UNIVERSITY OF SASKATCHEWAN

Population ecology of woodland caribou in the Saskatchewan Boreal Shield: Key findings and next steps

SMA ENVIRONMENTAL FORUM, Oct 17, 2018

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Outline

- Introduction
- Key results:
  - Population trends and rates
  - Mapping
  - Habitat selection and critical habitat features
- Conclusions and next steps

Funding and Support

Government of Saskatchewan

UNIVERSITY OF MANITOBA

Population dynamics and critical habitat of woodland caribou in the Saskatchewan Boreal Shield

Interim Project Report, 2013–2016

Department of Biology
University of Saskatchewan

UNIVERSITY OF SASKATCHEWAN

November 18, 2016

Report copy freely available at:

http://mcloughlinlab.ca/lab/lab-publications/

Or by emailing:

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Species at Risk Act
Recovery Strategy Series

Recovery Strategy for the Woodland Caribou (*Rangifer tarandus caribou*), Boreal population, in Canada

Woodland Caribou, Boreal population

2012

Canada

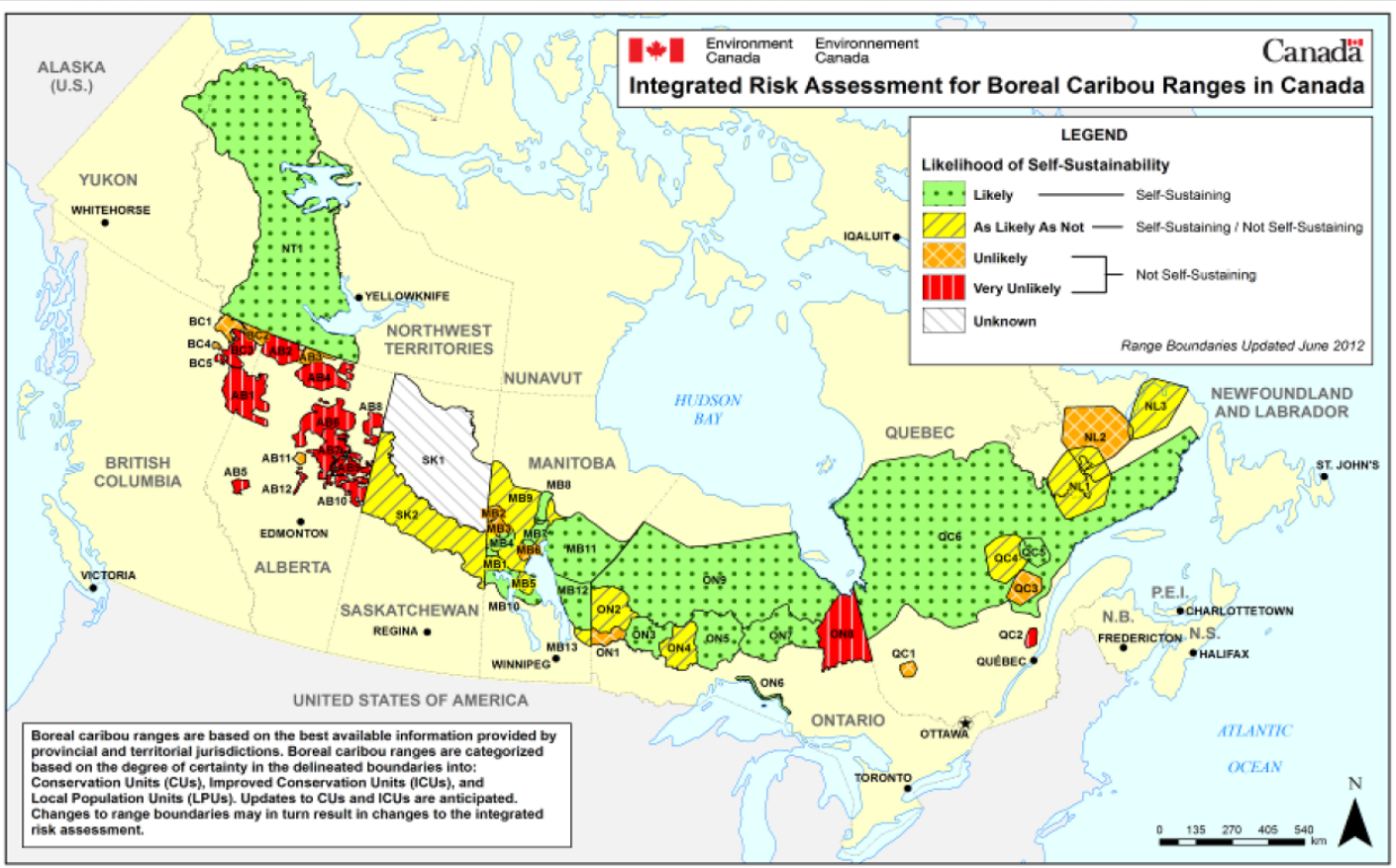
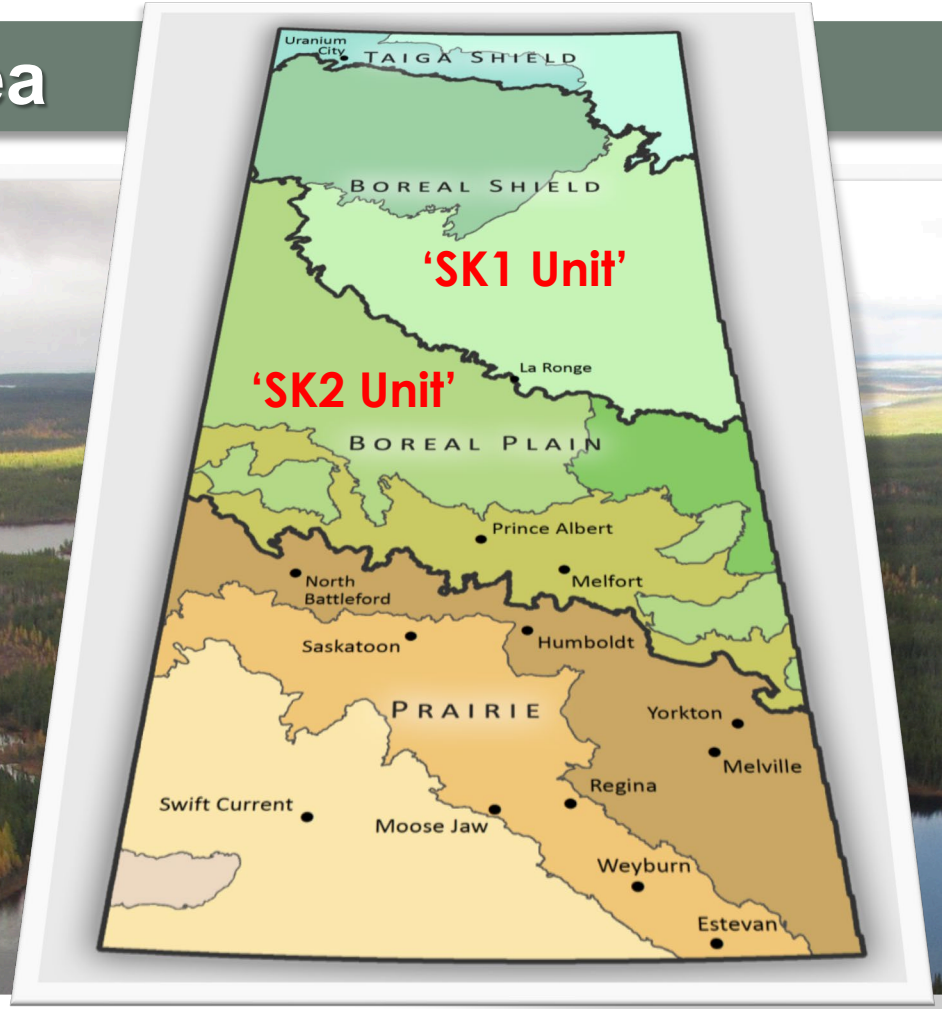


Figure 3. Integrated risk assessment for boreal caribou ranges in Canada, reflecting the capacity of each range to maintain a self-sustaining local population of boreal caribou.

Why the uncertainty?

- Saskatchewan contributed outlier data with respect to both of the two predictor variables of the ECCC model:
  1) forest fire, with Boreal Shield Saskatchewan having one of the highest coverages of any jurisdiction; and
  2) anthropogenic disturbance, where we possess some of the lowest human activity within caribou range in Canada.
- Doubly skewed nature of our input data was unique

Study Area


Uranium City
TAIGA SHIELD
BOREAL SHIELD
'SK1 Unit'
La Ronge
'SK2 Unit'
BOREAL PLAIN
Prince Albert
North Battleford
Melfort
Saskatoon
Humboldt
PRAIRIE
Yorkton
Melville
Regina
Swift Current
Moose Jaw
Weyburn
Estevan

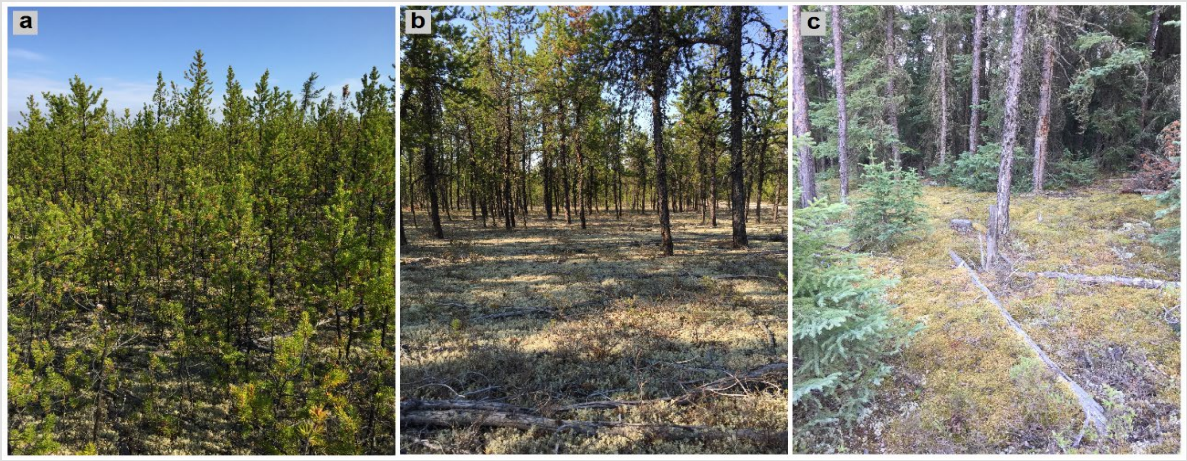
Research Themes

1. Caribou habitat
2. Population dynamics and behaviour

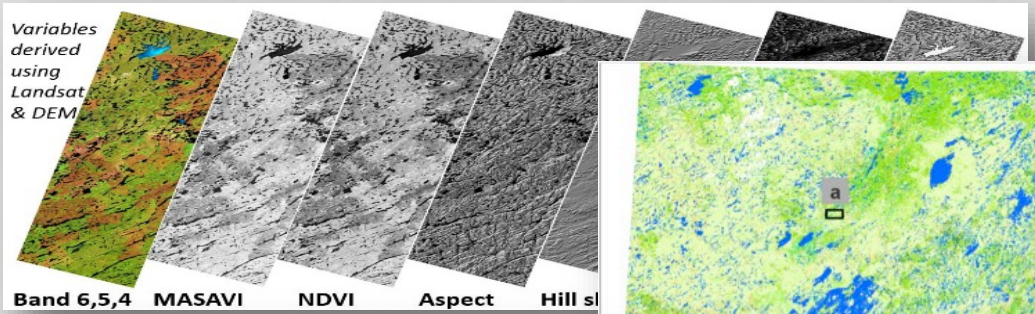
Population trend, status,
probability of occurrence, critical habitat

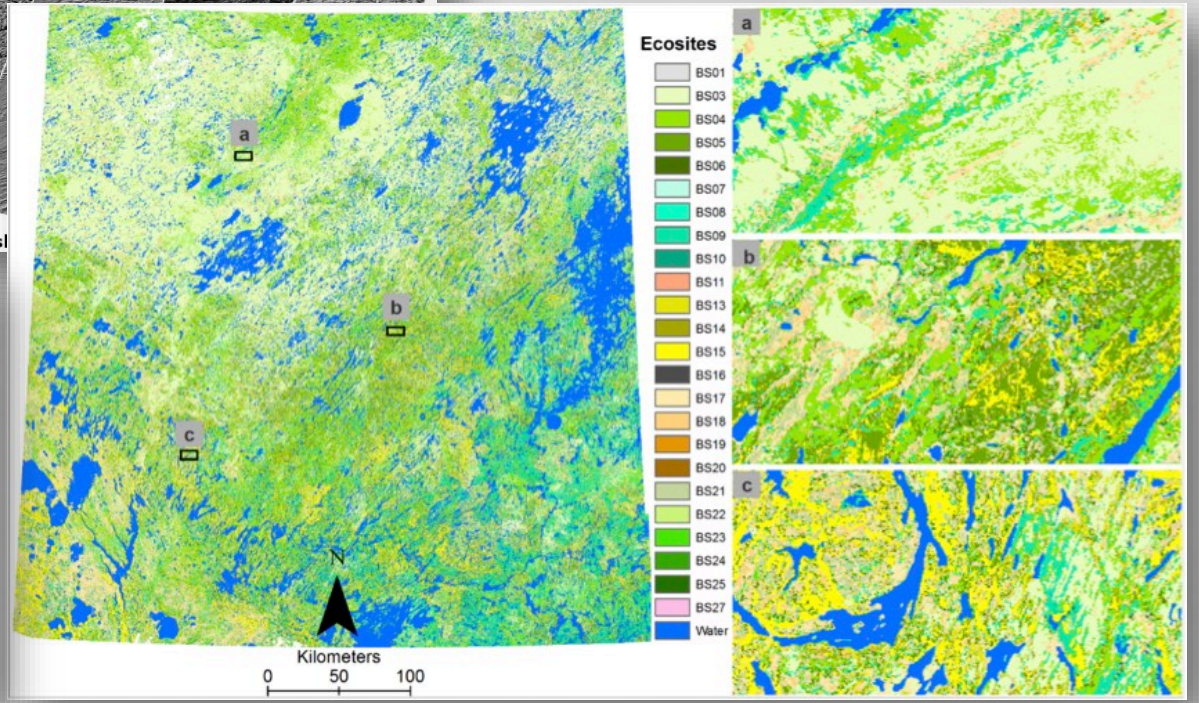
Vegetation Sampling

- 312 sites sampled by us in 2014-15-16
- Adds to 718 sites >40 yrs old sampled for the Sask. Forest Ecosite Classification

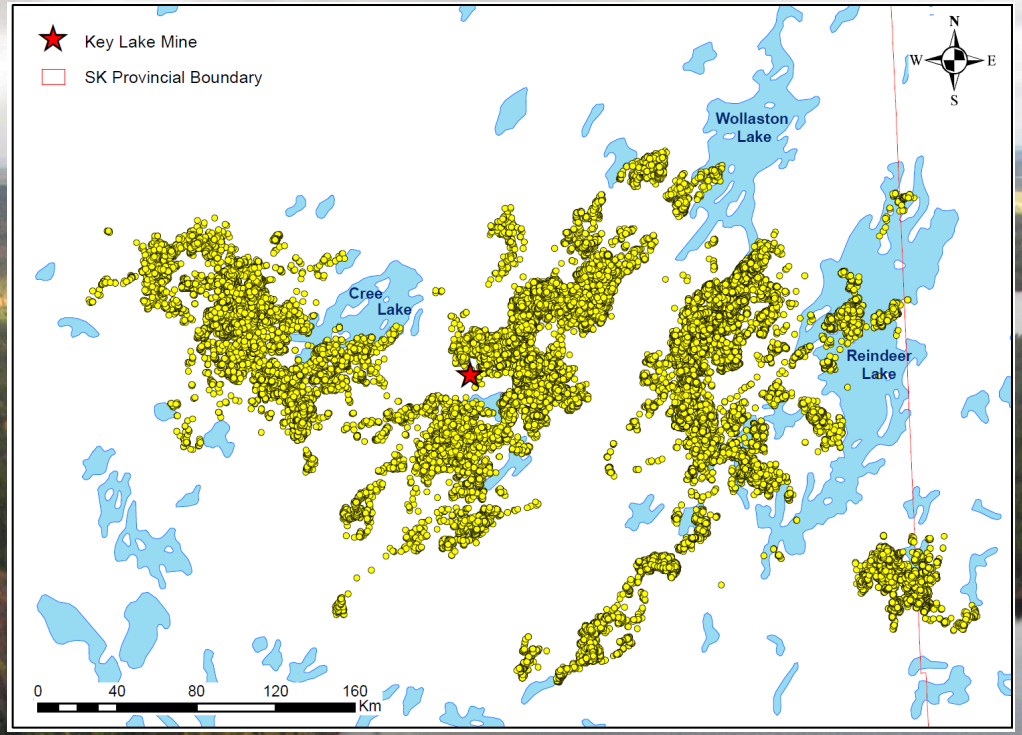


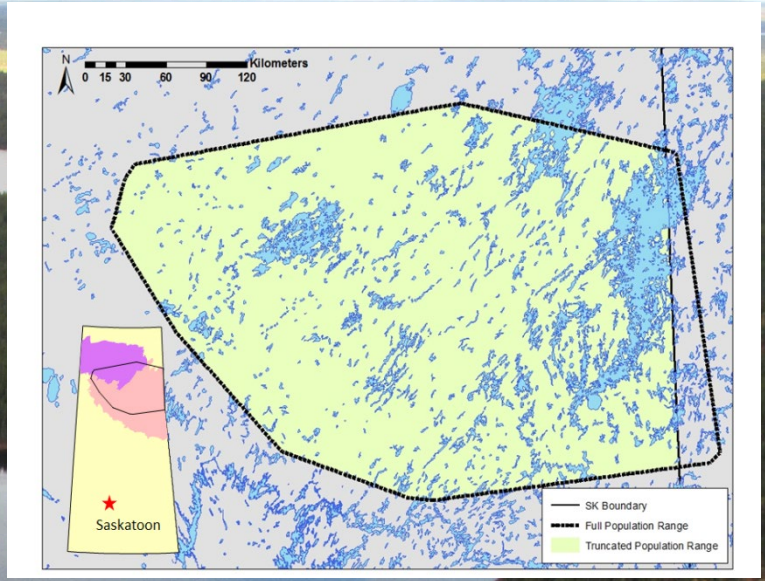
Habitat Remote Sensing



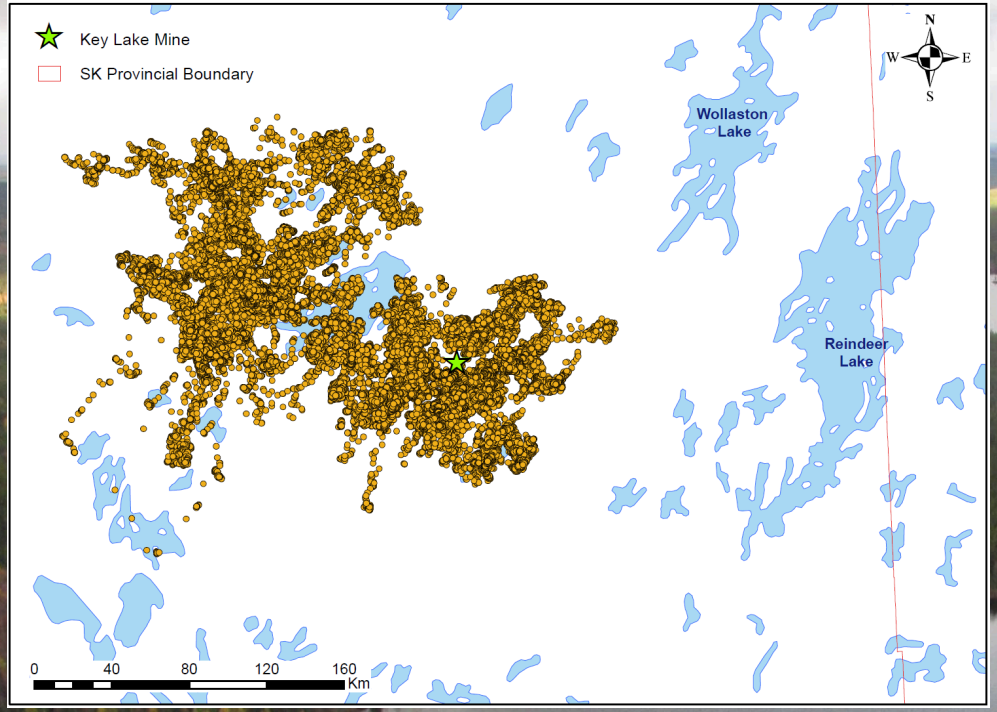


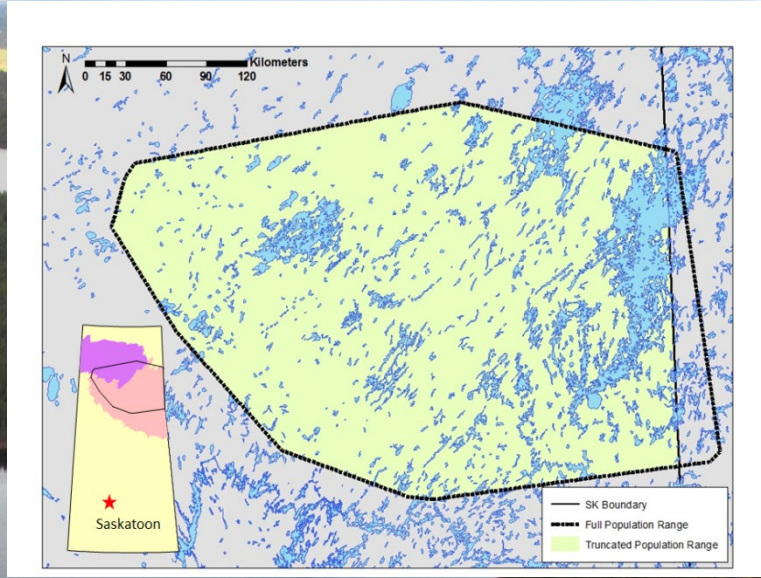
Study Area: Locations of Collared Caribou





Study Area: Partner Collar Data





Population Size

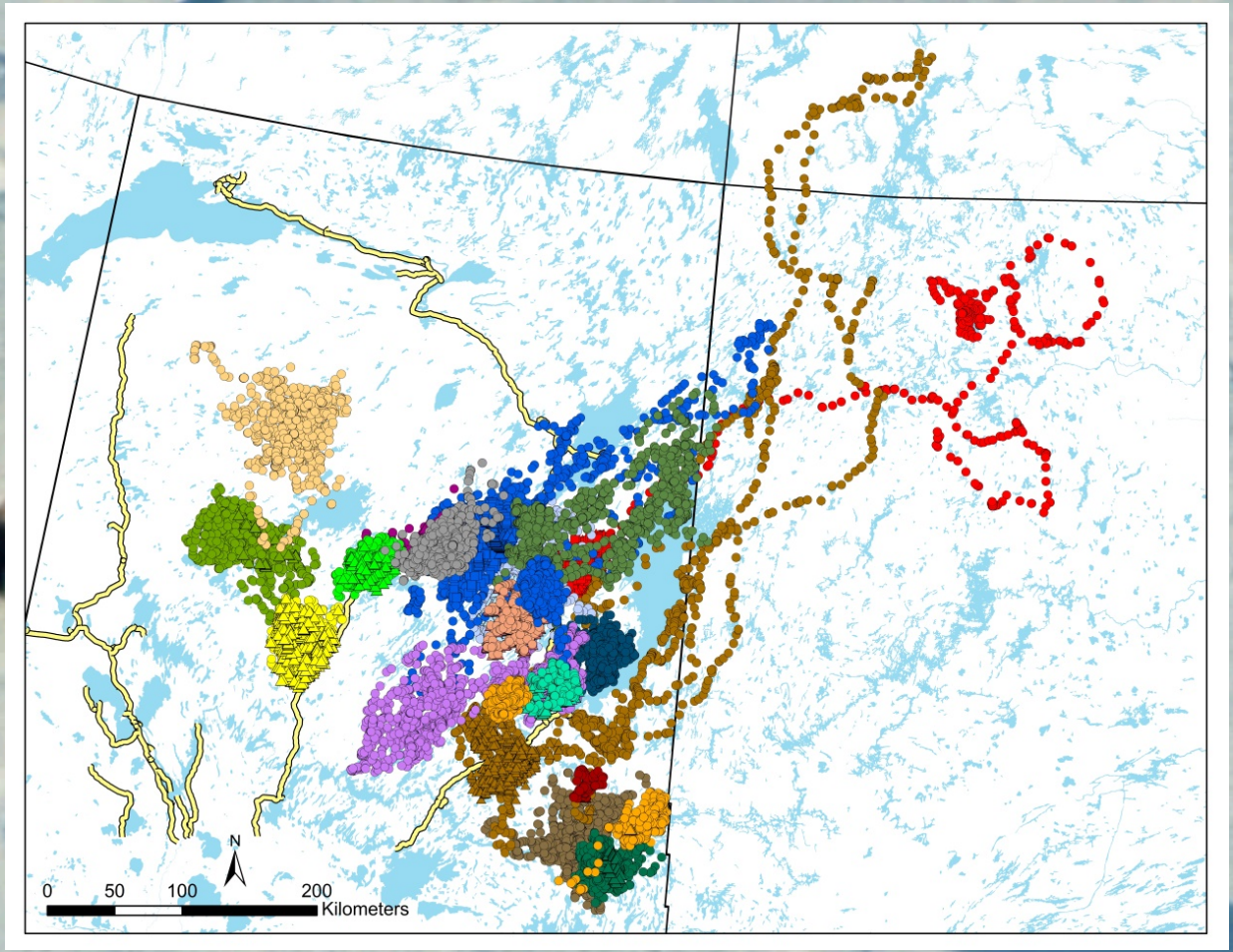
- Average density of caribou across 16 surveys conducted since 2018
  - 36.9 caribou/1000 km^2 (95% CI: 26.7–47.2 caribou/1000 km^2)
  - This is high for woodland caribou, roughly twice the density as found in Alberta
  - Minimum density based on sightability test using collared caribou on grid

Population Size

- Extrapolating density to population size
  - Min. 3380 caribou (95% CI: 2436–4304 caribou) in area where collared caribou occurred (91,238 km^2)
  - Est. 4000 to 5000 in whole of the SK1 unit

Moose Densities

- Among the lowest in boreal forests of North America where wolves co-occur
  - 45.7 moose/1000 km^2 (37.8–53.6 moose/1000 km^2), 13 surveys.

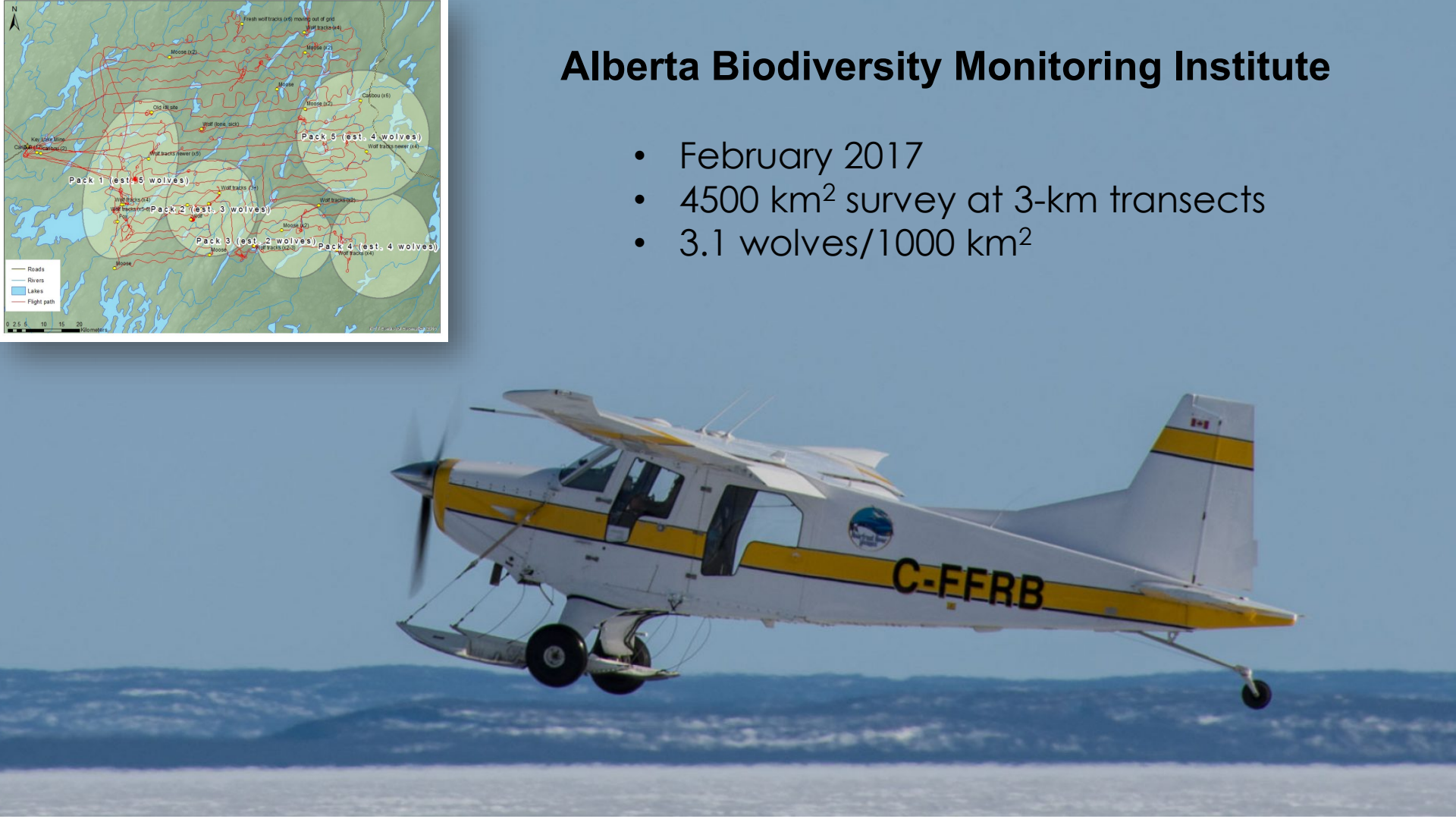

N
0 50 100 200
Kilometers

Wolf Densities

- Also estimated to be low
  - Based on known relationship between moose density and wolf density est. at <2 wolves per 1000 km^2
  - Established (non-transitory) territories are also very large
    - 3531 ± 598 km^2 ($\bar{x}$ ± SE, n = 12 packs; 100% minimum convex polygon [MCP]
  - Pack sizes small
    - 2–9 wolves (4.6 ± 0.6, n = 19 packs, lone = 4)

Alberta Biodiversity Monitoring Institute

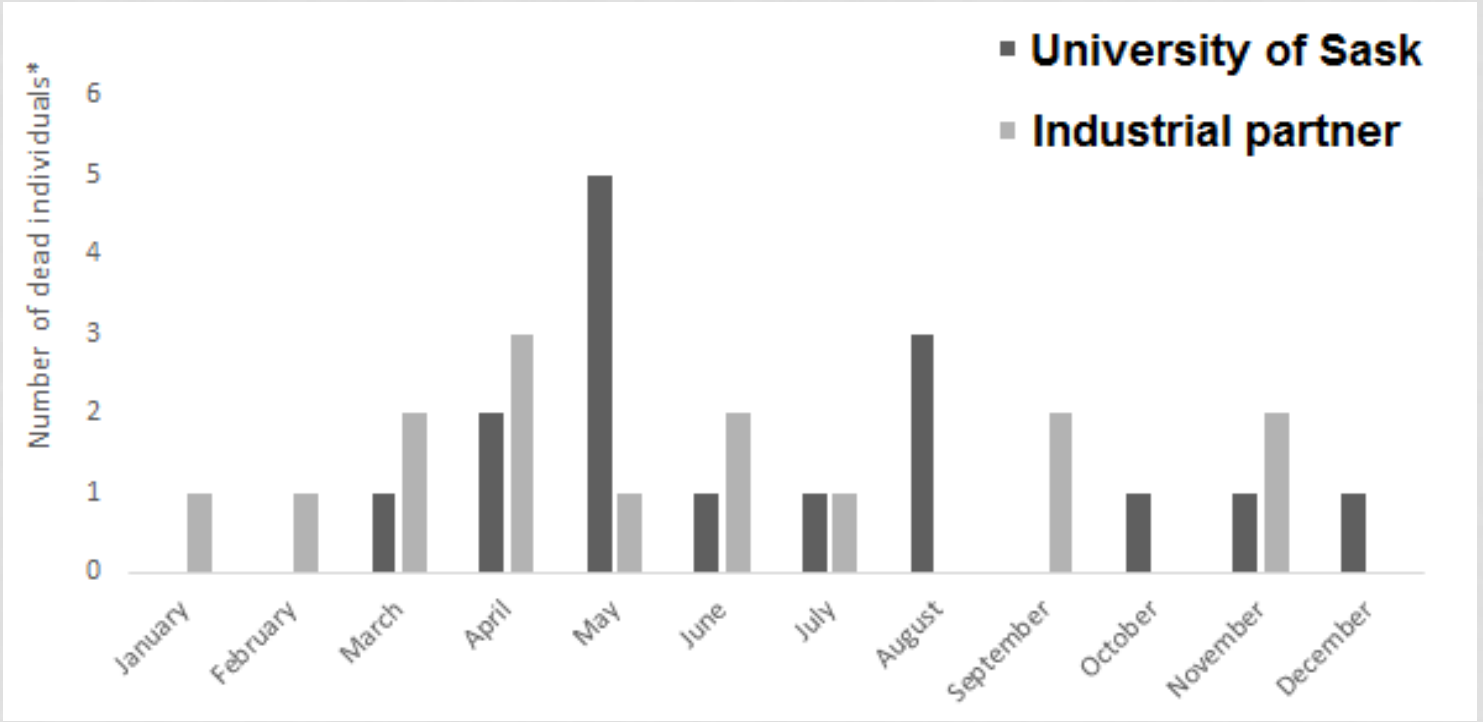
- February 2017
- 4500 km^2 survey at 3-km transects
- 3.1 wolves/1000 km^2



Caribou Survival

- Survival (out of 94 collared females as at March 15, 2014)
  - 2014-18 = 0.896 with 95% confidence interval {0.855-0.932} (assumes all non-investigated drops are deaths)
  - Rate applies to U of S sample, which covers the SK1 range
    - *Note: this is a **conservative survival rate**, as our sample of 94 females aged with time, so that in summer 2018 all females were aged at least 6+ years old*

Mortality highest in snow-free season



Caribou Pregnancy Rates

- Pregnancy rates from blood samples of collared caribou are high-normal
  - Across two years of captures (2013 and 2014) averaged 0.897 (95% CI: 0.834–0.951)

Caribou Recruitment

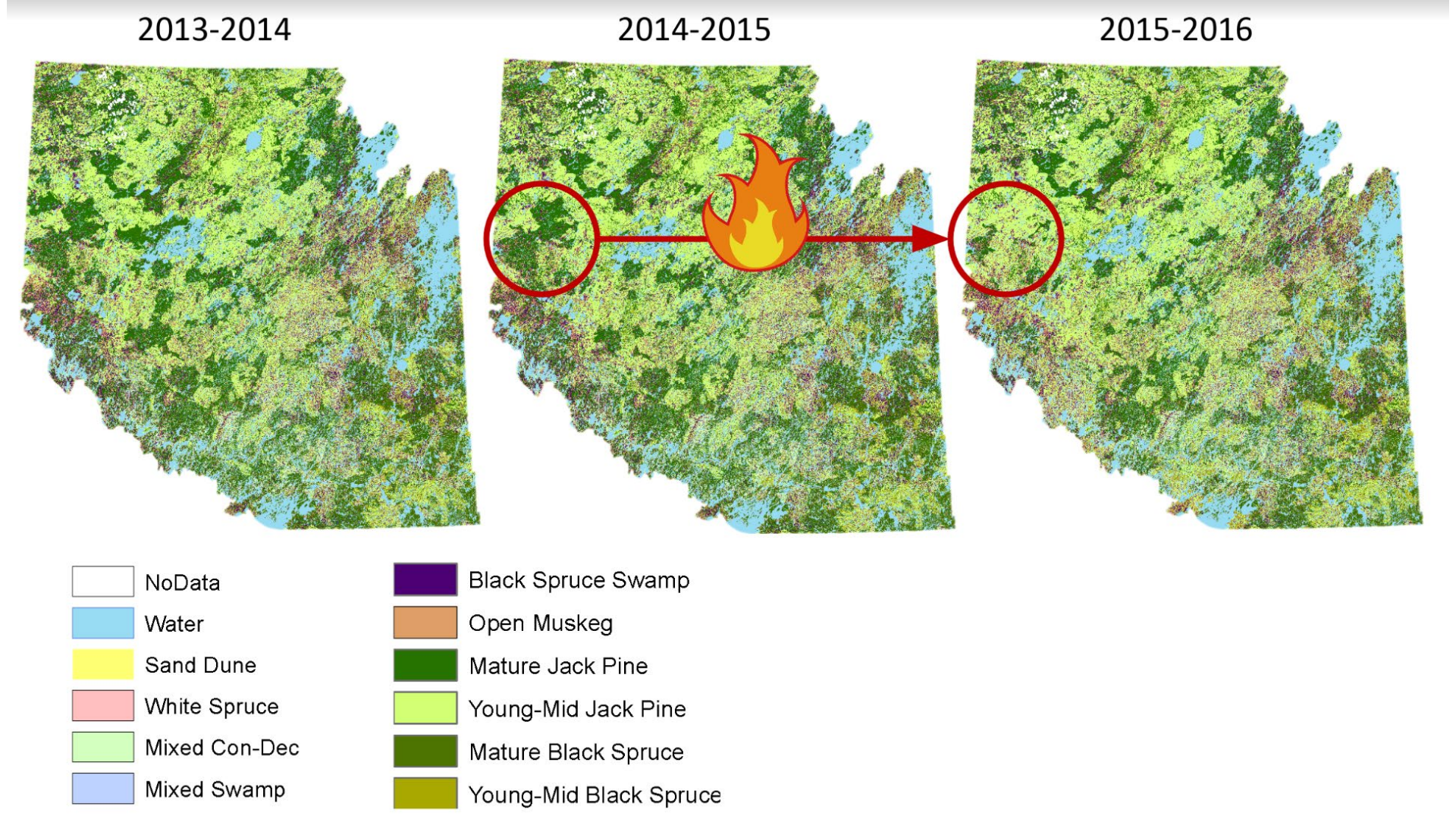
- Recruitment (calves/100 cows)
  - Averaged 0.196 (0.164-0.227) from 2014-18 (50:50 sex ratio assumed)
  - Applies across the SK1 range (U of S sample)
  - 2018 was the highest observed recruitment (0.244); 2017 was lowest (0.140)

2014-18 Population Growth

- 2014 to 2018, $\lambda = 0.99$ [0.94–1.03]
  - Increase in the first two years
  - Decline in the last two years
  - U of S sample, applies throughout all SK1 range
  - **Conclusion: stable population**
    - *Tight 95% confidence interval that overlaps 1.0*
    - *Conservative adult survival rates*

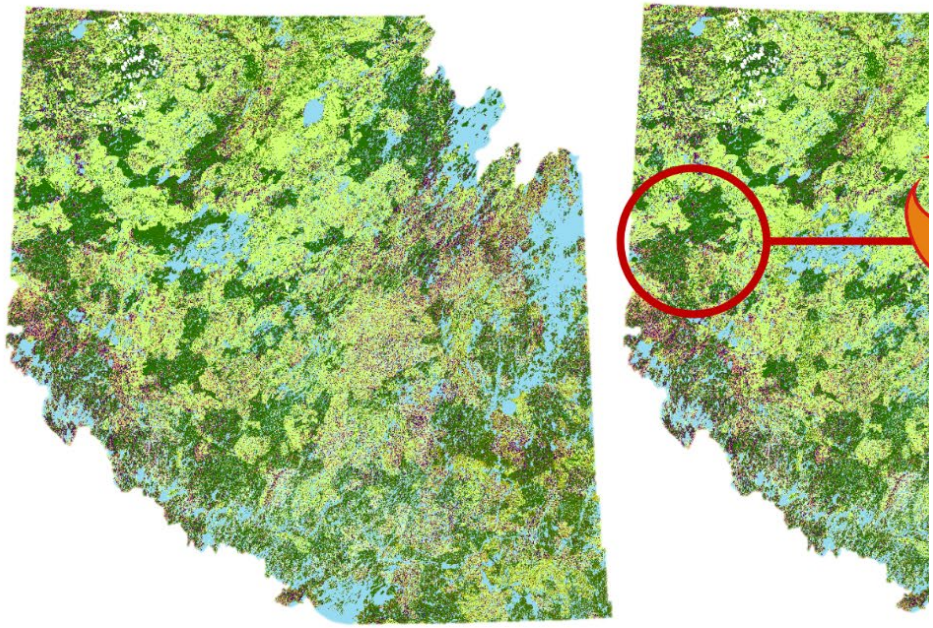
Habitat Selection Analysis

- Multi-scale, multi-season analysis based on collared caribou locations
  - Caribou focused on 4 main associations:
    - Mature (>40 yr) pine forests
    - Mature black spruce
    - Black-spruce bog (almost all mature)
    - Open muskeg
- Land area of these components comprises 50.1% of study area


2013-2014
2014-2015
2015-2016
NoData
Water
Sand Dune
White Spruce
Mixed Con-Dec
Mixed Swamp
Black Spruce Swamp
Open Muskeg
Mature Jack Pine
Young-Mid Jack Pine
Mature Black Spruce
Young-Mid Black Spruce

2013-2014

2014-2(



NoData

Water

Sand Dune

White Spruce

Mixed Con-Dec

Mixed Swamp

Black Spruce Swamp

Open Muskeg

Mature Jack Pine

Young-Mid Jack Pine

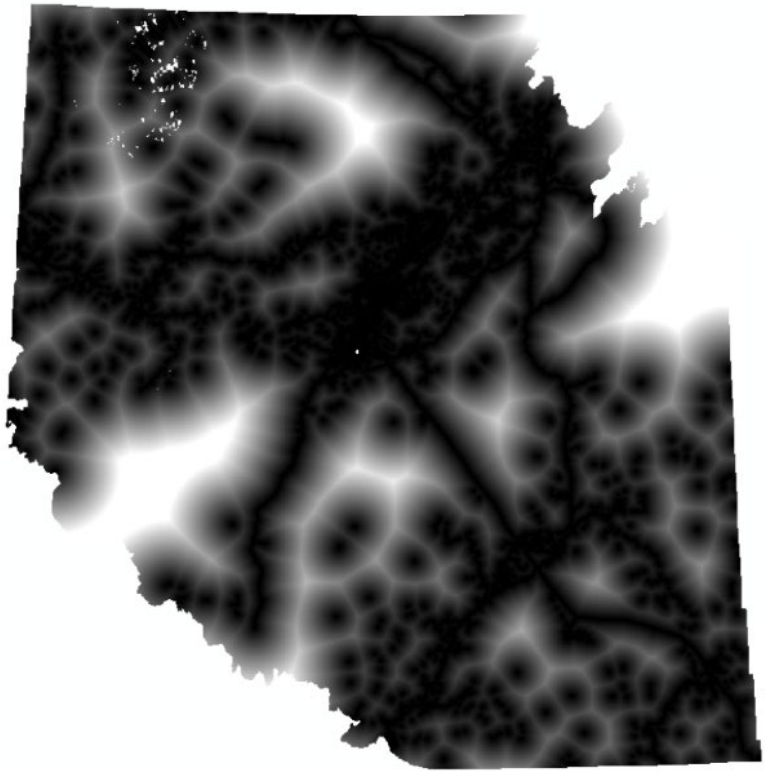
Mature Black Spruce

Young-Mid Black Spruce

Distance to linear features (m)

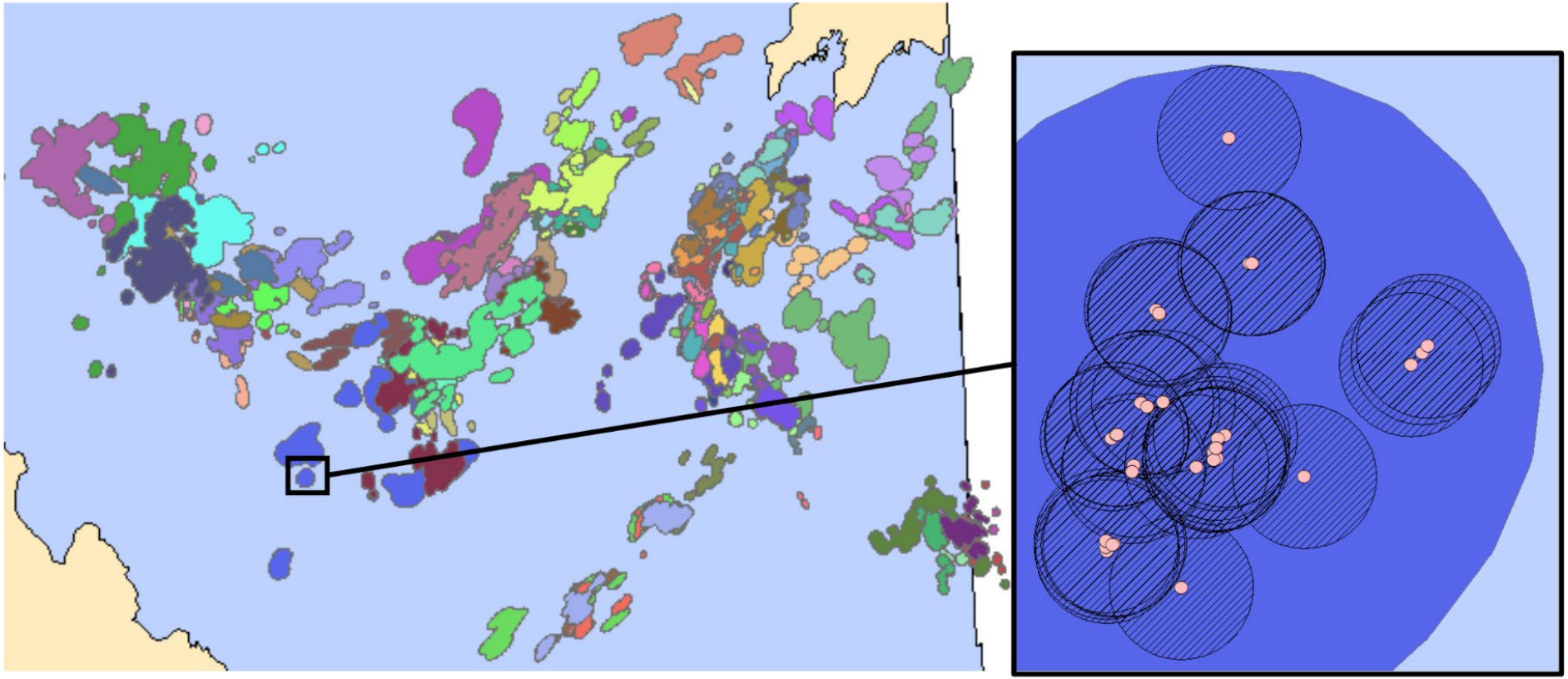
High : 73894

Low : 0



Habitat Selection Analysis

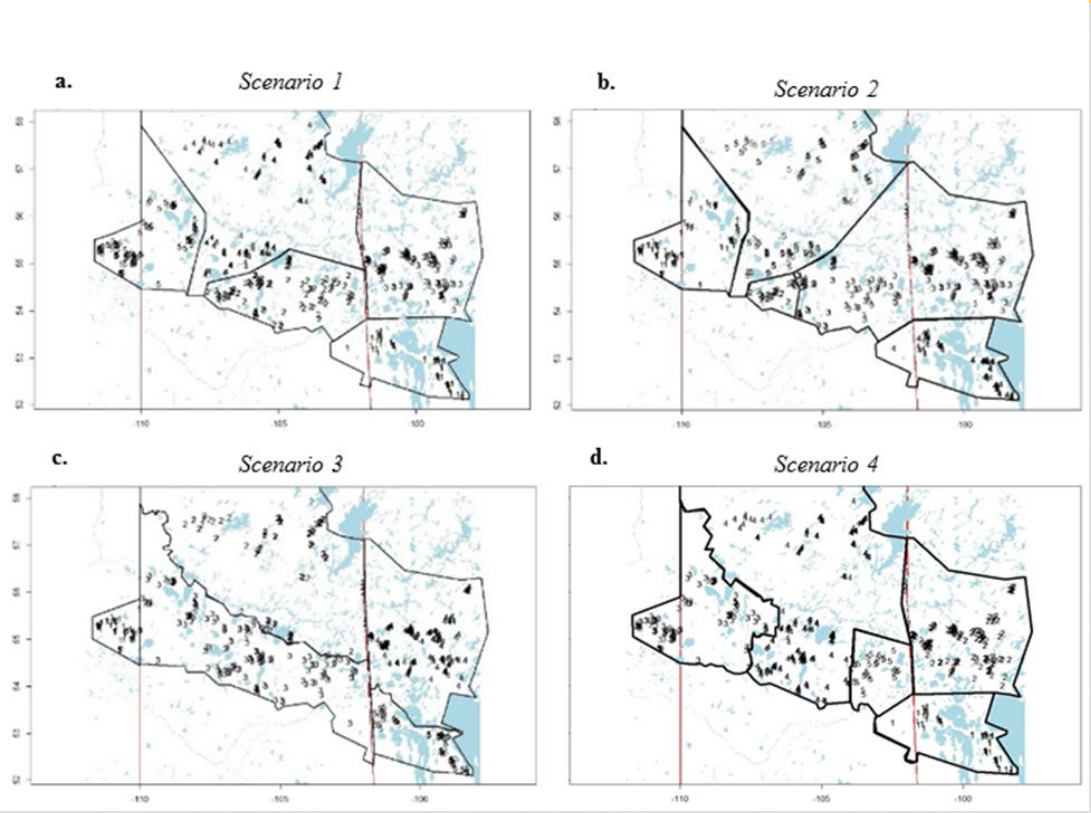
- Linear features occurred at very low density
  - 0.1 km/km^2; some caribou had no exposure
- Caribou were consistently predicted to occur closer than expected to linear features at large scale, in all seasons
- At finer scales (within home range, step-length), caribou are now shown to avoid linear features
  - consistent with known behaviour of caribou
  - scale-dependence in avoidance



- Population scale, home range scale, and 800 m step-length scale

Genetic Relatedness

- Groupings using different approaches
  - A. STRUCTURE
  - B. MEMGENE
  - C. Status quo
  - D. A + B combined
  - Small F_{ST} differences in relatedness



General Conclusions

1. Population occupies some of the most pristine habitat available to boreal woodland caribou in Canada
2. Natural fire cycle of ~100 years resulting in 50.1% of land mass supporting preferred habitat associations; highly resilient forest
3. Some of the highest densities of woodland caribou in Canada

General Conclusions

4. Wolf and alternate prey (moose) densities among the lowest in caribou range in Canada
5. Hunting pressure also very low
6. High adult female survival, mod-low recruitment, high pregnancy

General Conclusions

7. Population is stable
8. The population and study area may be useful as a 'natural baseline' for caribou biologists and managers
   - Population dynamics in a large, pristine area where natural processes dominate, no invasive species

Ongoing…

- Finishing 26-collar black bear study
- Model for caribou in boreal shield
- ECCC enhanced meta-analysis
- Publishing findings
- Producing final report
- New CRD grant

Thanks! philip.mcloughlin@usask.ca

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Patricia, M.Sc. student
Sarah, Postdoctoral
Lucie, Postdoctoral
Nadine, Technician
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Ruth, M.Sc student
Kunwar, Postdoctoral
Alexandre, technician
Kristine, undergraduate
Alex, undergraduate NSERC USRA
Gwen, undergraduate
Megan, undergraduate NSERC USRA
Charlie, undergraduate NSERC USRA
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