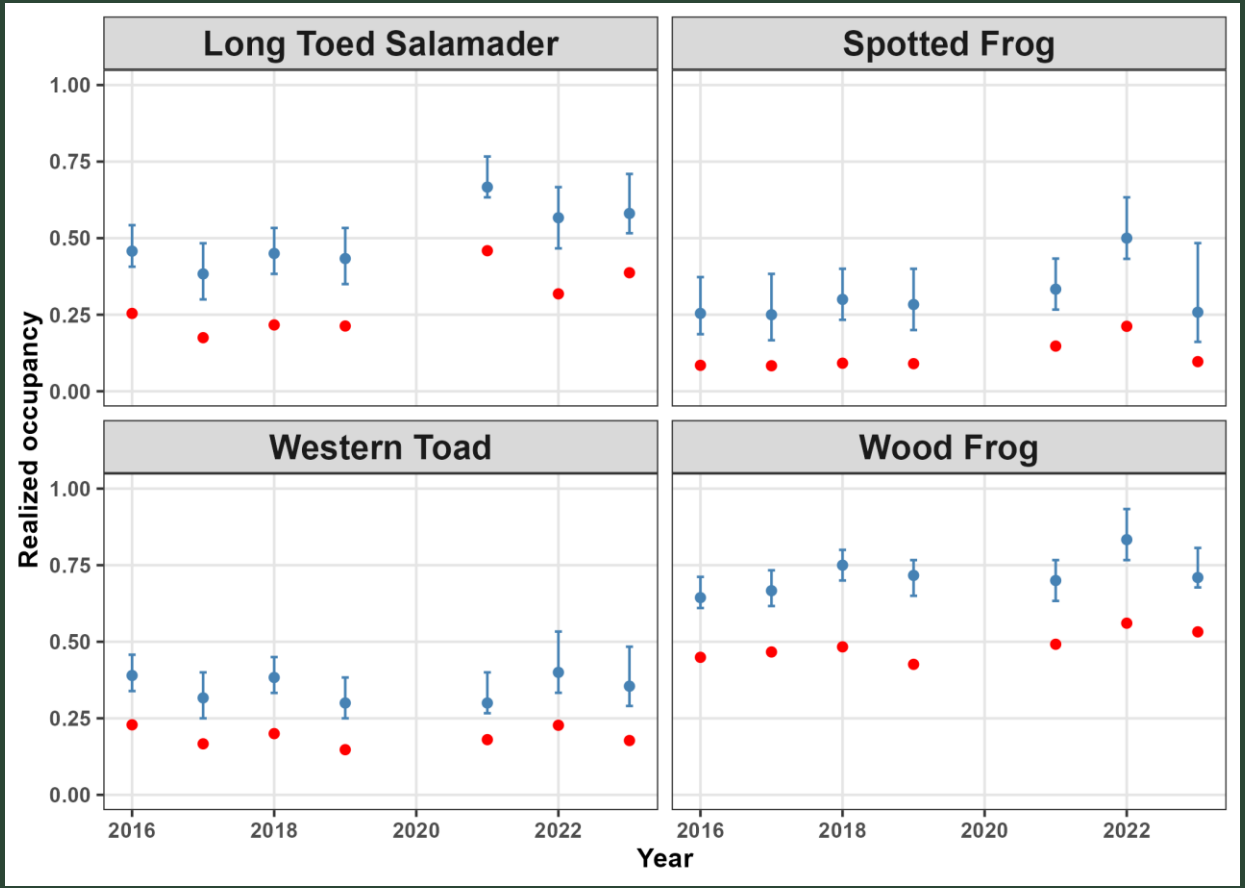
Amphibian Trends

- *Leads: Cathy Gill & Geoff Prophet*
- Repeat visual surveys
- Western toad: special concern
- Indicators of water quality

Amphibian Detections

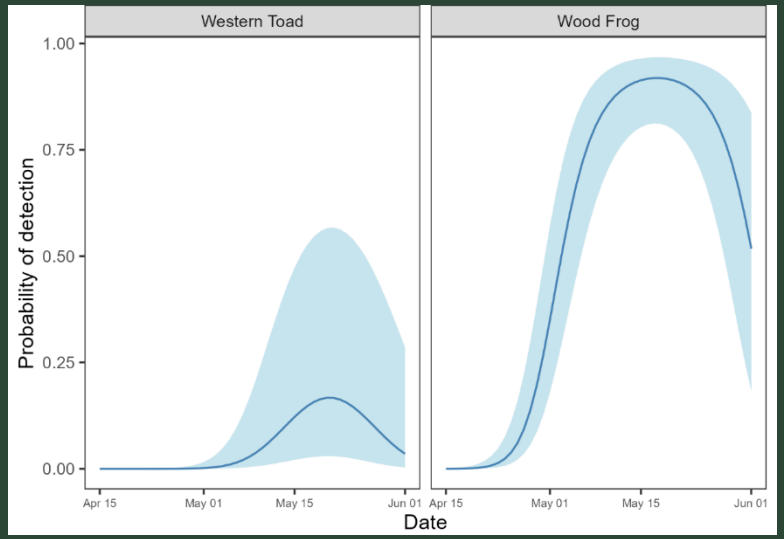


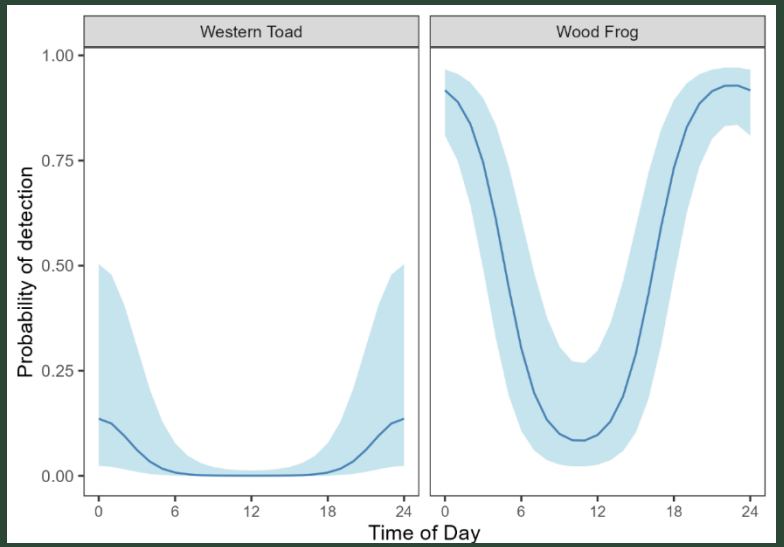
Amphibian Trends



Amphibian: Acoustic monitoring

- *Leads: Robin Baron & Cathy Gill*
- Acoustic recording devices (ARU's)
- Increase number of sites and samples per site

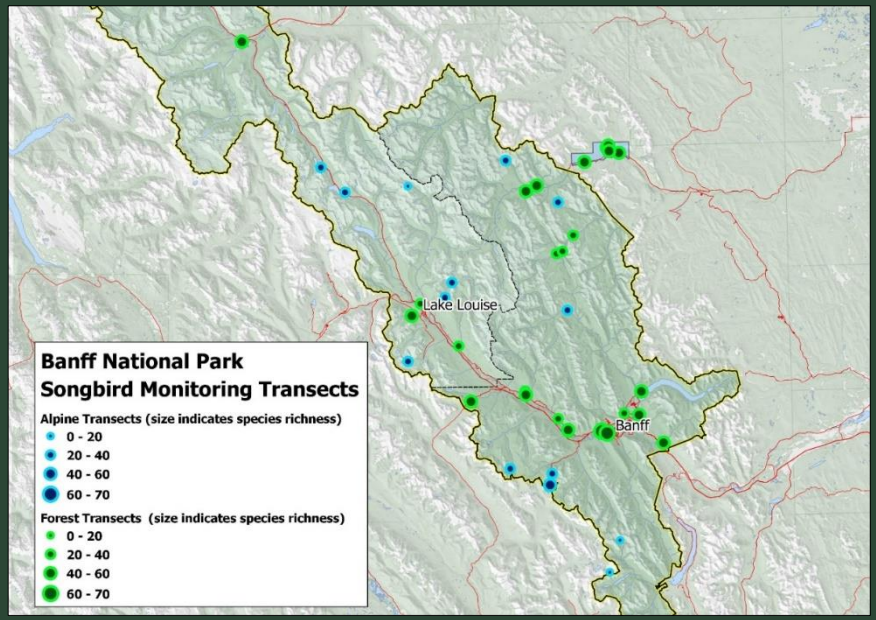




Songbird Trends: 2007 - 2023

- *Leads: Adam Zier-vogel, Sara Jaward, Robin Baron*
- Long-term trends: Forests & Alpine
- Bison reintroduction
- 10 point counts per transect
- Sample 300 points in BNP

Divide pass songbird monitoring for bison project



Songbirds Trends

Forests

- Increasing: 47%
- Stable: 44%
- Decreasing: 9%

Alpine

- Increasing: 19%
- Stable: 68%
- Decreasing: 13%

Songbirds & Climate Change

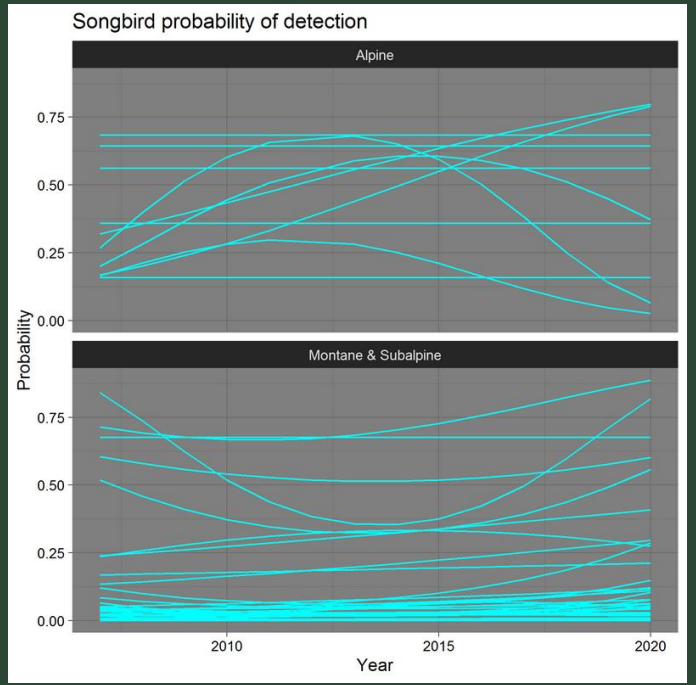
Climate change

- Population increased during warmer & drier years.
- Most other studies find population declines.

Landbird trends in protected areas using time-to-event occupancy models

2019

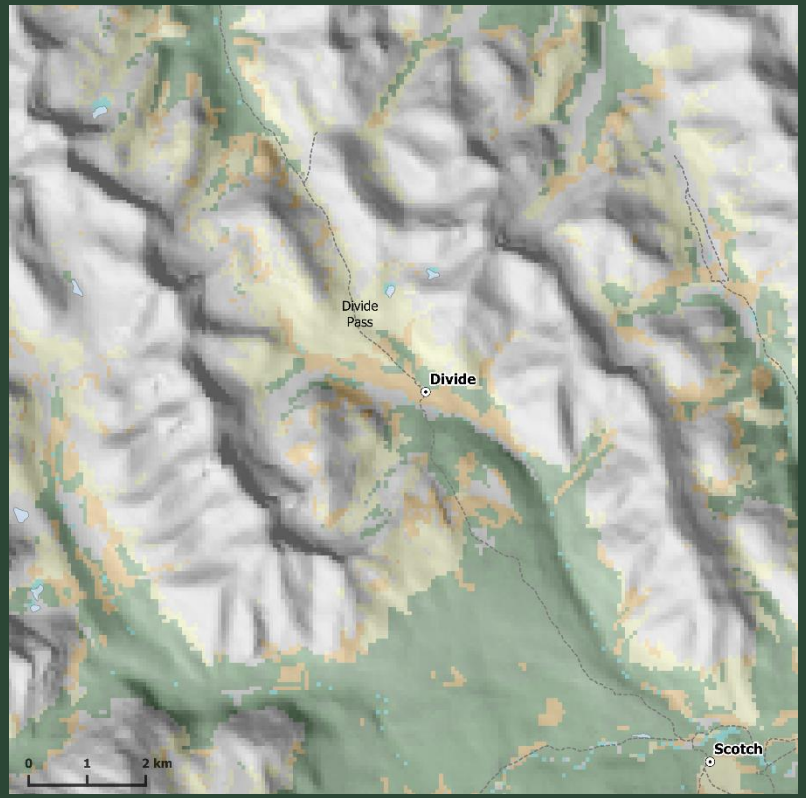
Jesse Whittington,[1,†] Brenda Shepherd,[2] Anne Forshner,[3] Julien St-Amand,[2] Jennifer L. Greenwood,[3] Cameron S. Gillies,[4] Barb Johnston,[5] Rhonda Owchar,[3] Derek Petersen,[3] and James Kimo Rogala[1]



Landcover change

Jonathan Farr, University of Montana

Divide Basin

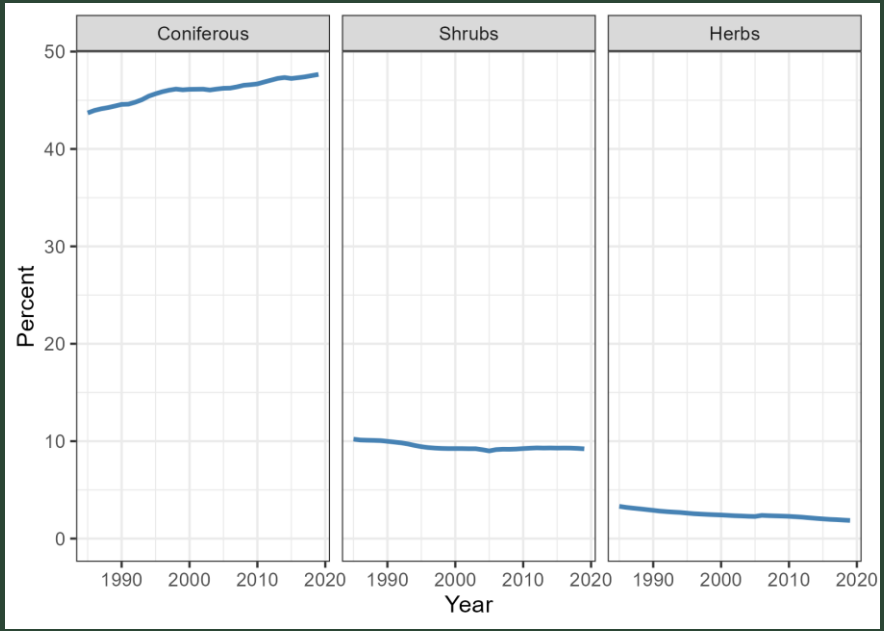


Hermosilla et al. 2022. *Land cover classification in an era of big and open data: Optimizing localized implementation and training data selection to improve mapping outcomes*. Remote Sensing of Environment.

Landcover change: 1985 to 2019

Banff National Park

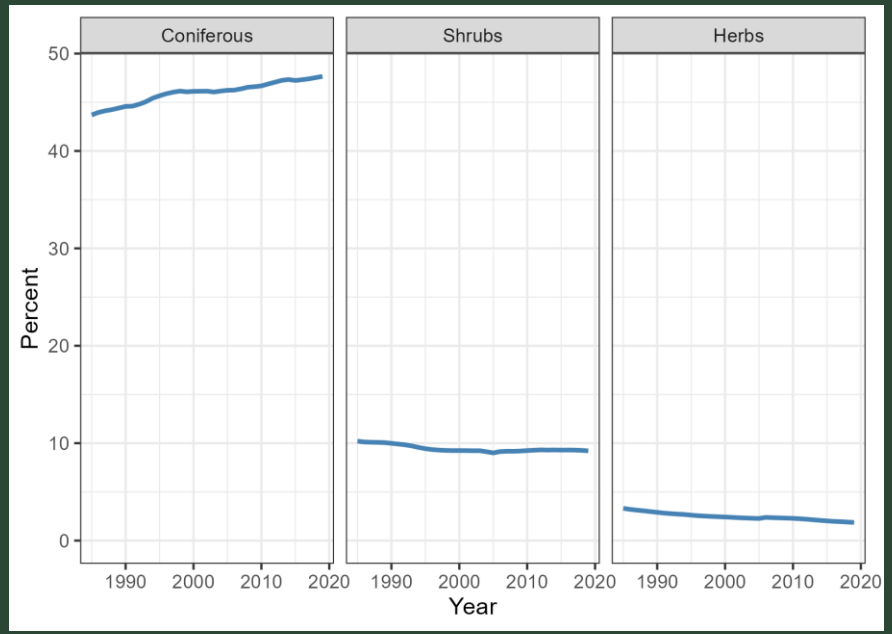
Percent of Landscape



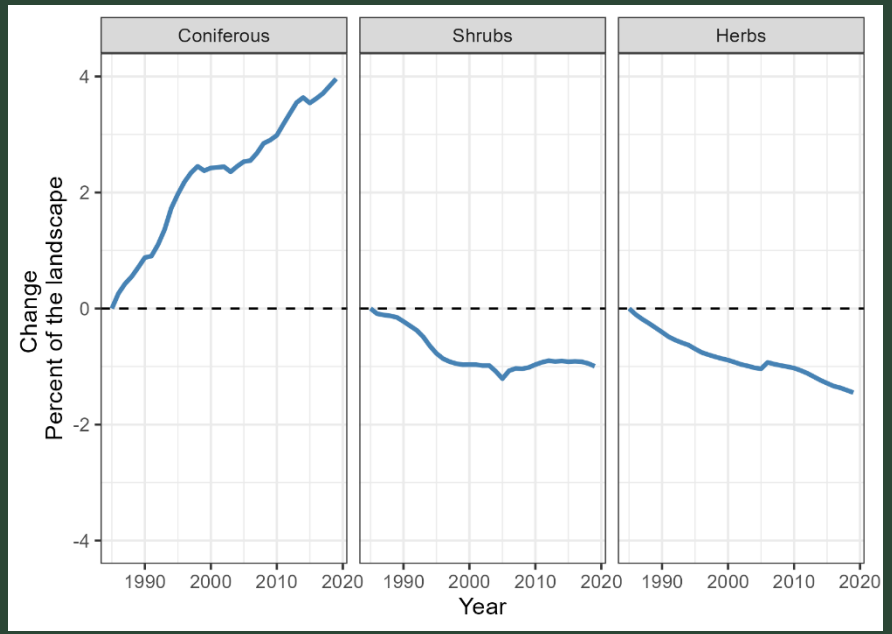
Landcover change: 1985 to 2019

Banff National Park

Percent of Landscape



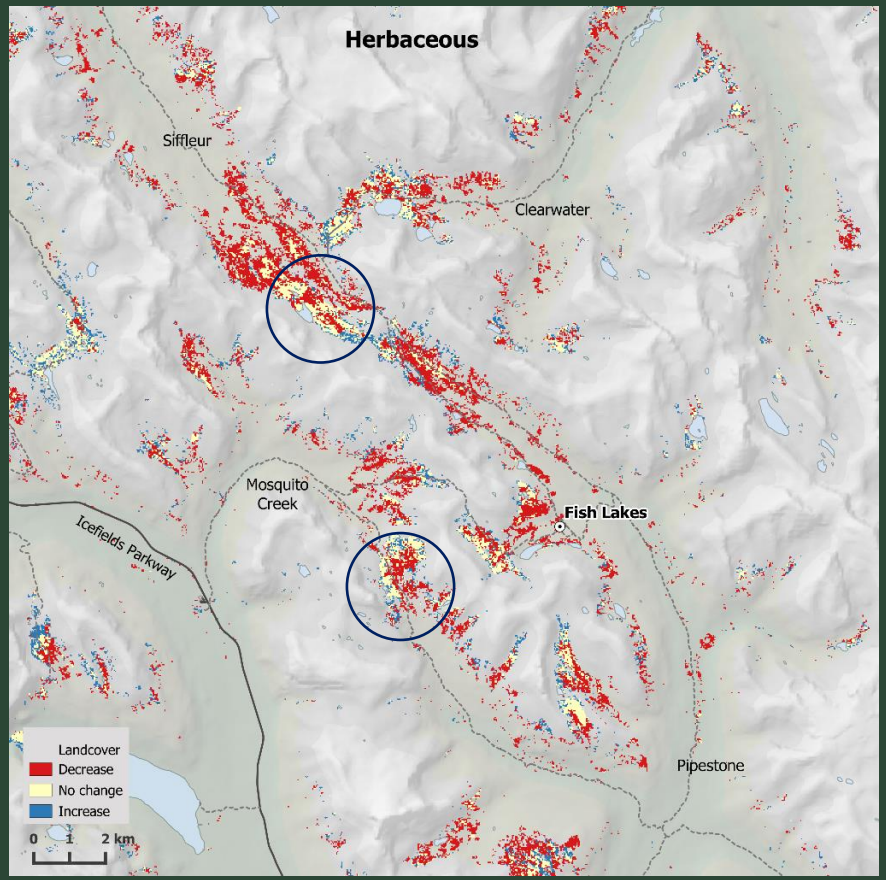
Change in percent

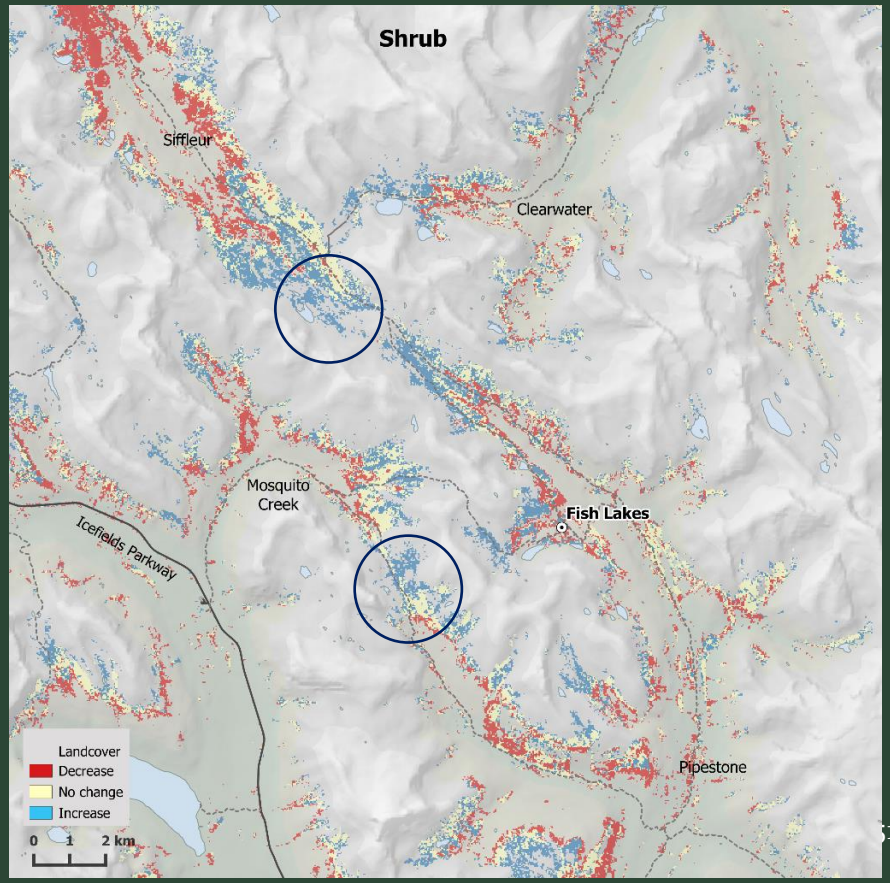


Change 1985 to 2019: Pipestone & Clearwater Pass

Landcover
Decrease
No change
Increase

Alpine meadows → Shrubs

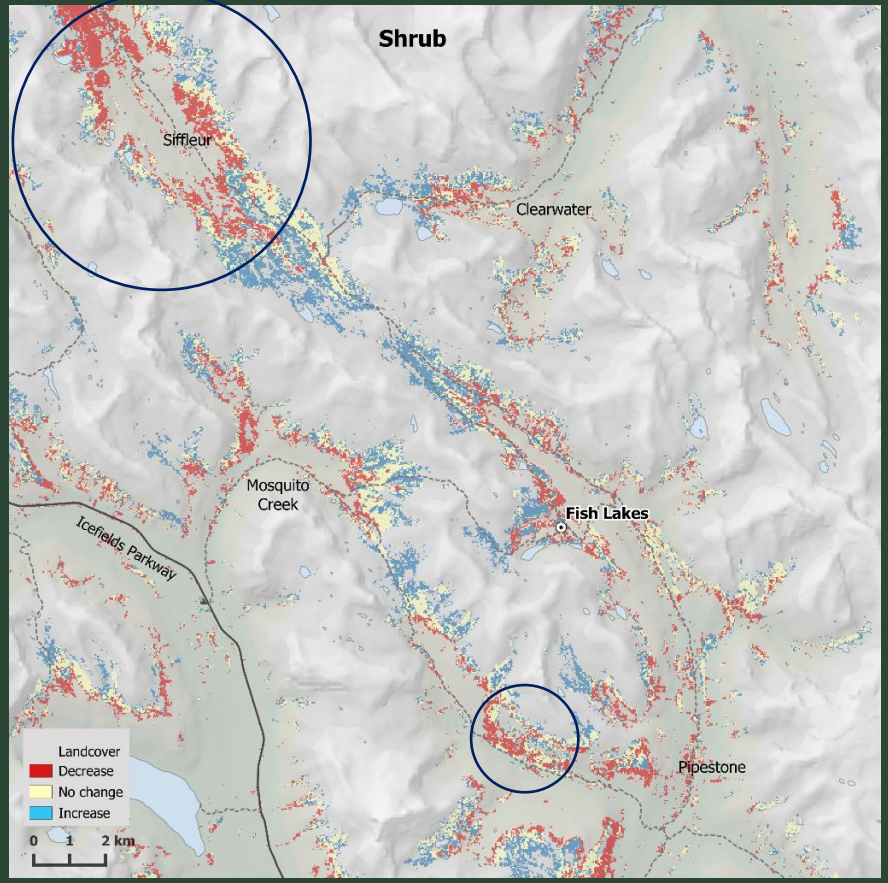


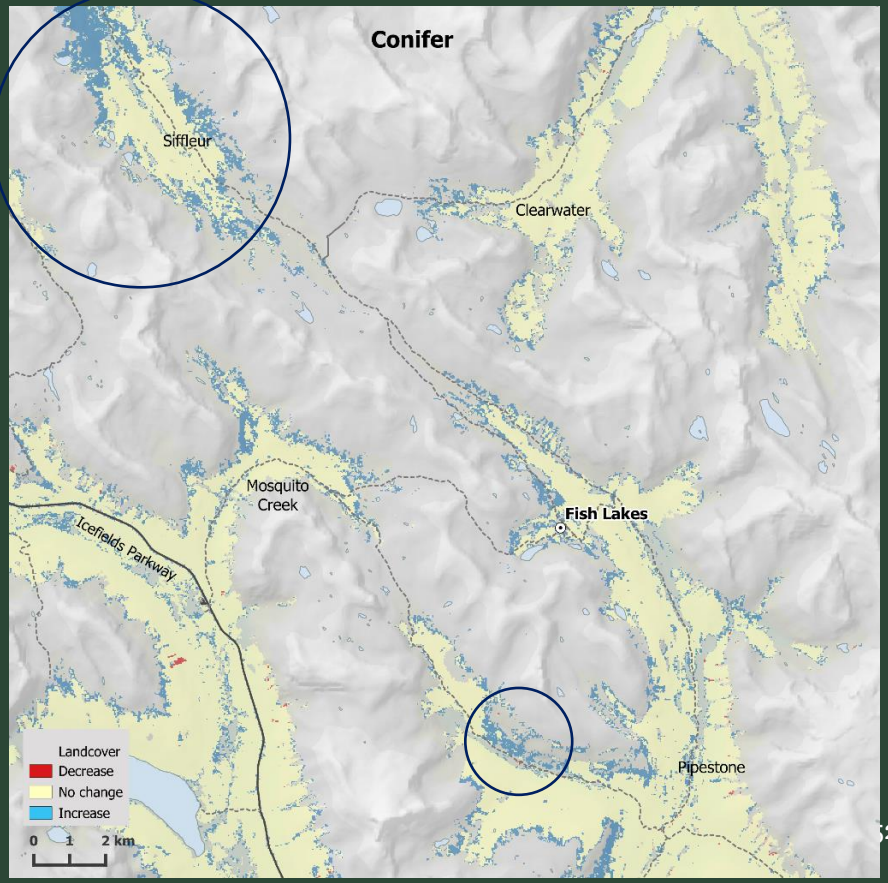


Change 1985 to 2019: Pipestone & Clearwater Pass

Landcover
Decrease
No change
Increase

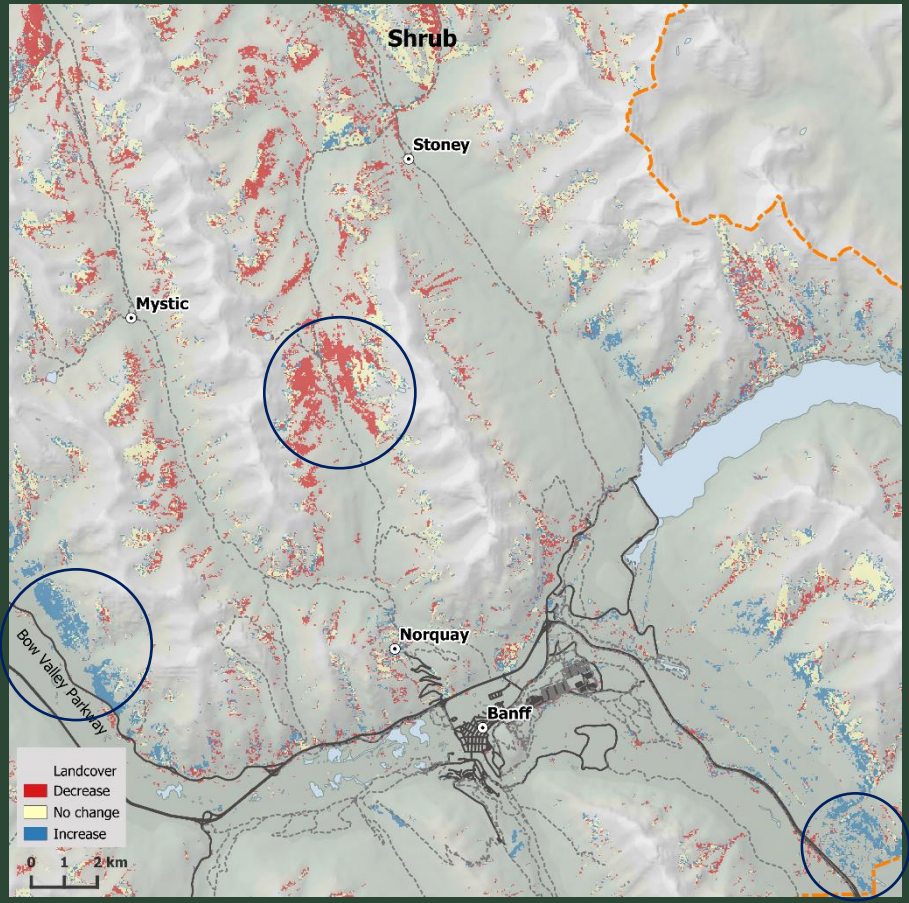
Shrubs → Conifer

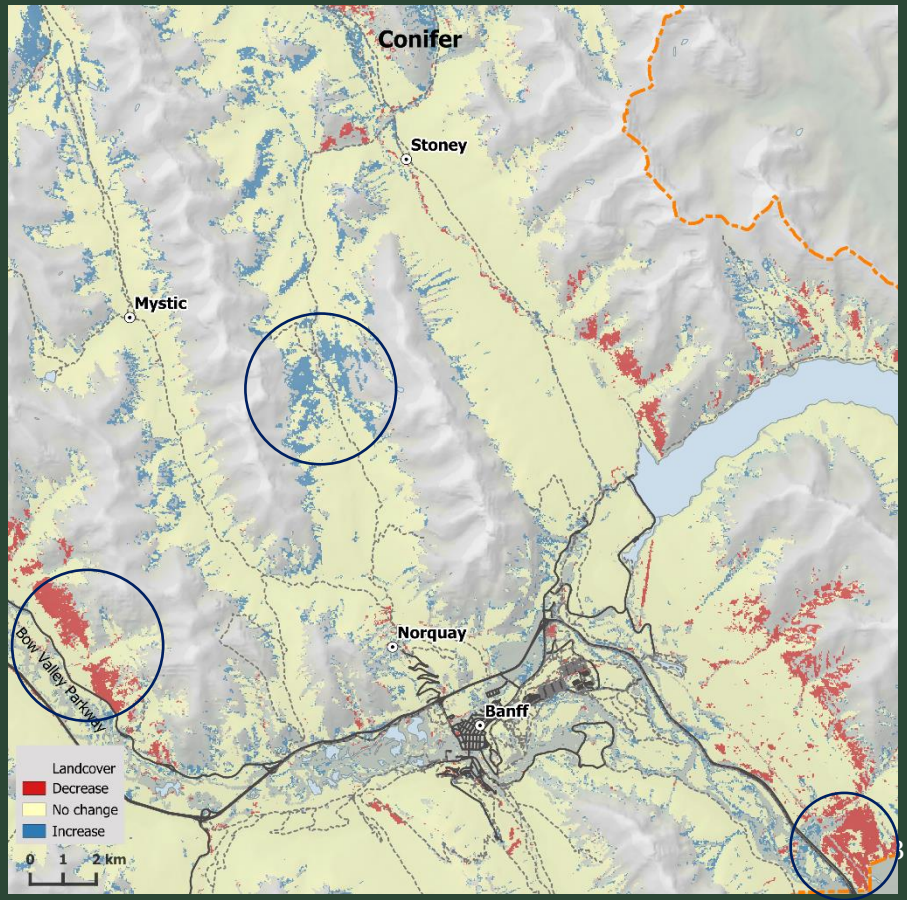




Change 1985 to 2019: Bow Valley

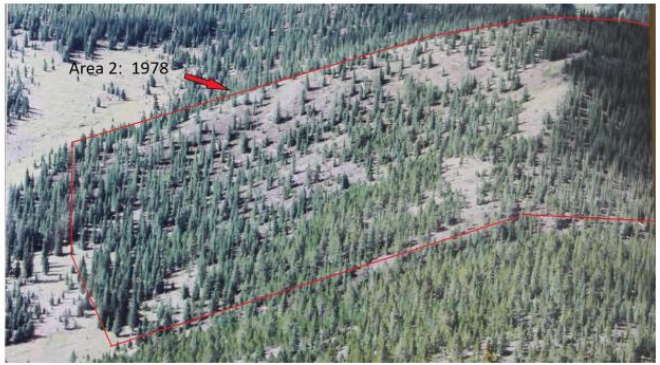
Shrubs ⟷ Conifers





Conifer recruitment in grouseberry habitat: Hamer & Pengelly 1978 to 2022 – Upper Cascade

1978



2022

Hamer, D., and I. Pengelly. 2023. Conifer recruitment in upper-subalpine Grouseberry (*Vaccinium scoparium Leiberg ex Coville) habitat* in Banff National Park, Alberta.

Landcover change

- High elevation (Climate change): meadows → shrubs → conifers
  - Depends on soil, slope, moisture, and aspect
- Low elevation (Fire): meadows ←→ shrubs ←→ conifers
- High elevation localized species (HELS): Bow Valley Naturalists

Trant, A., E. Higgs, and B. M. Starzomski. 2020. A century of high elevation ecosystem change in the Canadian Rocky Mountains. Scientific reports 10:9698.

Summary

- Importance of protected areas!
- Wildlife population trends
  - Why? Mechanisms?
  - Climate change?
  - Importance of long-term monitoring & collaboration
- Our activities affect wildlife movement, connectivity, and abundance