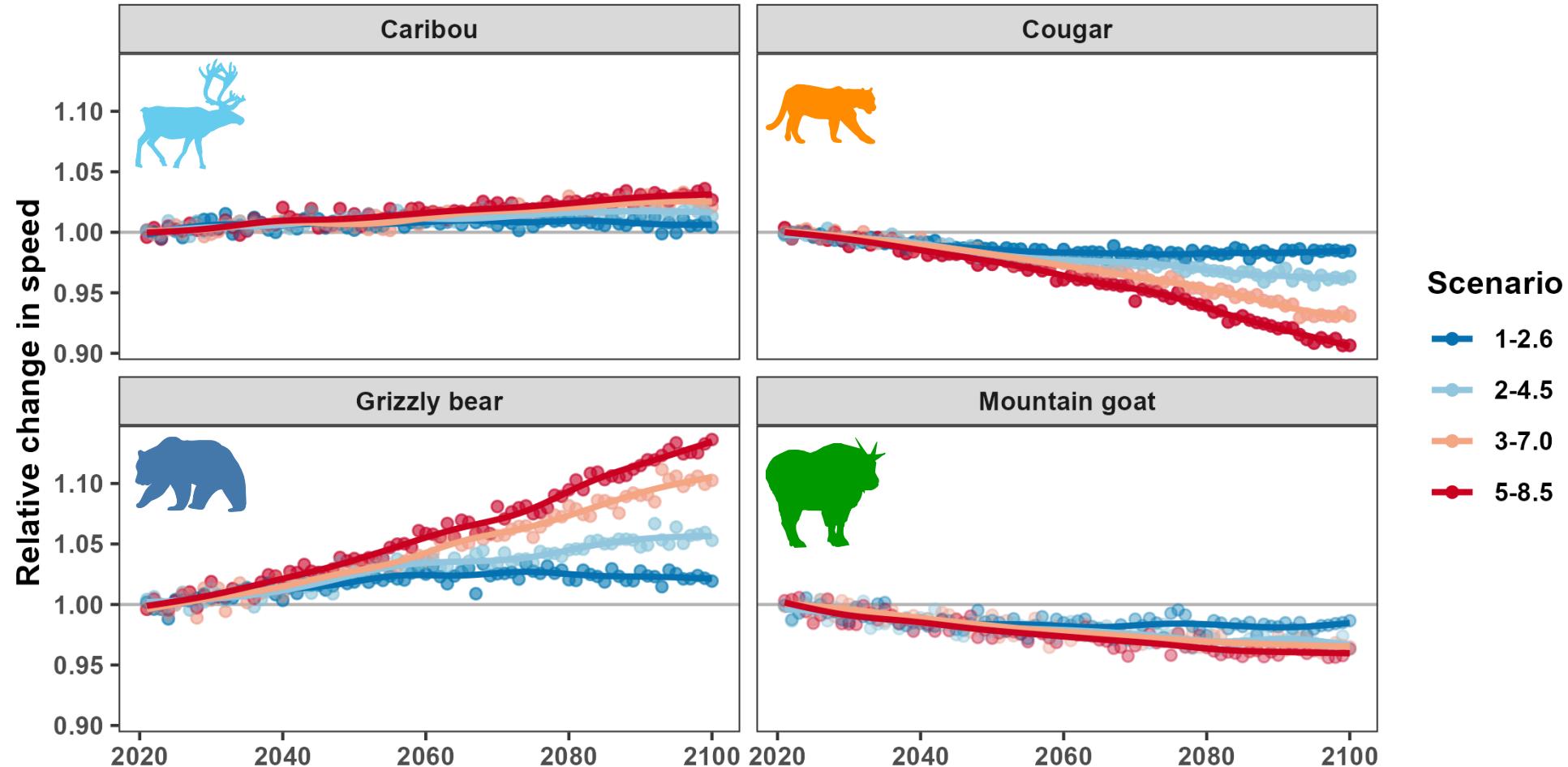


How climate change will shape the future of human-wildlife conflict in BC's protected areas



A two-part project

Dayna Weststrate:
CC & park attendance



Minimizing human-wildlife conflict

This talk:
CC & animal movement



Human-Wildlife Conflict

Human-wildlife conflict is scary...

- Sensational topic
- High risks for humans
- High risks for animals



© wiscohana

... but conflict goes both ways

- Climate change
- Habitat loss
- Overhunting
- Pointless confrontations...



© ABC News

Poking a sleeping bear

A *hangry* bear



A hangry bear



A hangry bear



© NPS Photo / Jake Bortscheller

Moving in a changing world

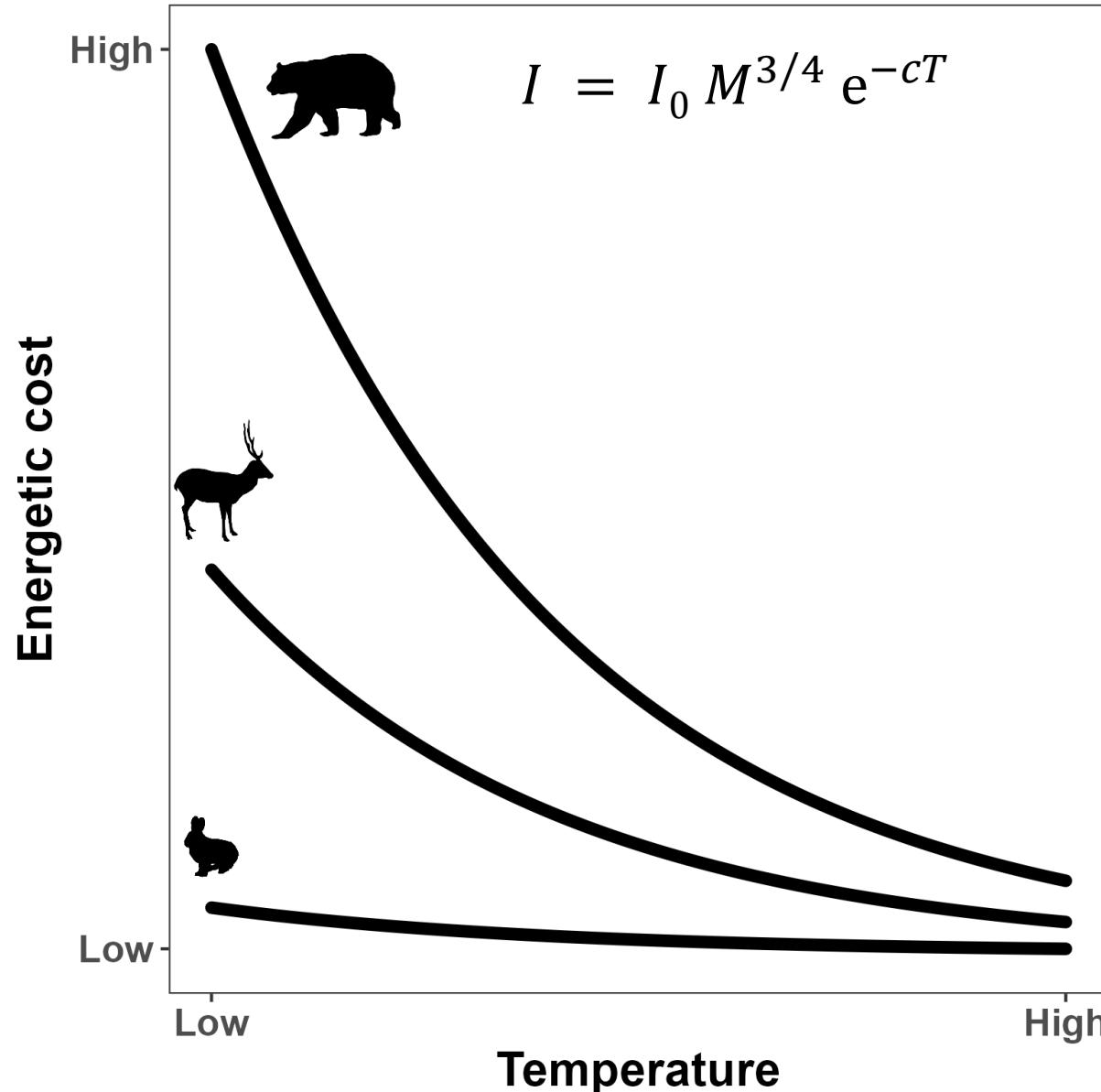
Maintaining an energetic balance

- Require energy to survive
- Move to collect resources
- Collect more than you spend
- Maintain an energetic balance

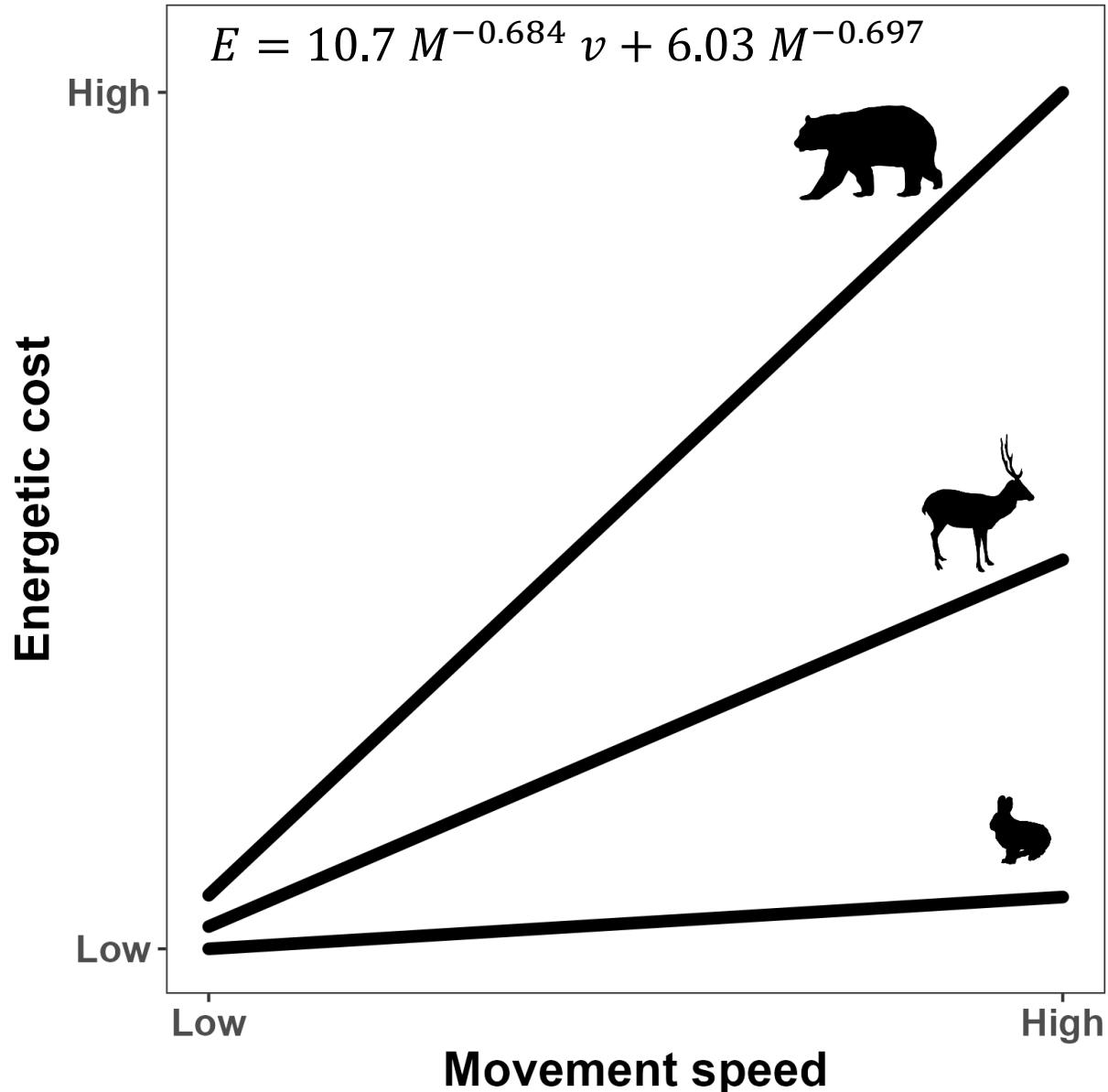


© Don Johnston_WC/Alamy Stock Photo (cropped)

Energetic costs depends on temperature

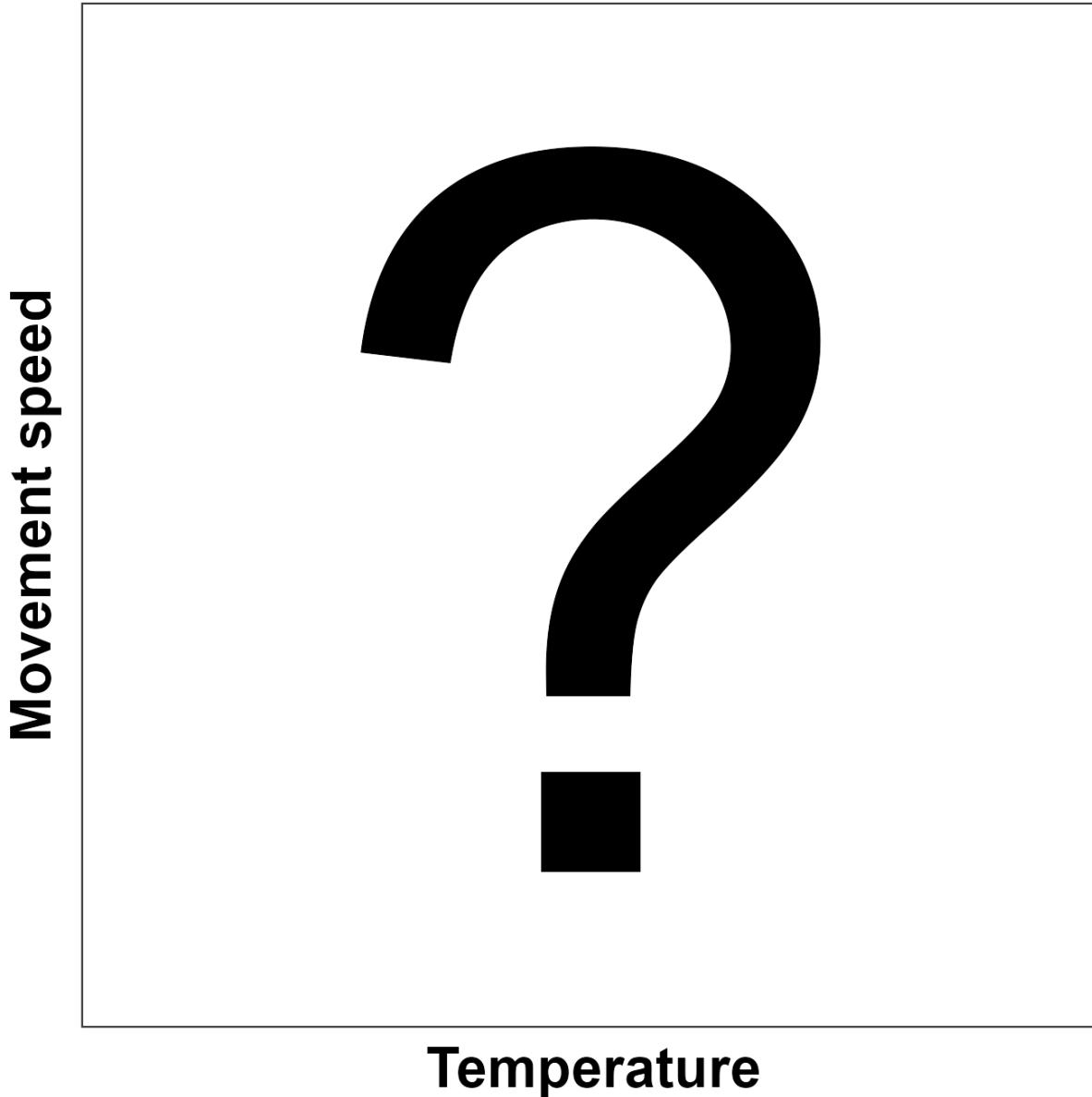


Movement comes at a cost



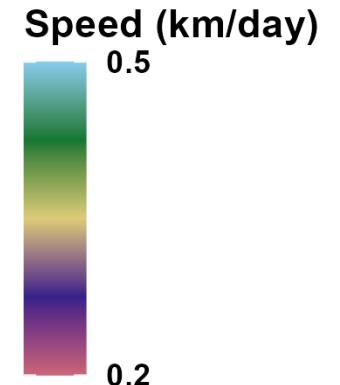
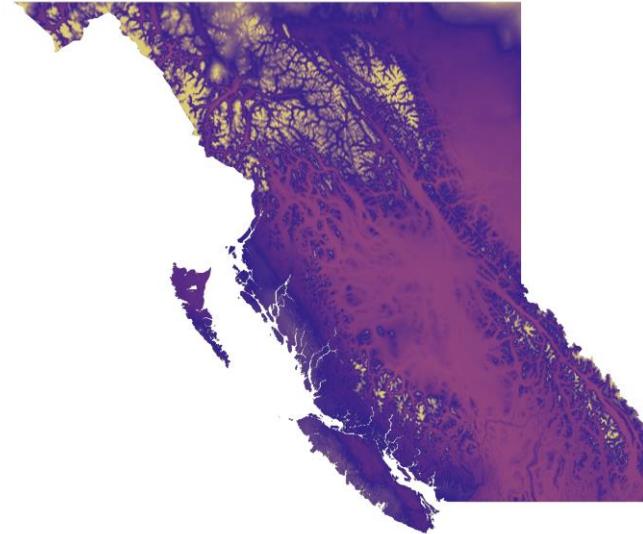
(Taylor et al. 1982)

Does speed depend on temperature?

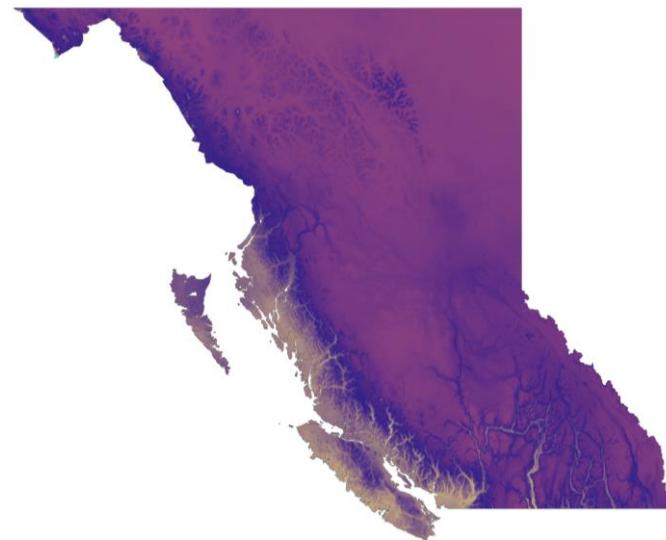


Predicting animal space use

Present



2100



Effects of climate change on:

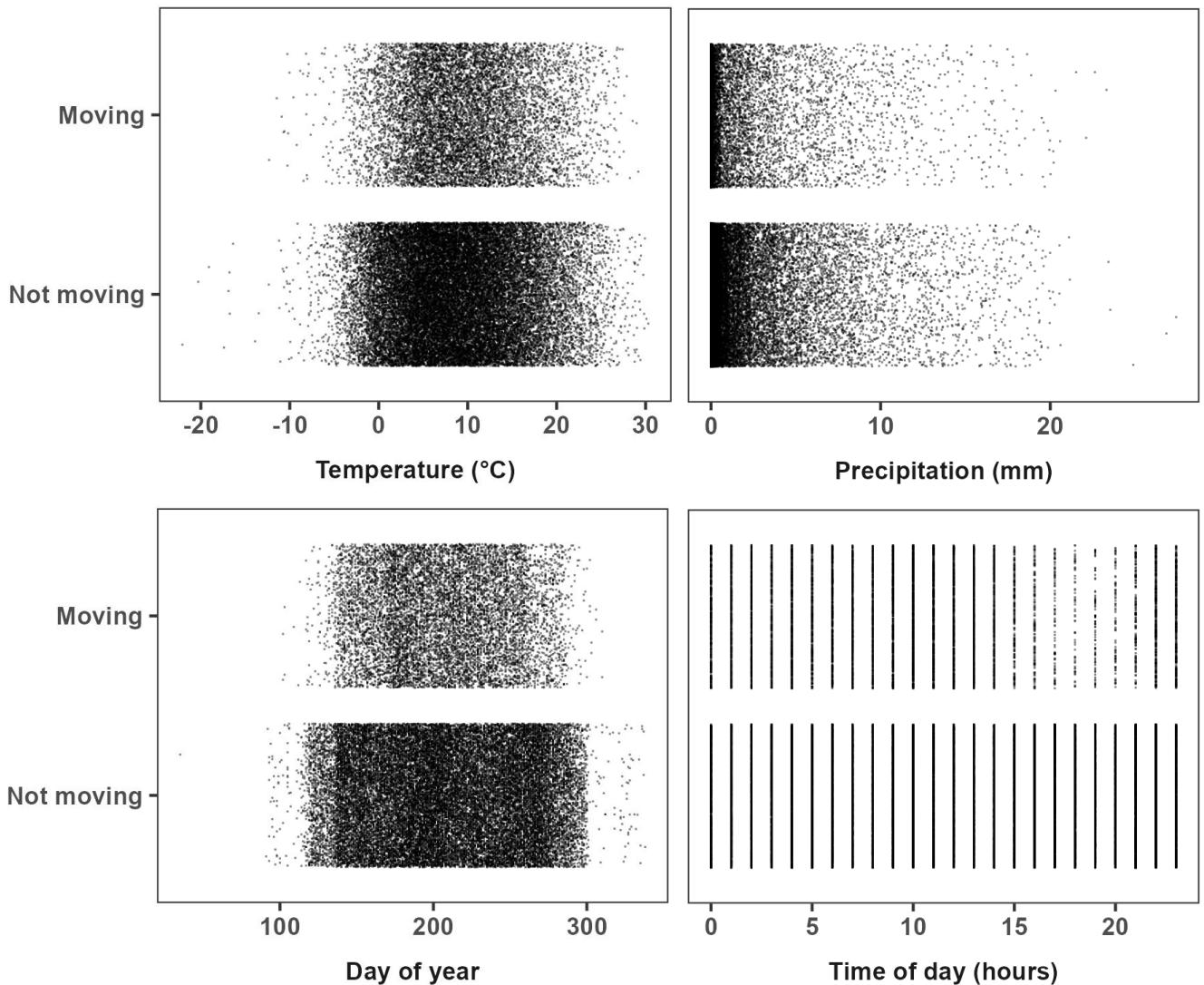
- When animals move
 - How much animals move
 - Where animals move
-
- Predict behavior and spatial use
 - Proactive management

Modeling bear movement

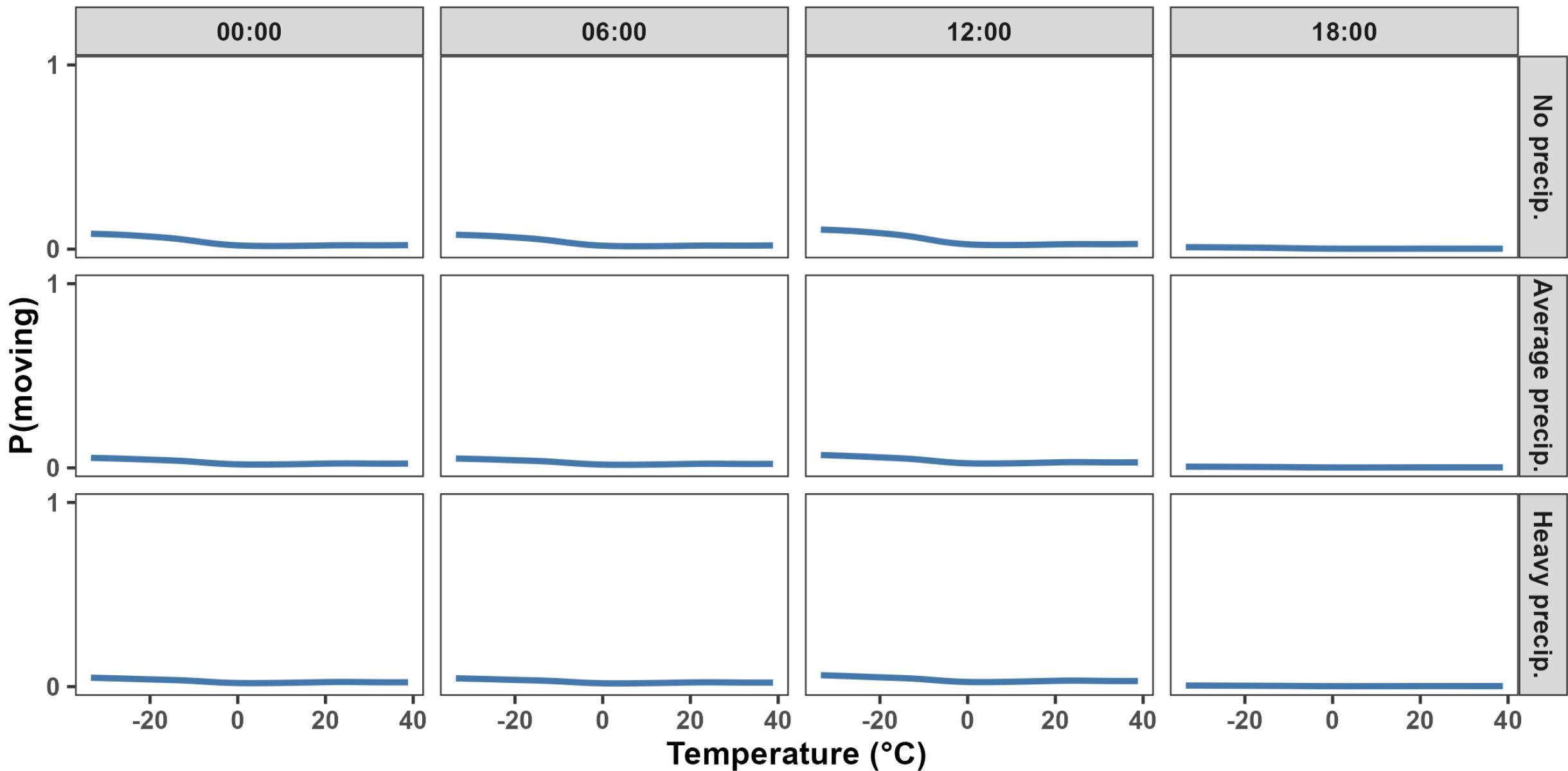
When do bears move?

Binomial model:

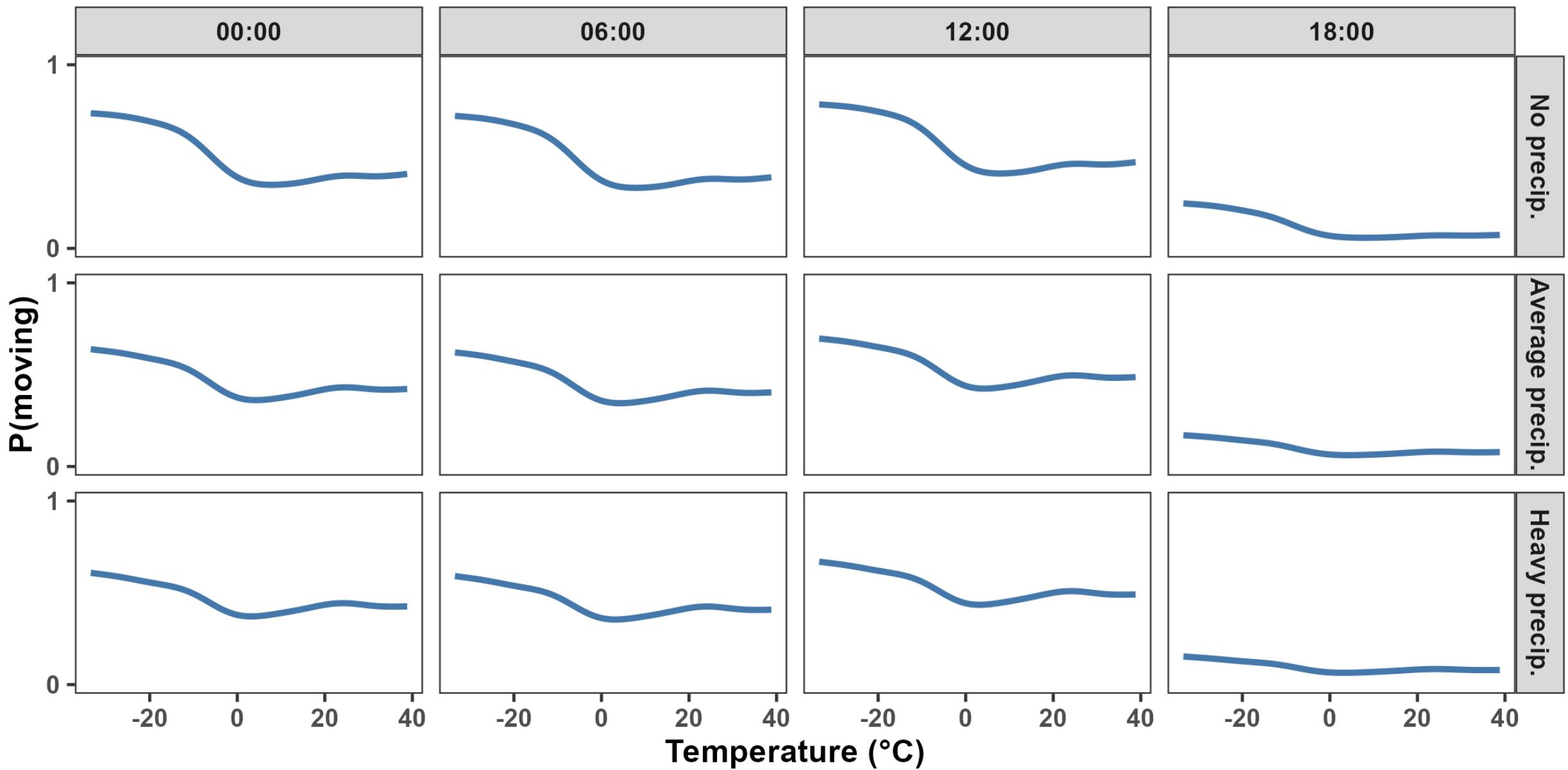
- Moving: yes/no
- Temperature (-25 to 30°C)
- Precipitation (0 to 27 mm)
- Day of year (Feb to Dec)
- Time of day (00:00, 24:00)



Predicting when bears move (December 13th)



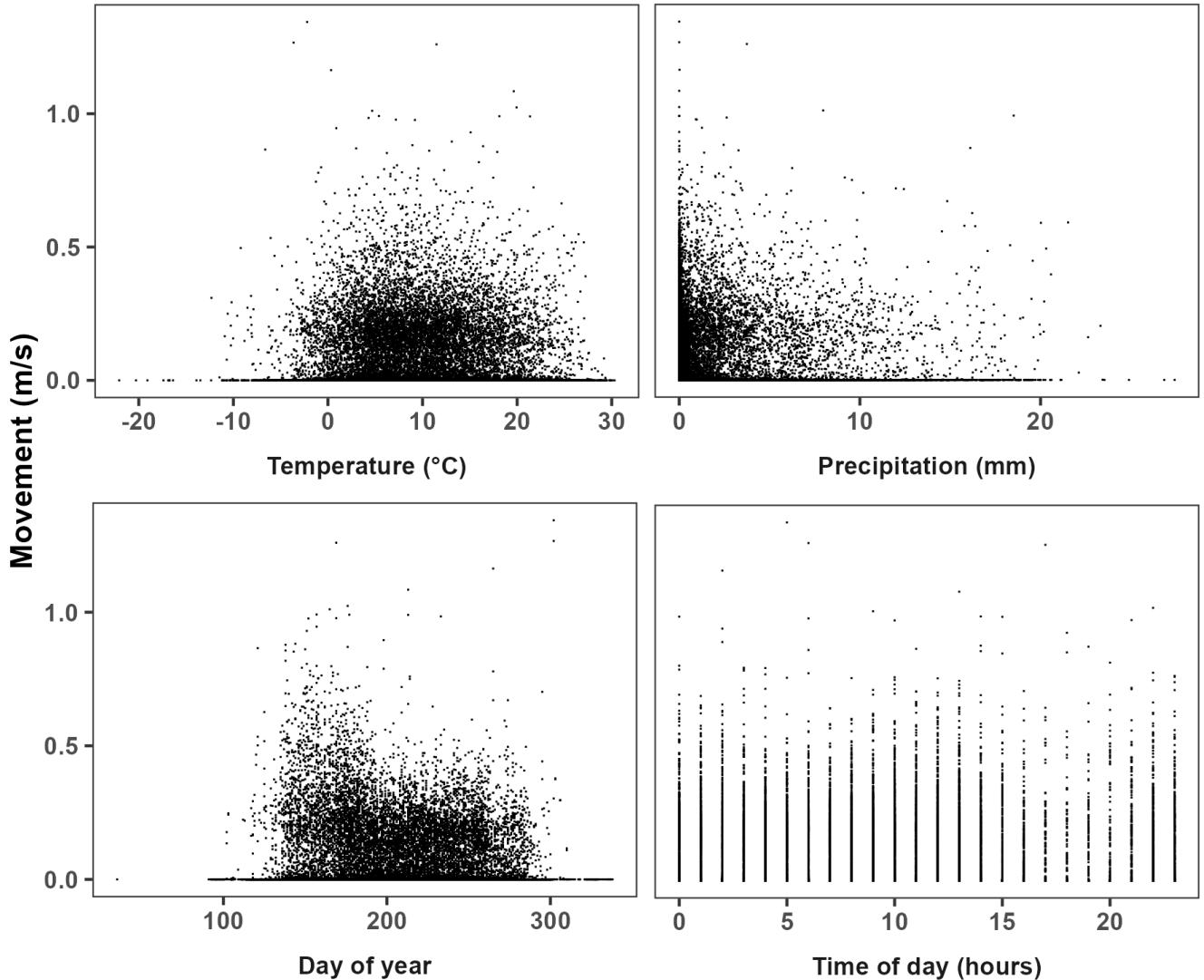
Predicting when bears move (June 15th)



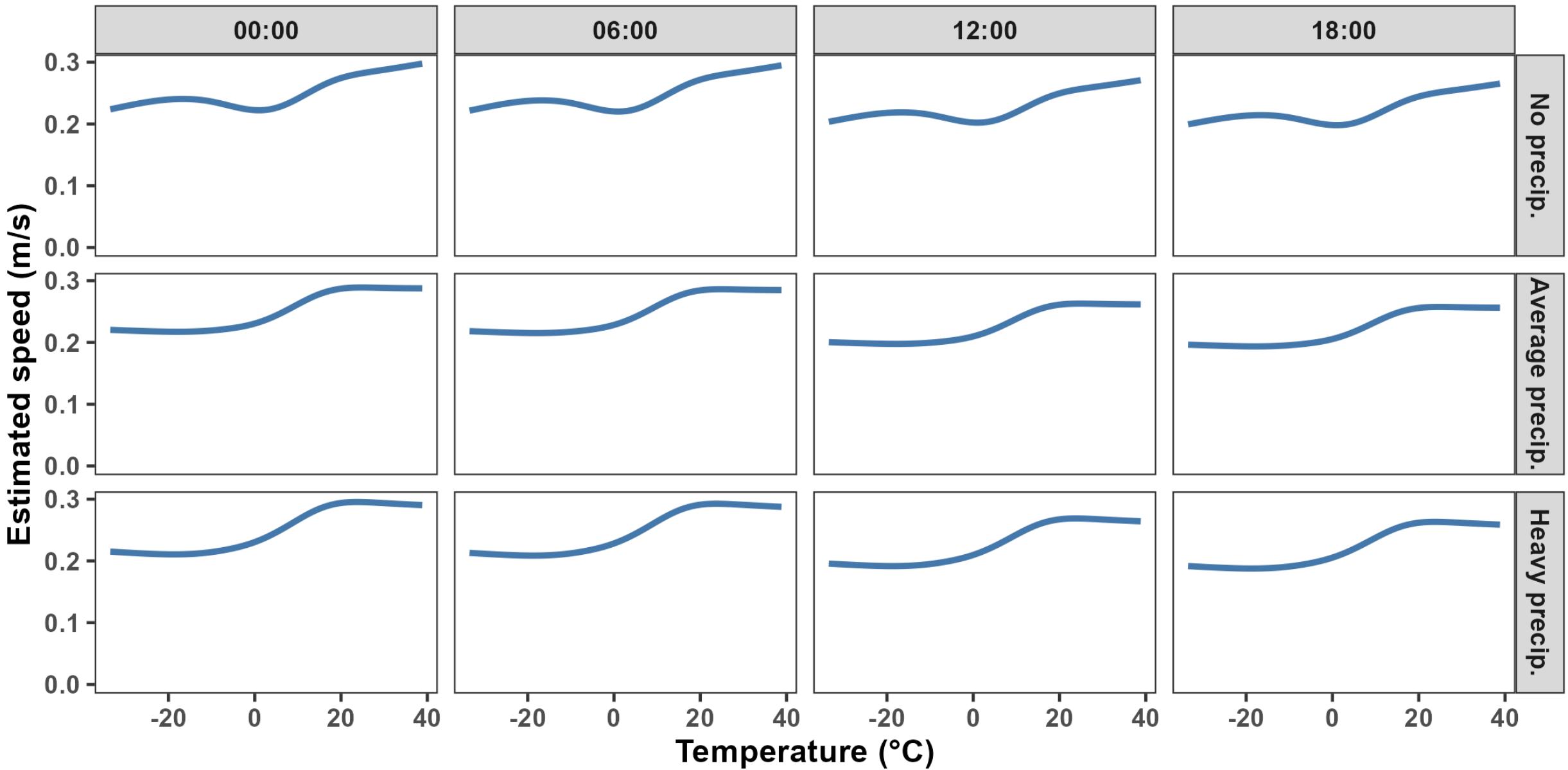
How much do bears move?

Gamma model:

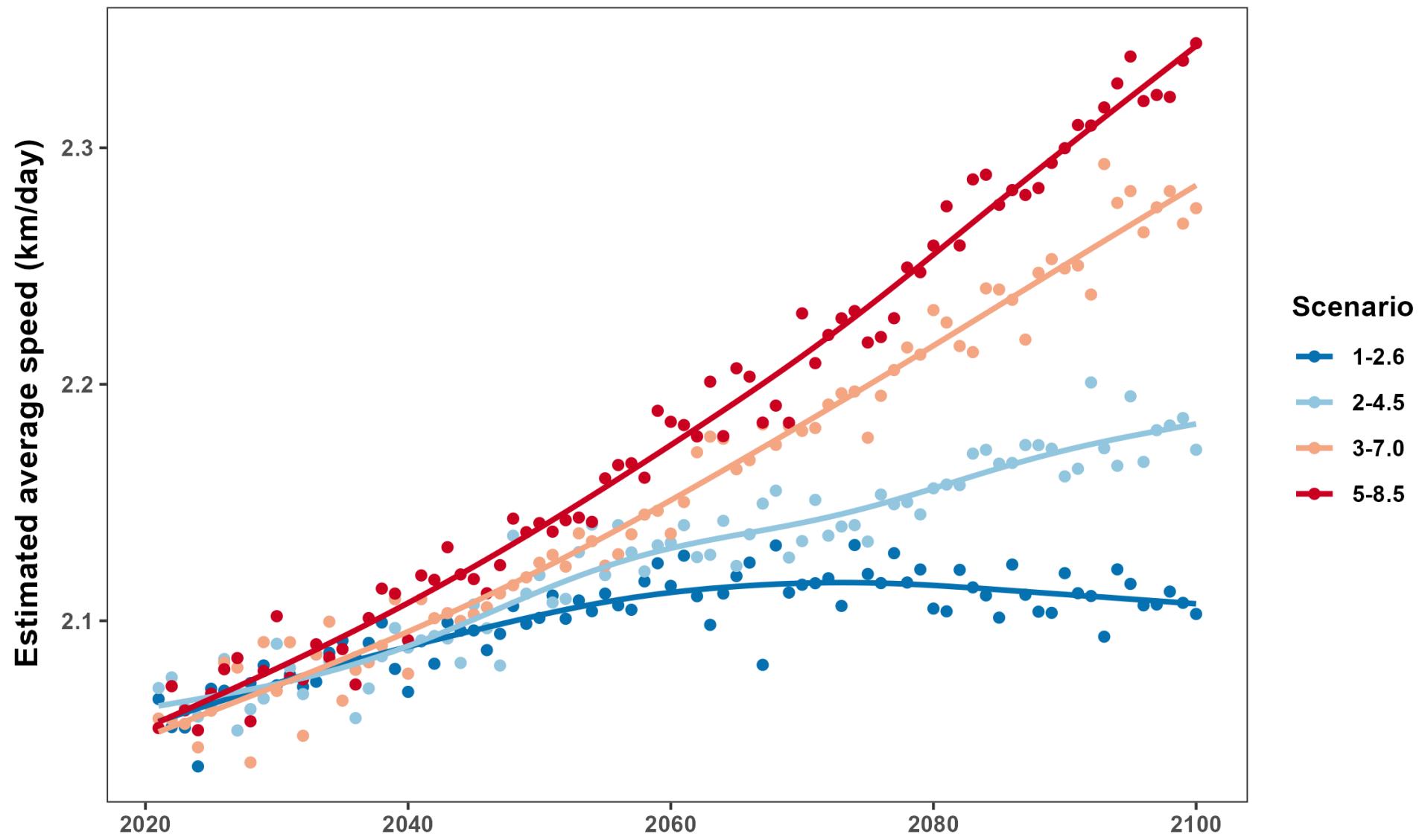
- Speed: > 0 m/s
- Temperature (-25 to 30°C)
- Precipitation (0 to 27 mm)
- Day of year (Feb to Dec)
- Time of day (00:00, 24:00)



Predicting how much bears move



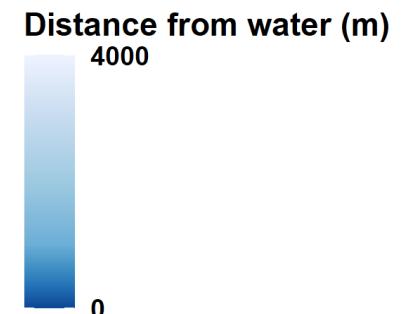
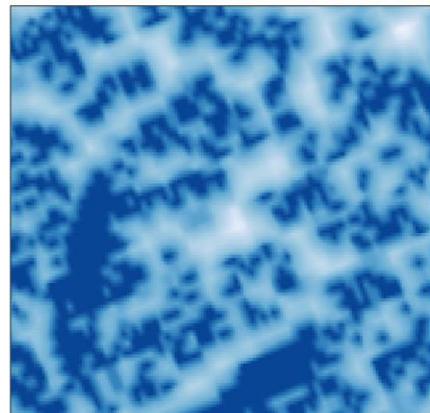
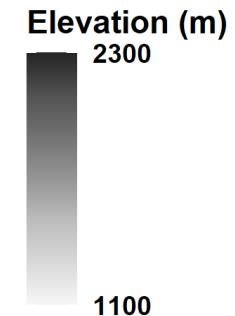
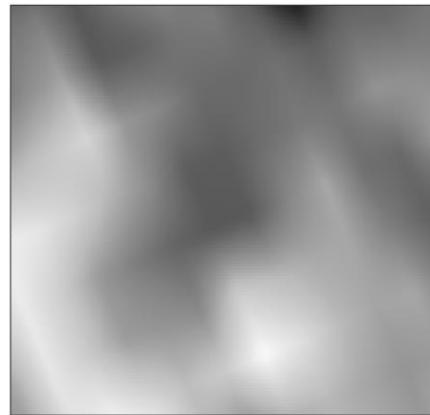
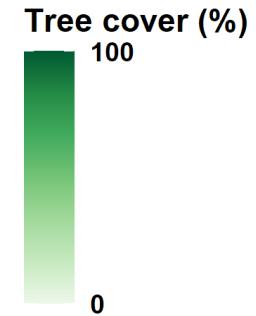
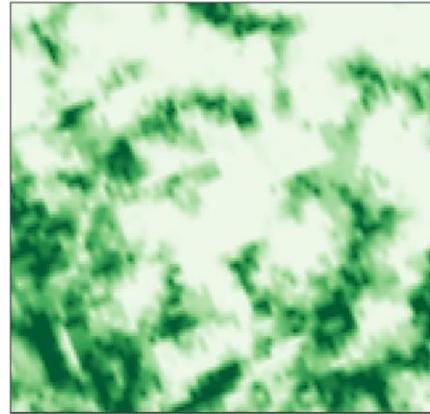
Predicting how bears will move in the future



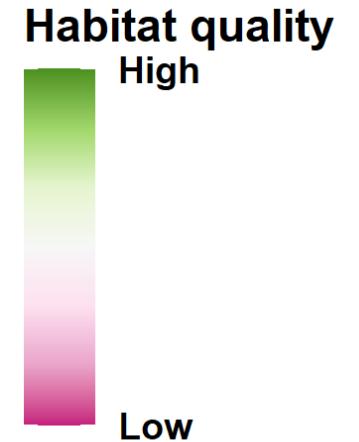
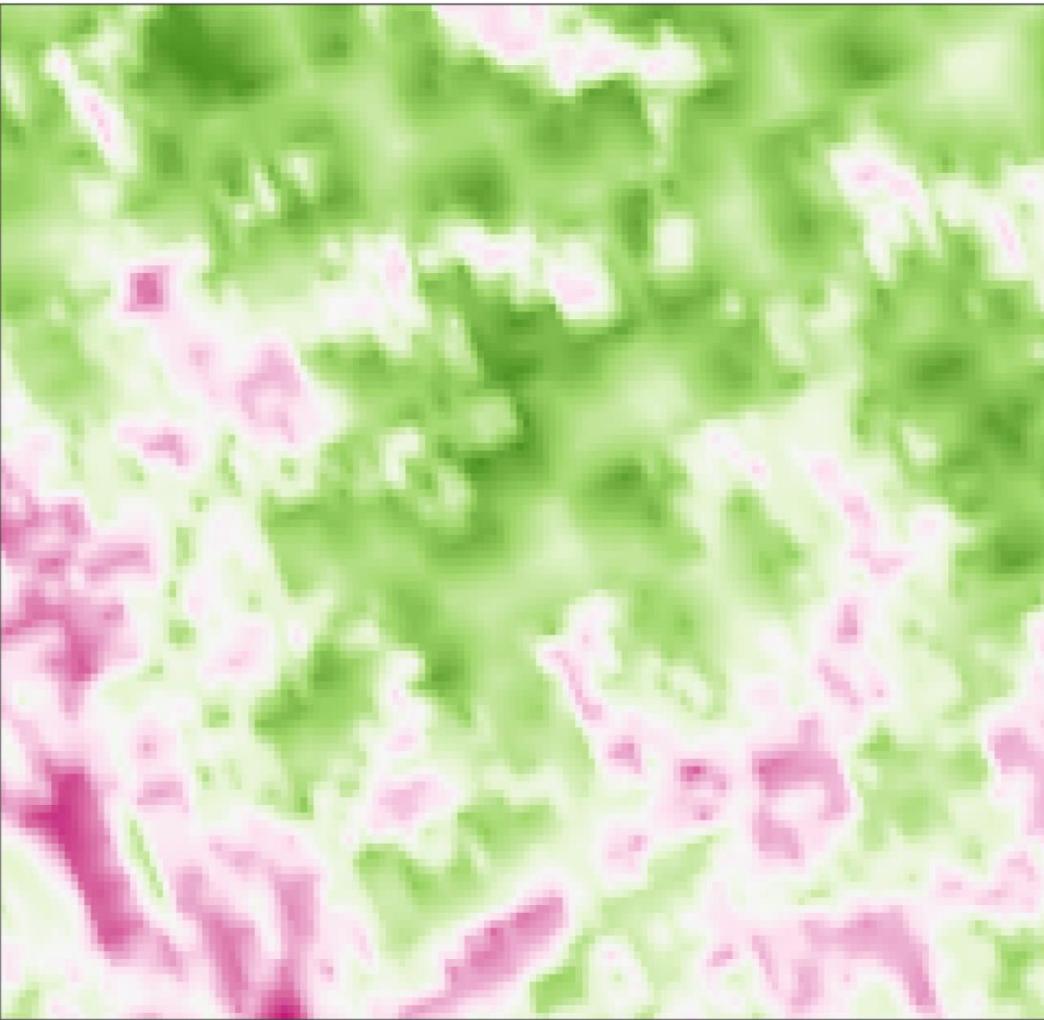
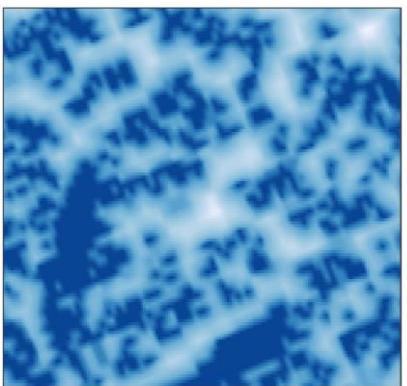
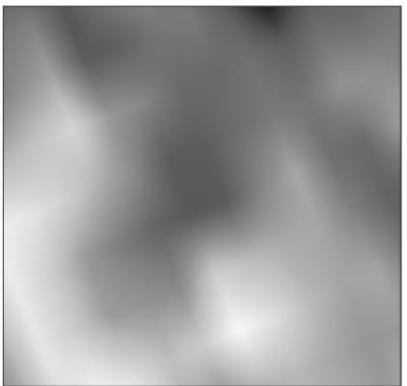
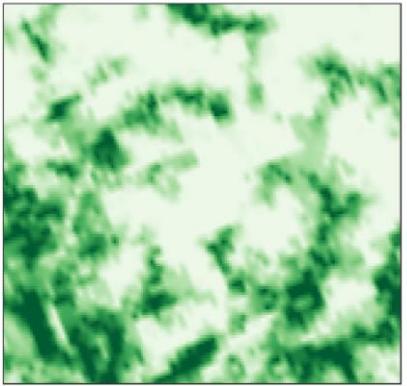
Where do bears move?

Integrated Resource Selection Function (iRSF; Alston et al. 2022):

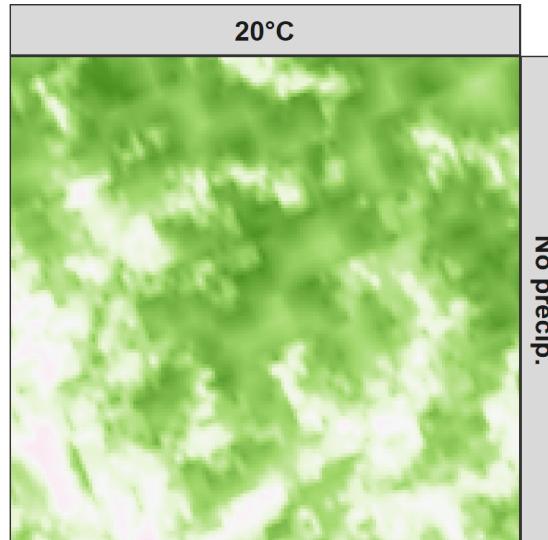
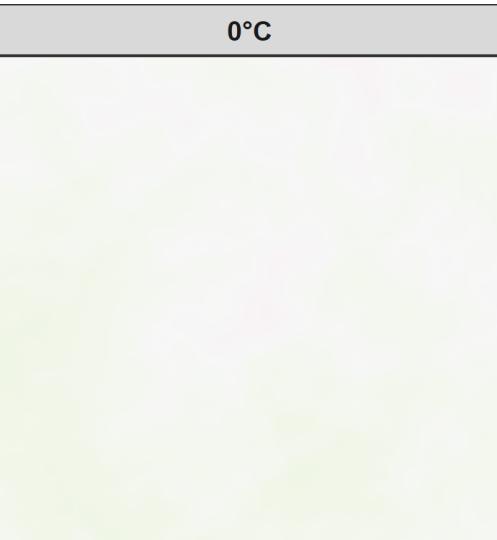
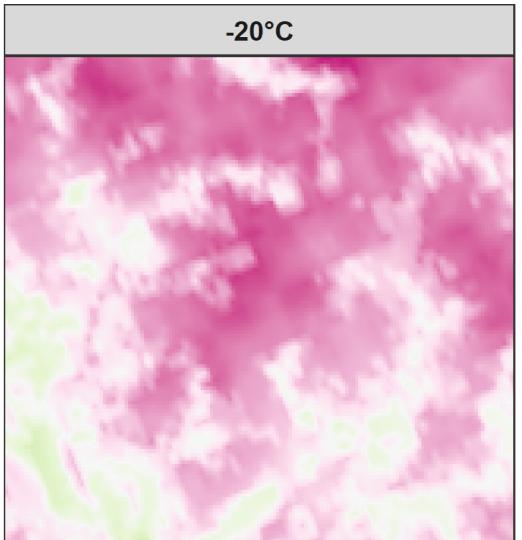
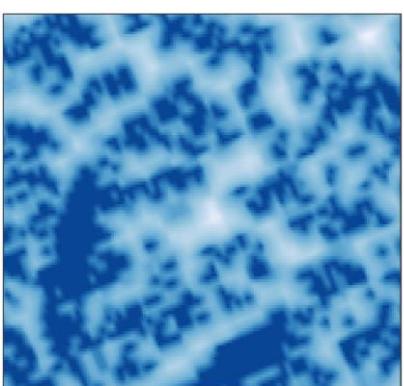
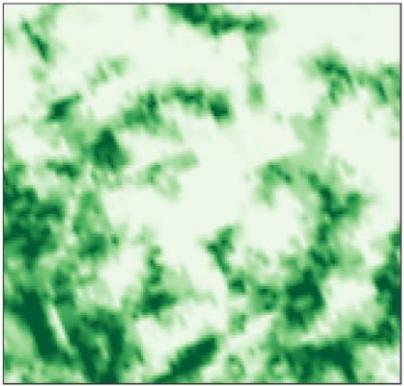
- Tree cover (0% – 100%)
- Elevation (m)
- Distance from water (m)
- Temperature interactions
- Precipitation interactions



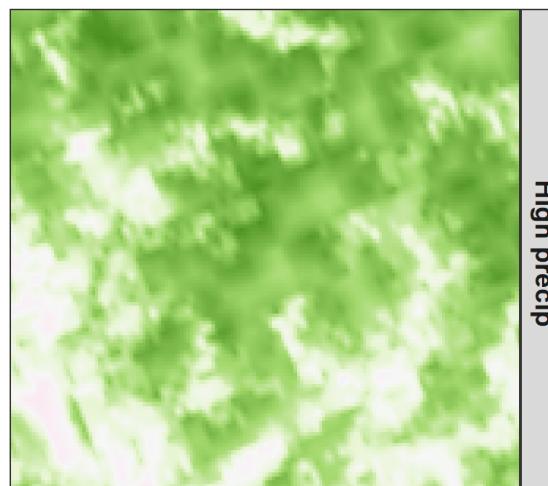
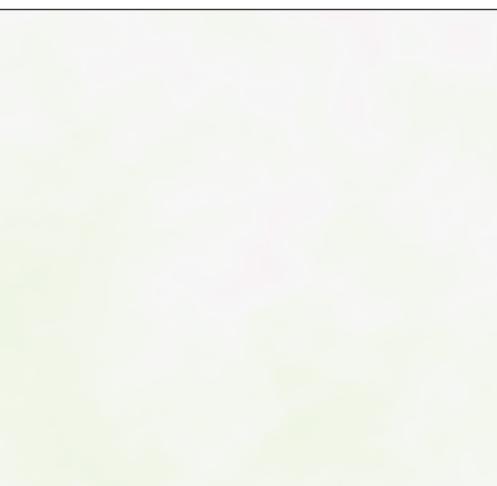
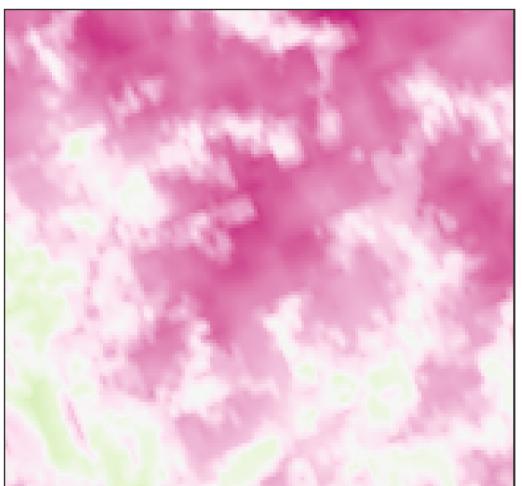
Where do bears move on a warm, dry day?



Where do bears move?



No precip.



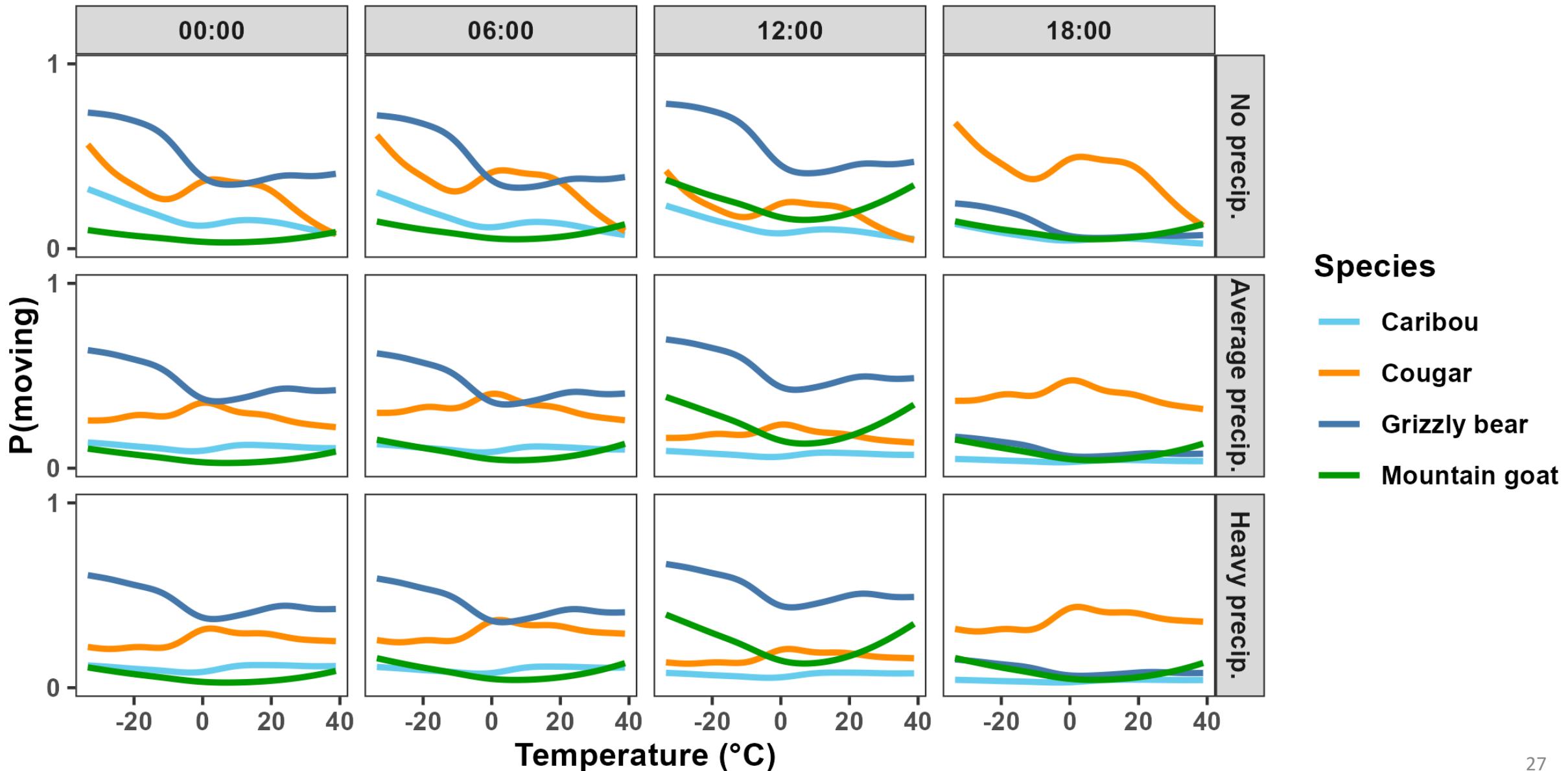
High precip

Habitat quality
High

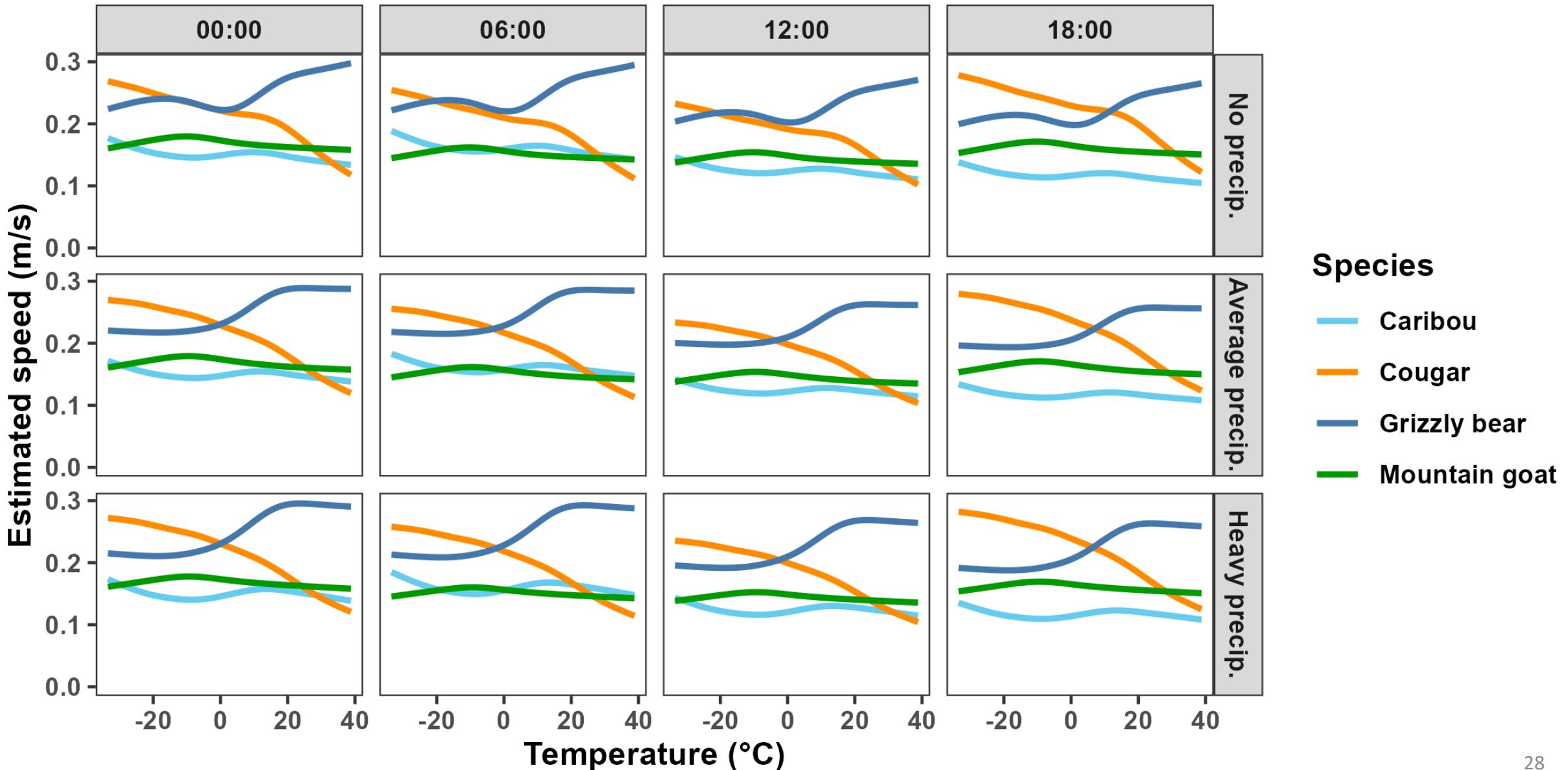
Low

Including more species

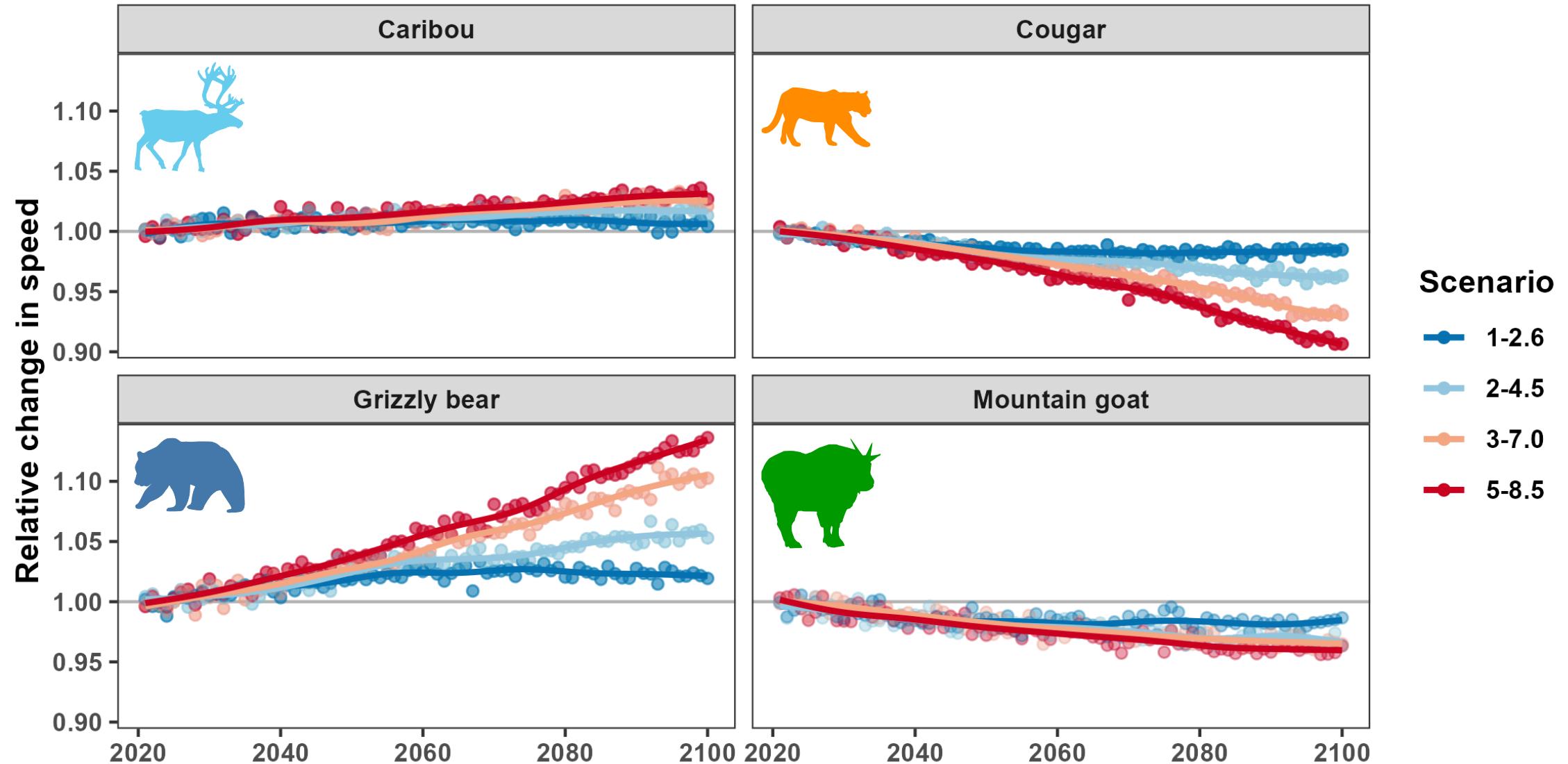
$P(\text{moving})$ varies strongly between species



Average speeds vary strongly between species



Predicting into the future



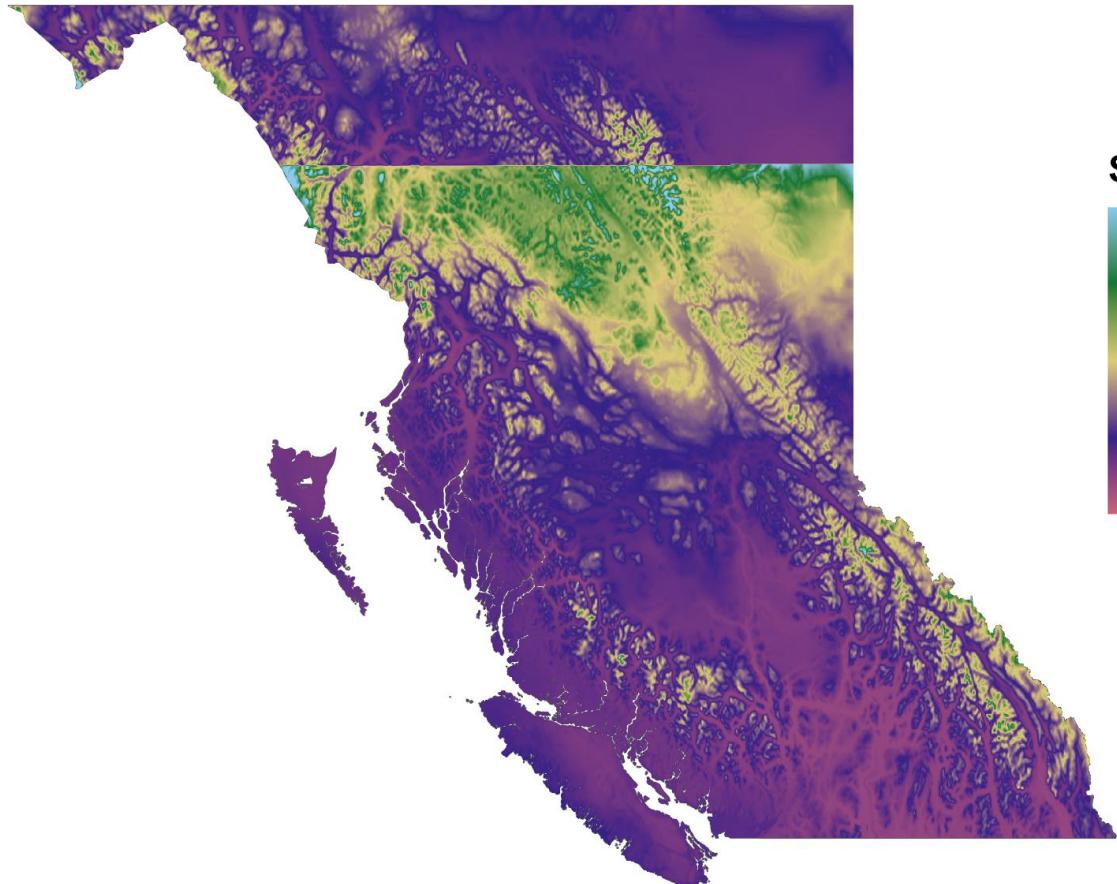
Applications for conservation

Bear speed depends on the location

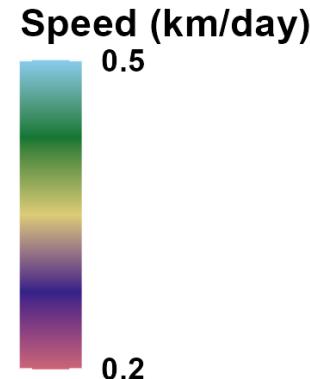
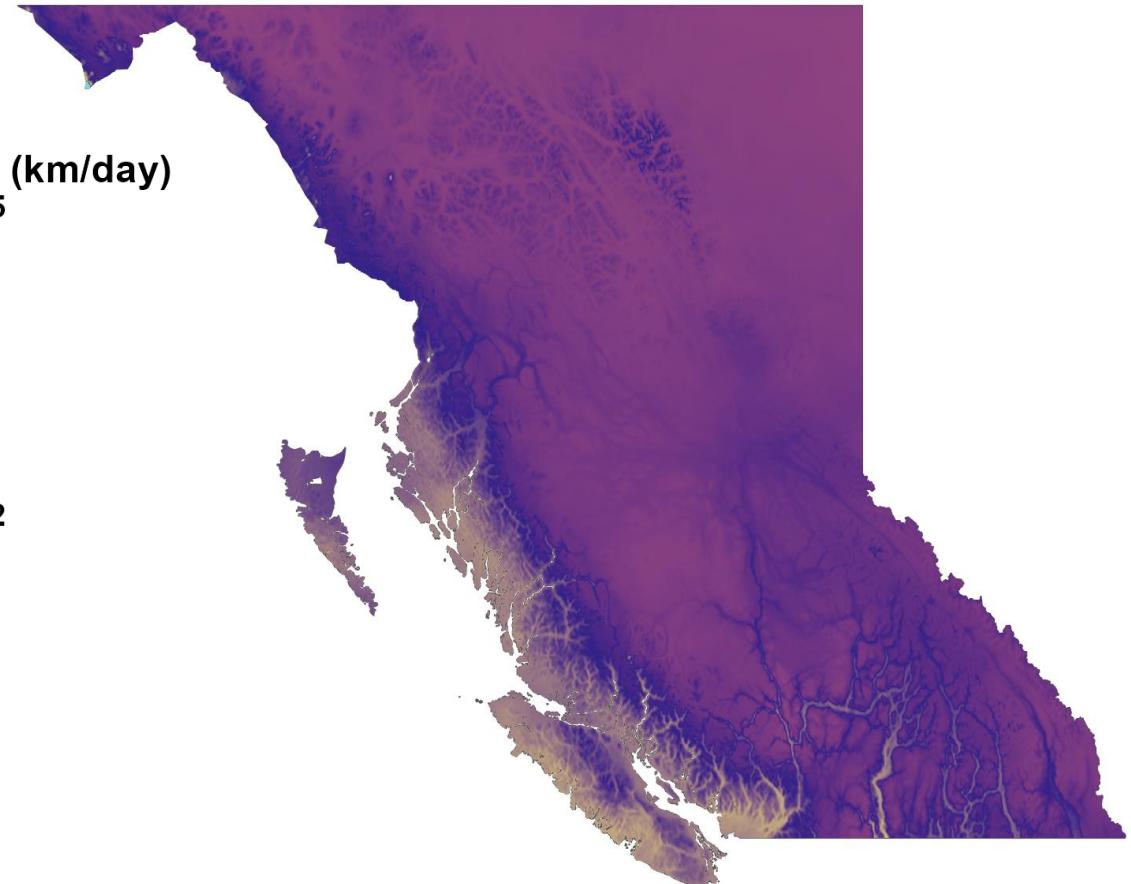


Bear speed depends on the climate scenario

SSP 1-2.6

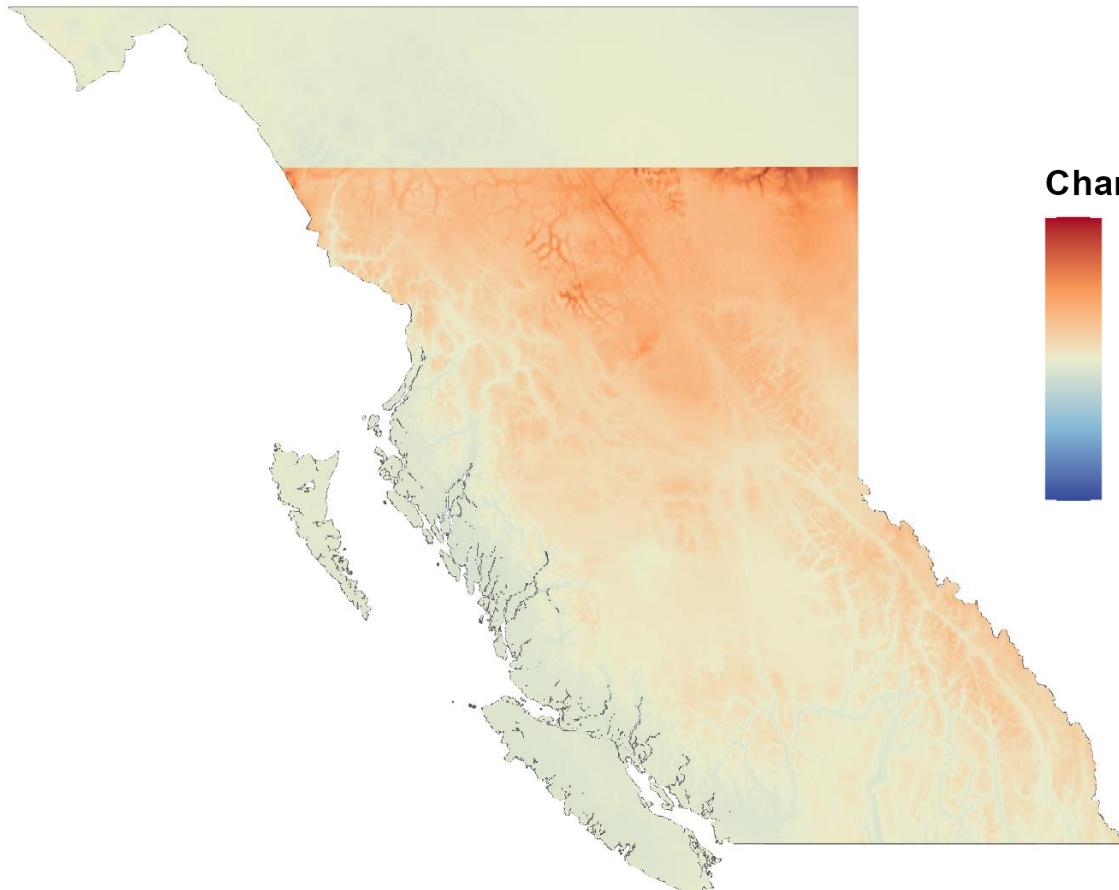


SSP 5-8.5

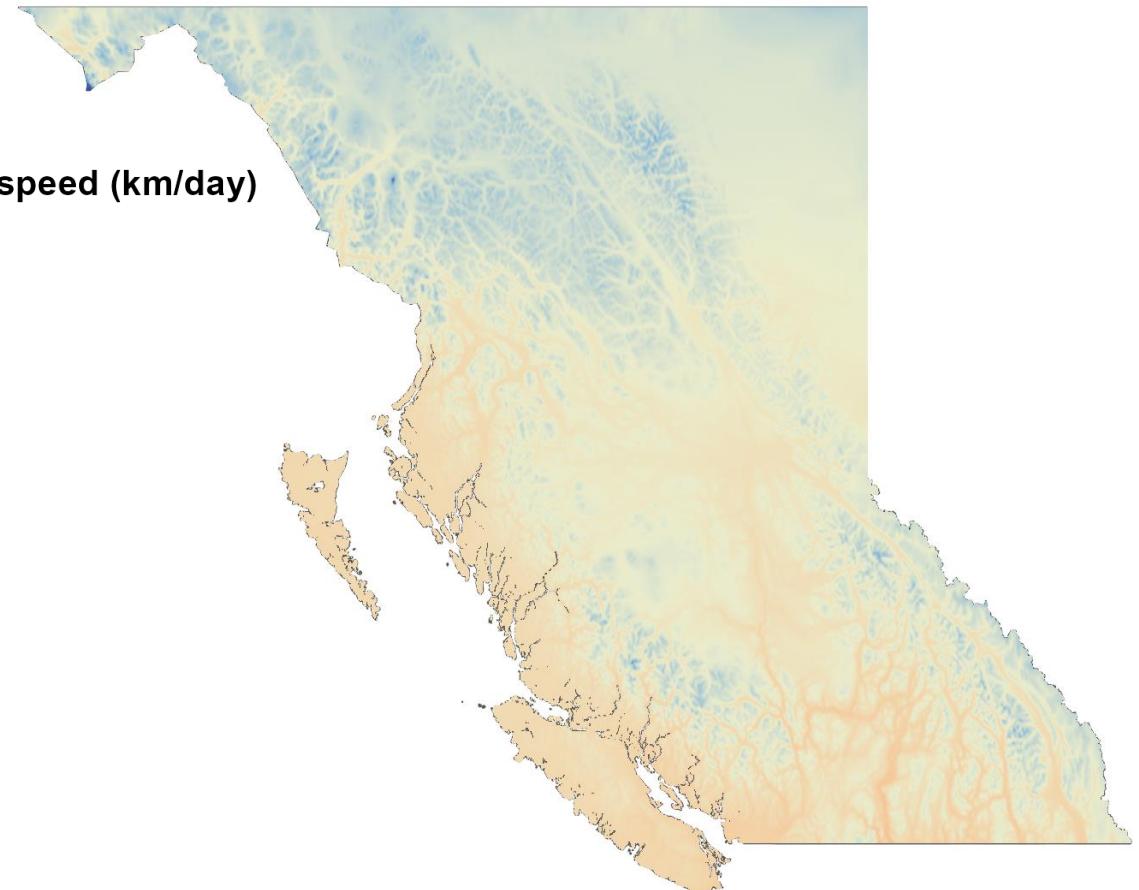


Changes in bear speed depend on the climate scenario

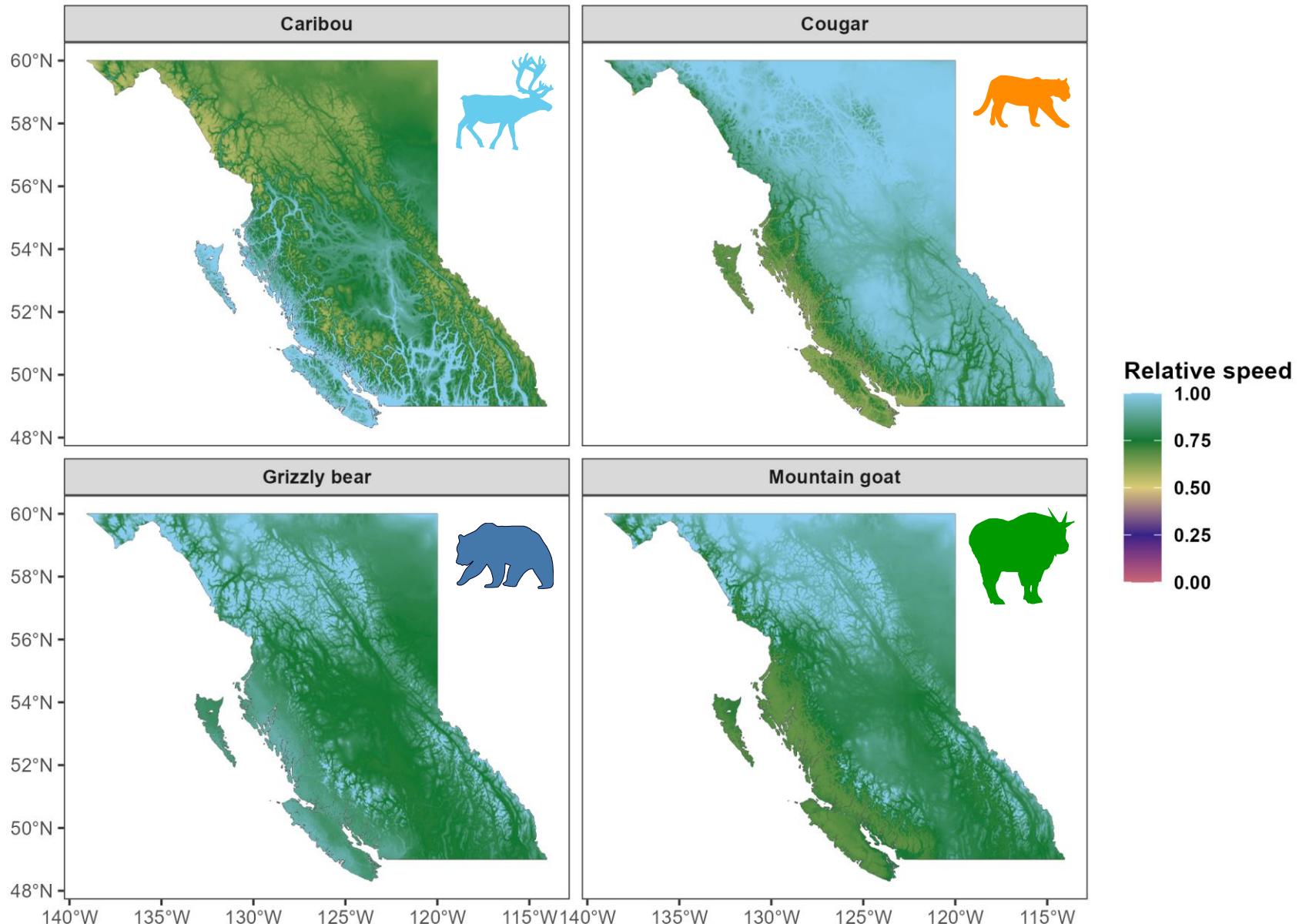
SSP 1-2.6



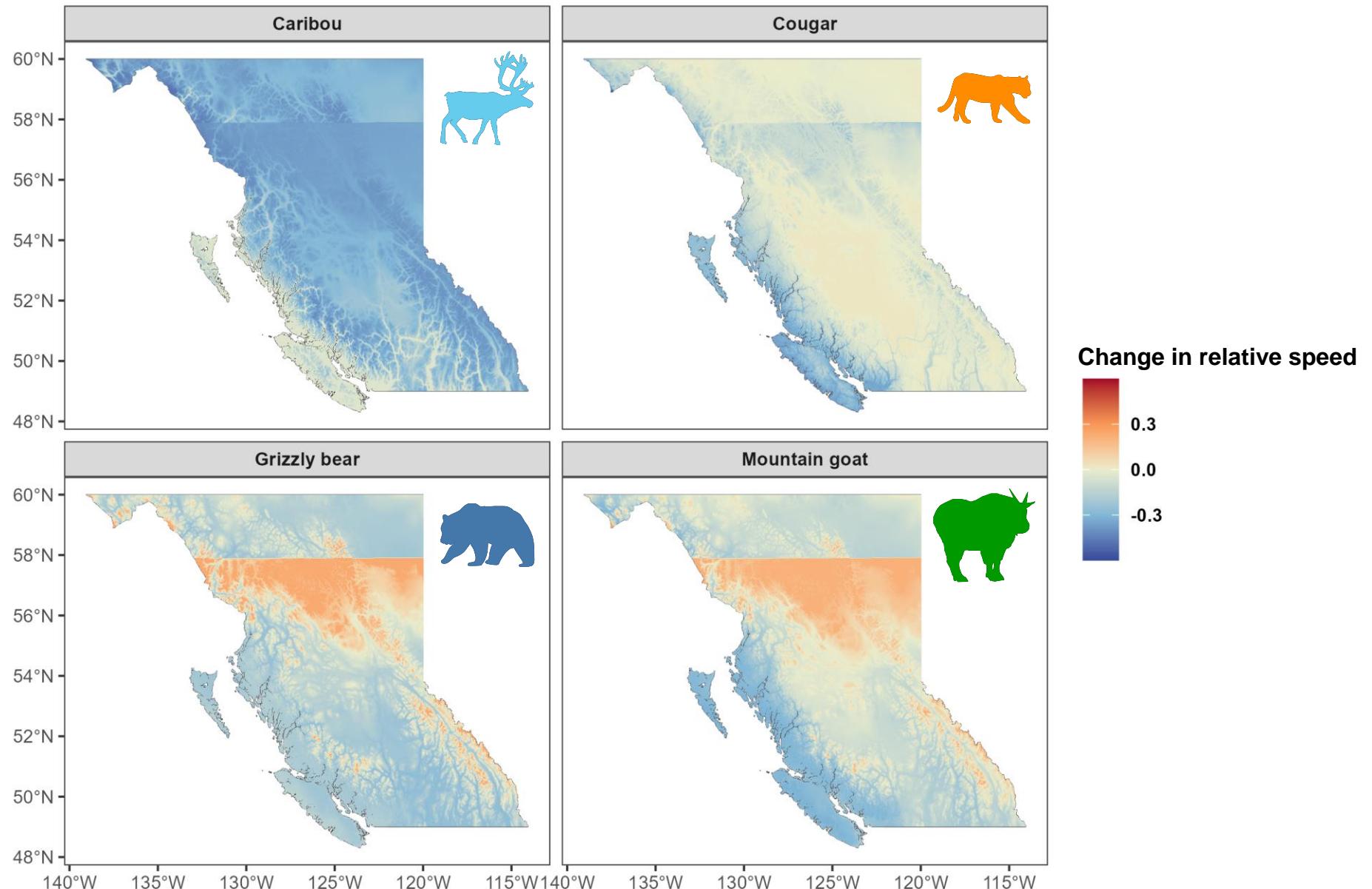
SSP 5-8.5



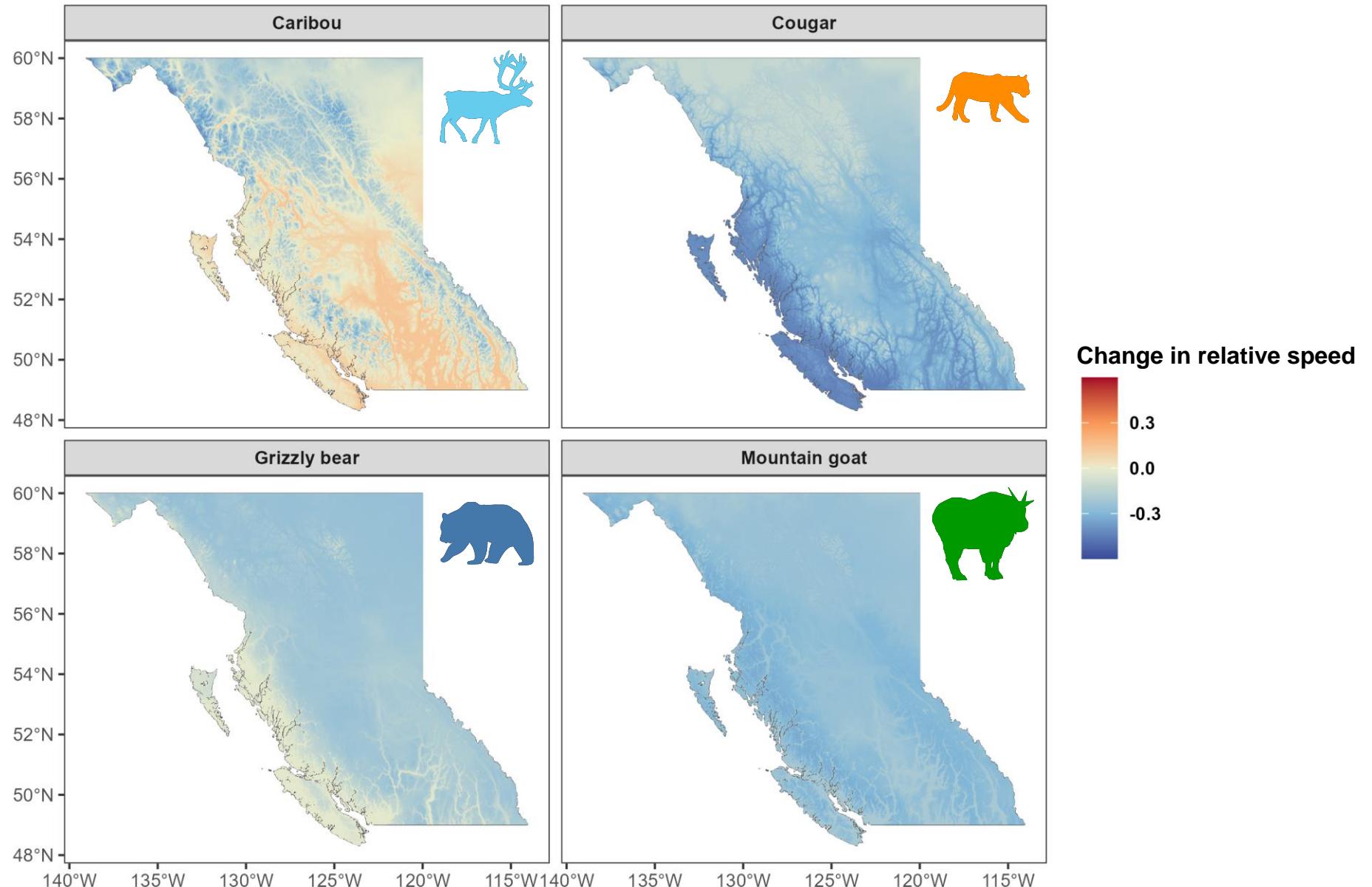
Estimating animal speeds in BC



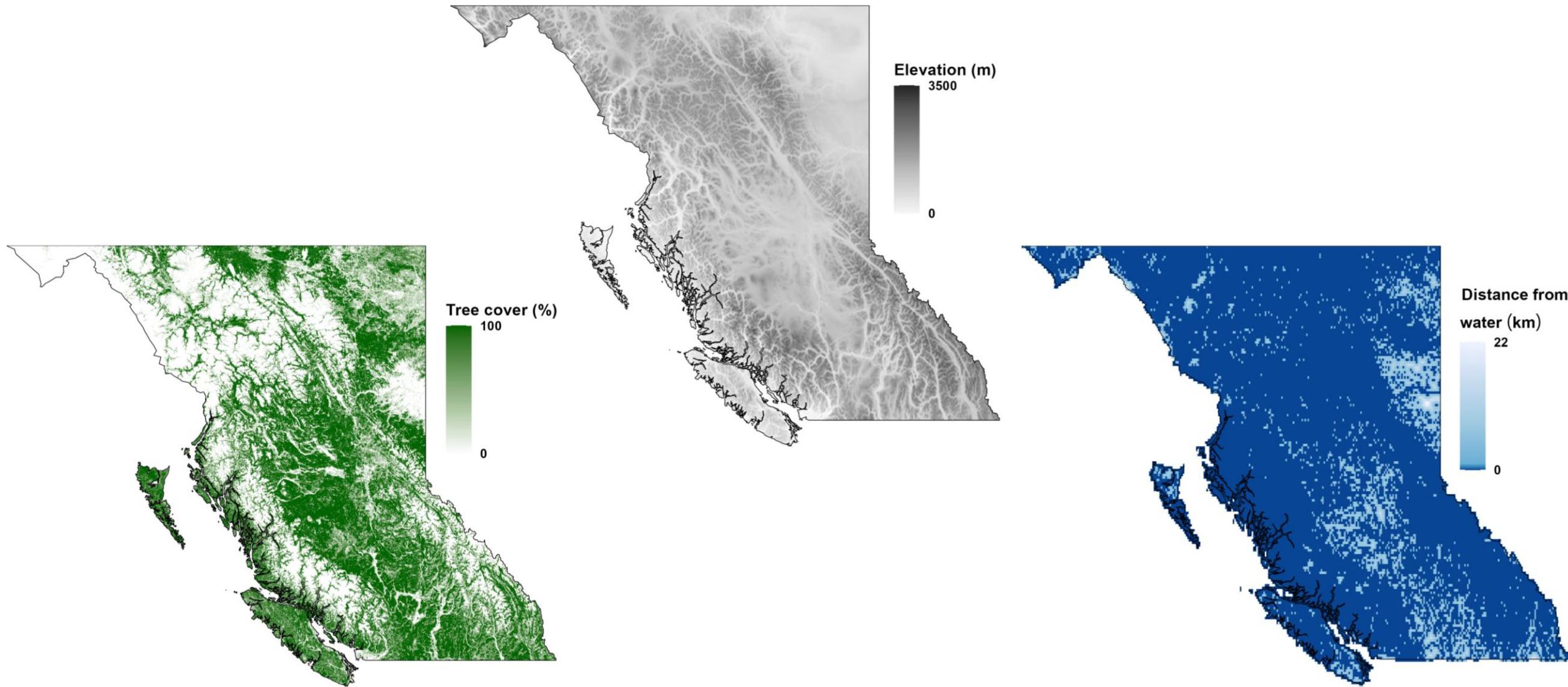
Predicting animal speeds in 2100 (best-case scenario)



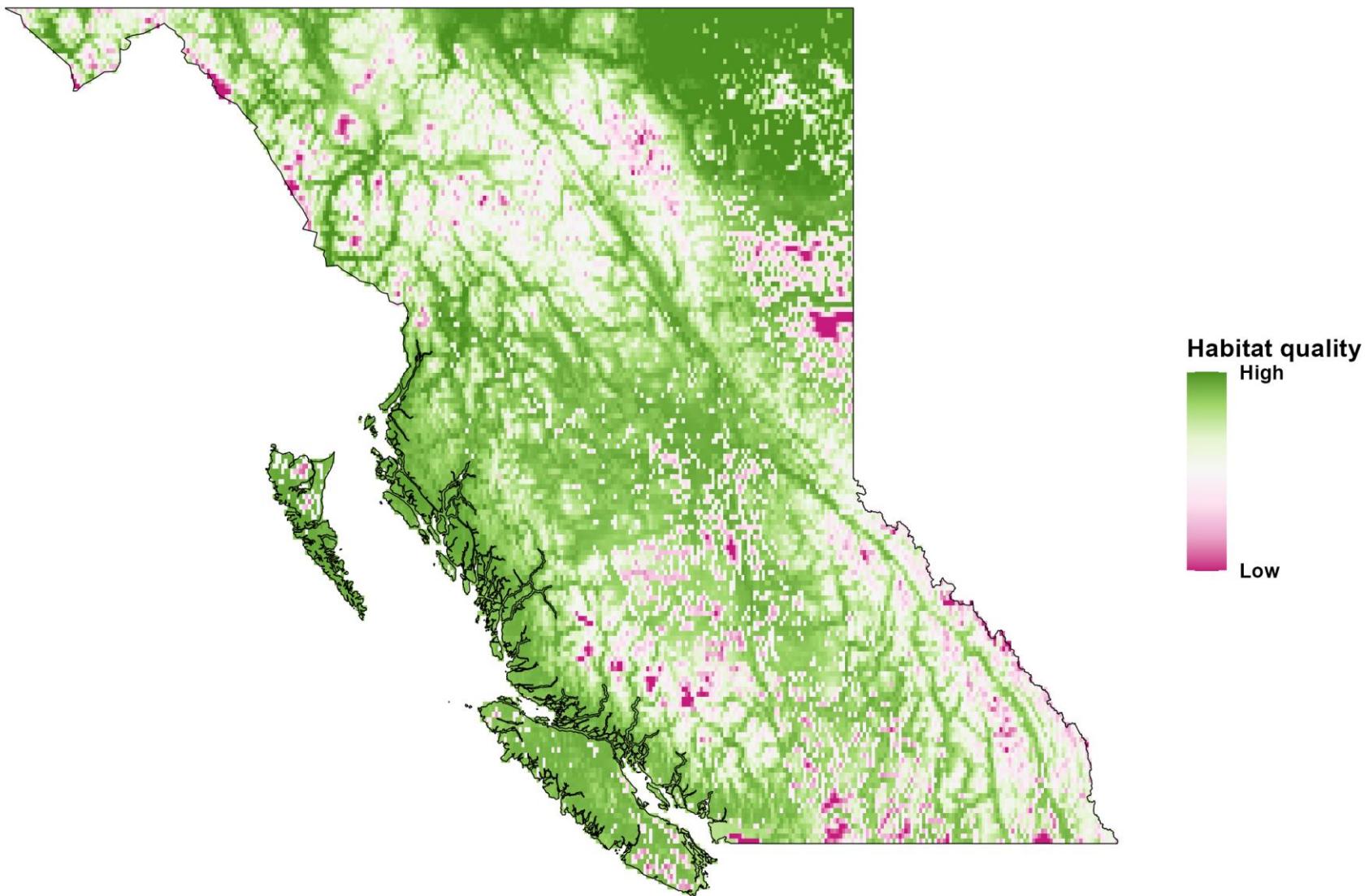
Predicting animal speeds in 2100 (worst-case scenario)



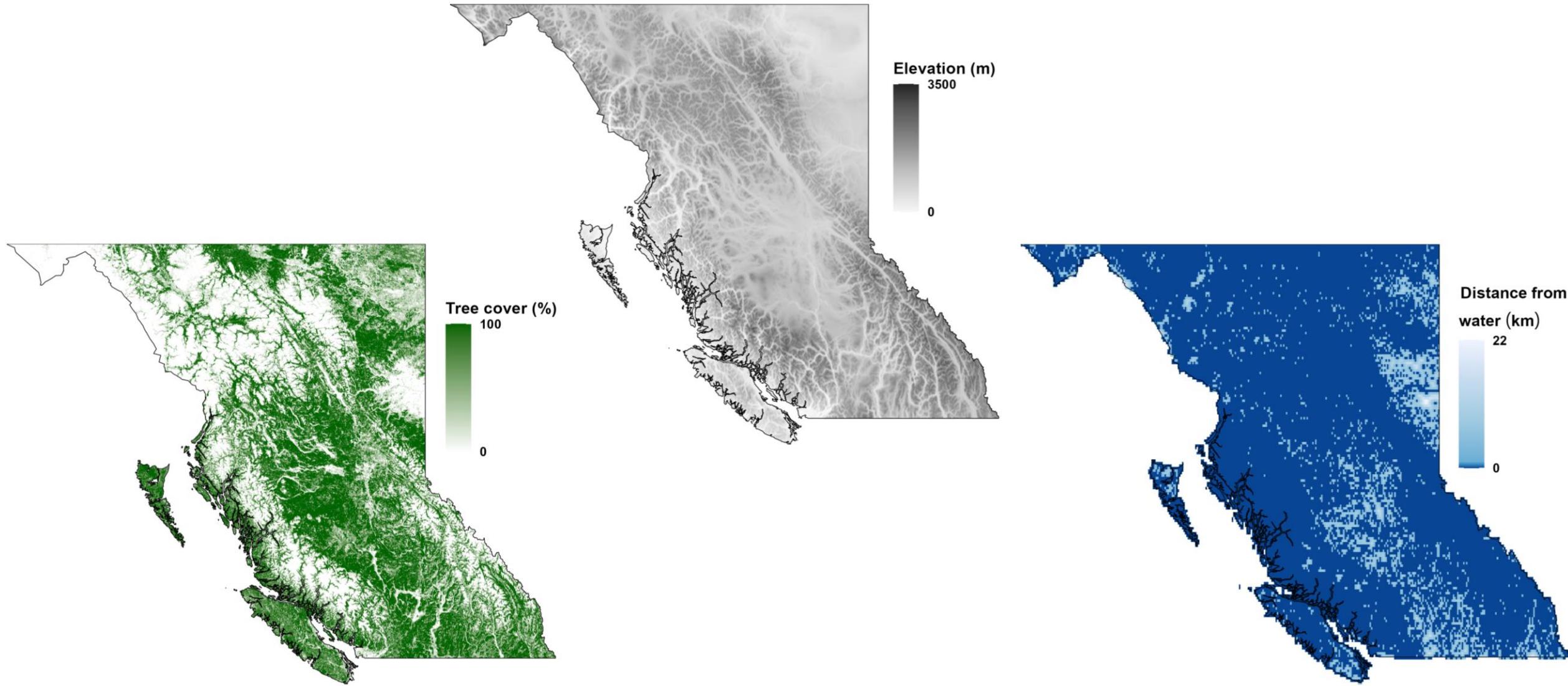
Bear habitat quality in 2005



Bear habitat quality in 2005

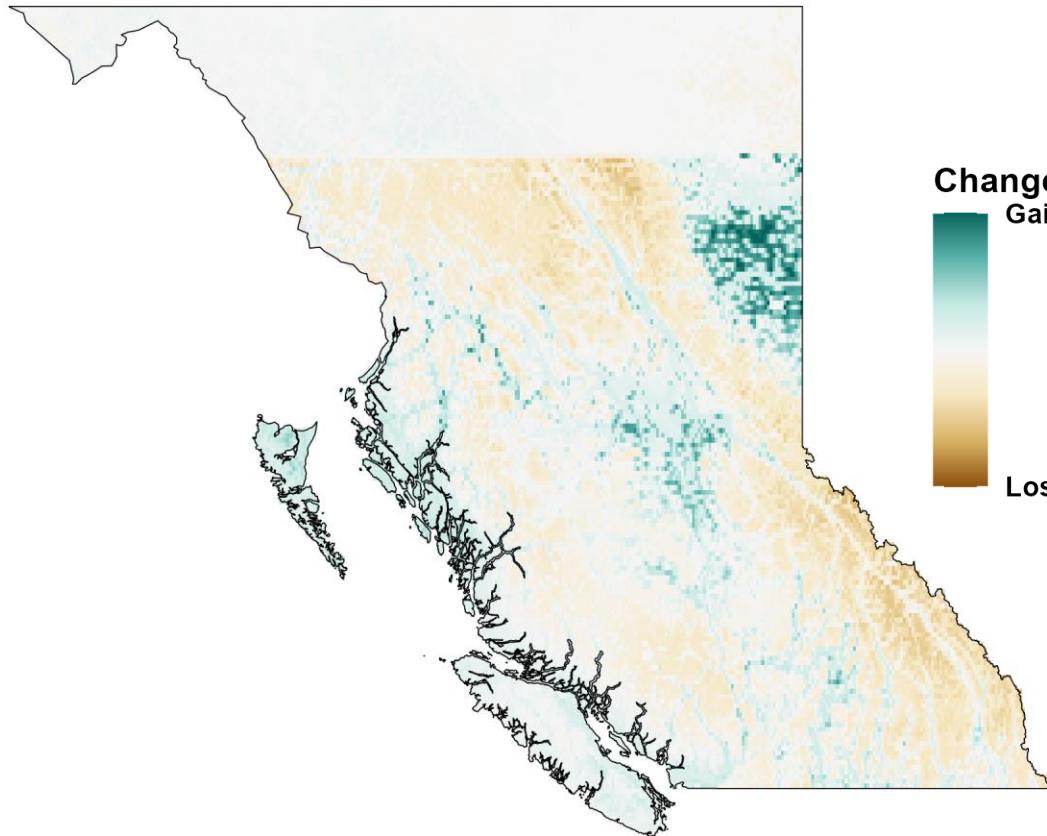


Bear habitat in 2100

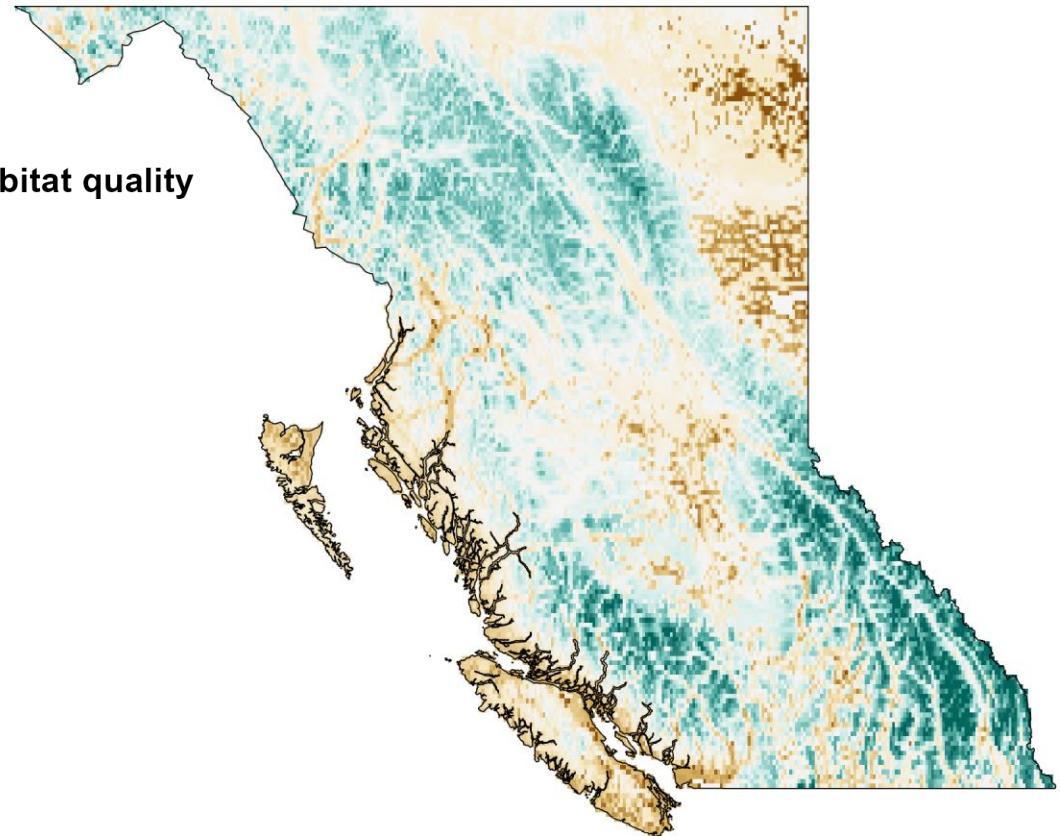


Bear habitat in 2100

SSP 1-2.6



SSP 5-8.5



Planning for the future

- Movement depends strongly on temperature and species
- Future of HWC depends strongly on CC scenario
- Habitat quality depends on CC scenario
- For bears:
 - SSP 1-2.6: prefer forested, low-elevation, and away from water
 - SSP 5-8.5: prefer open, high-elevation, and near water

What's next

- Fit iRSFs for additional animals
- Assess present and future quality of protected areas
- Quantify overlap of protected areas and parks

Acknowledgements



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Biology
Irving K. Barber Faculty of Science
Okanagan Campus



Quantitative Ecology Lab

UBC Okanagan



NSERC
CRSNG

Mitacs



Planning for the future

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References and credits

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Phylopic silhouettes:

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- Mountain goat: © [CC-BY-SA 3.0](#): Sarah E. Haworth