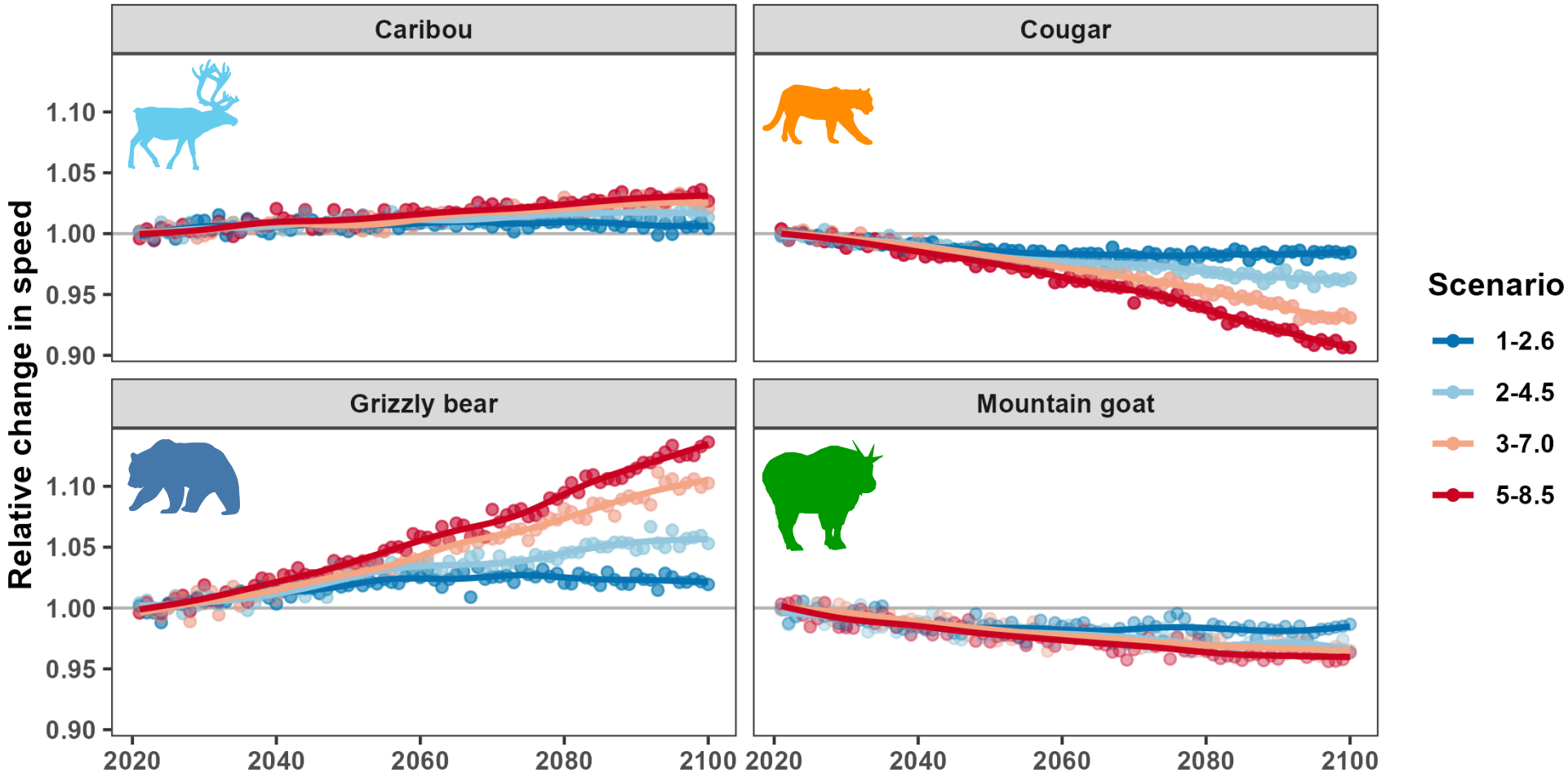
How climate change will shape the future of human-wildlife conflict in BC's protected areas



Quantitative Ecology Lab
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Biology
Irving K. Barber Faculty of Science
Okanagan Campus

A two-part project

Dayna Weststrate:

CC & park attendance

This talk:

CC & animal movement

Minimizing human-wildlife conflict

© Gannet & Jeff Swinger

© Brandon Pardy

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

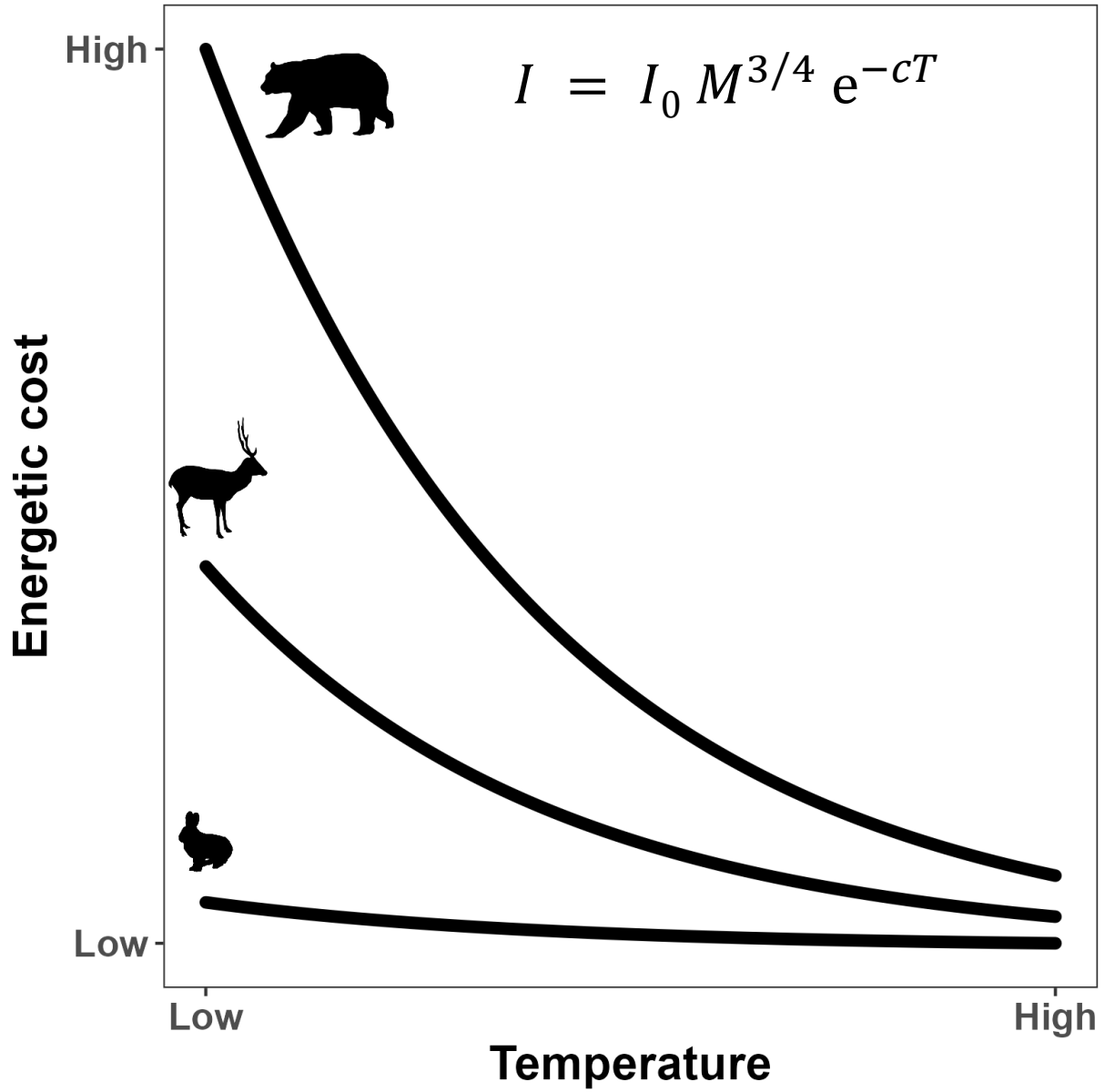
© NPS Photo / Jake Bortscheller

Moving in a changing world

Maintaining an energetic balance

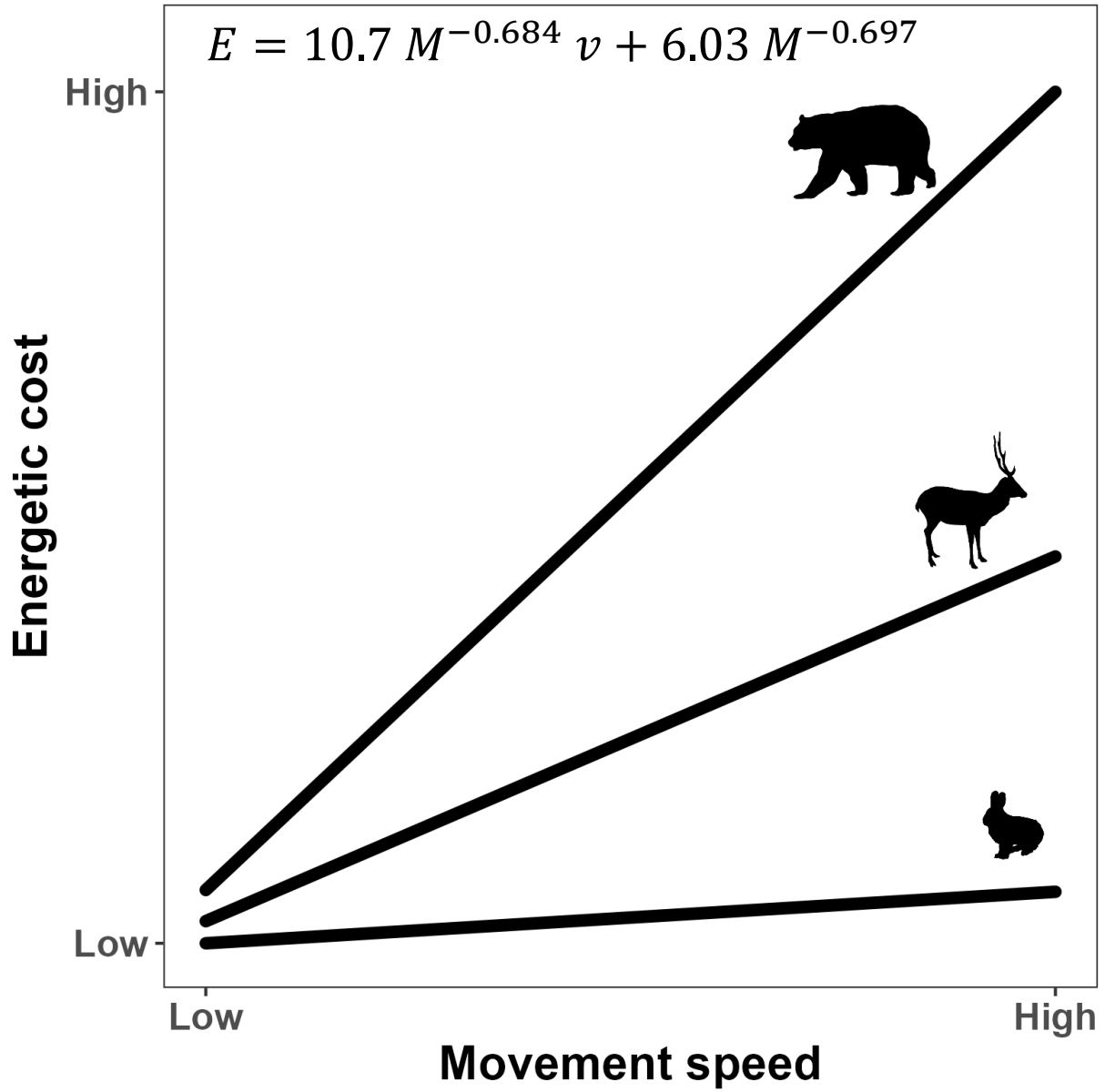
- Require energy to survive
- Move to collect resources
- Collect more than you spend
- Maintain an energetic balance

Energetic costs depends on temperature



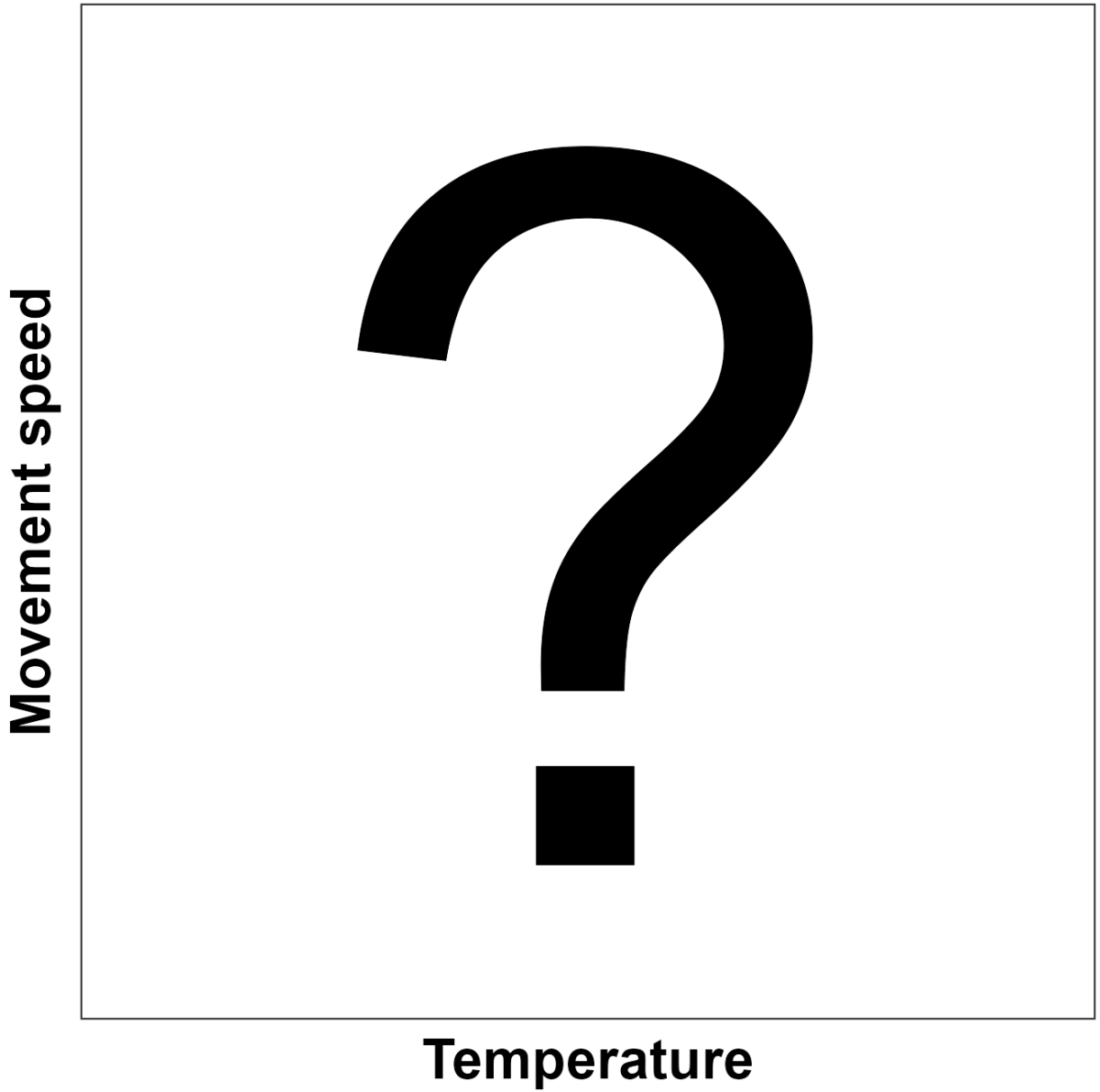
(Brown et al. 2004)

Movement comes at a cost



(Taylor et al. 1982)

Does speed depend on temperature?

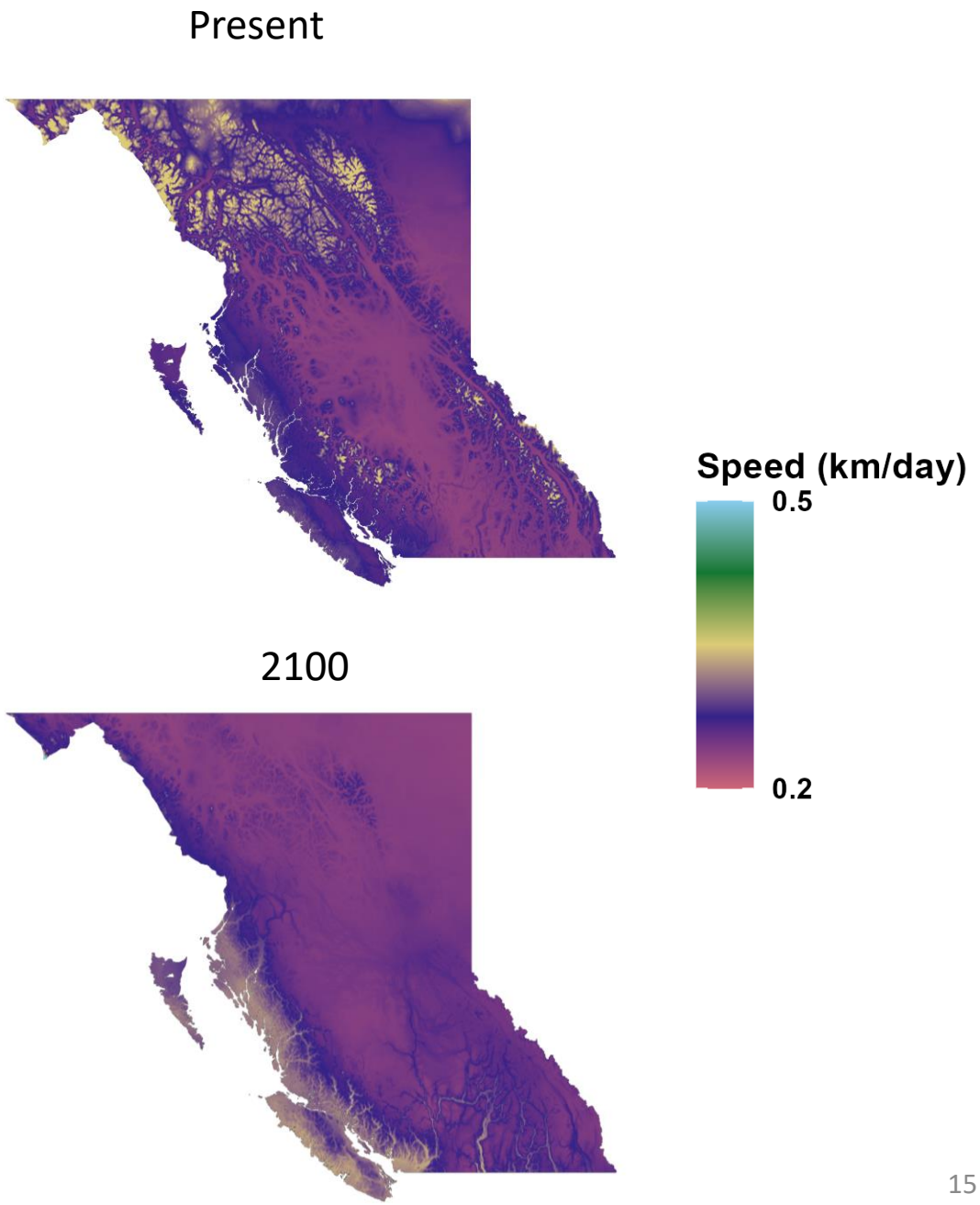


Predicting animal space use

Effects of climate change on:

- When animals move
- How much animals move
- Where animals move

- Predict behavior and spatial use
- Proactive management

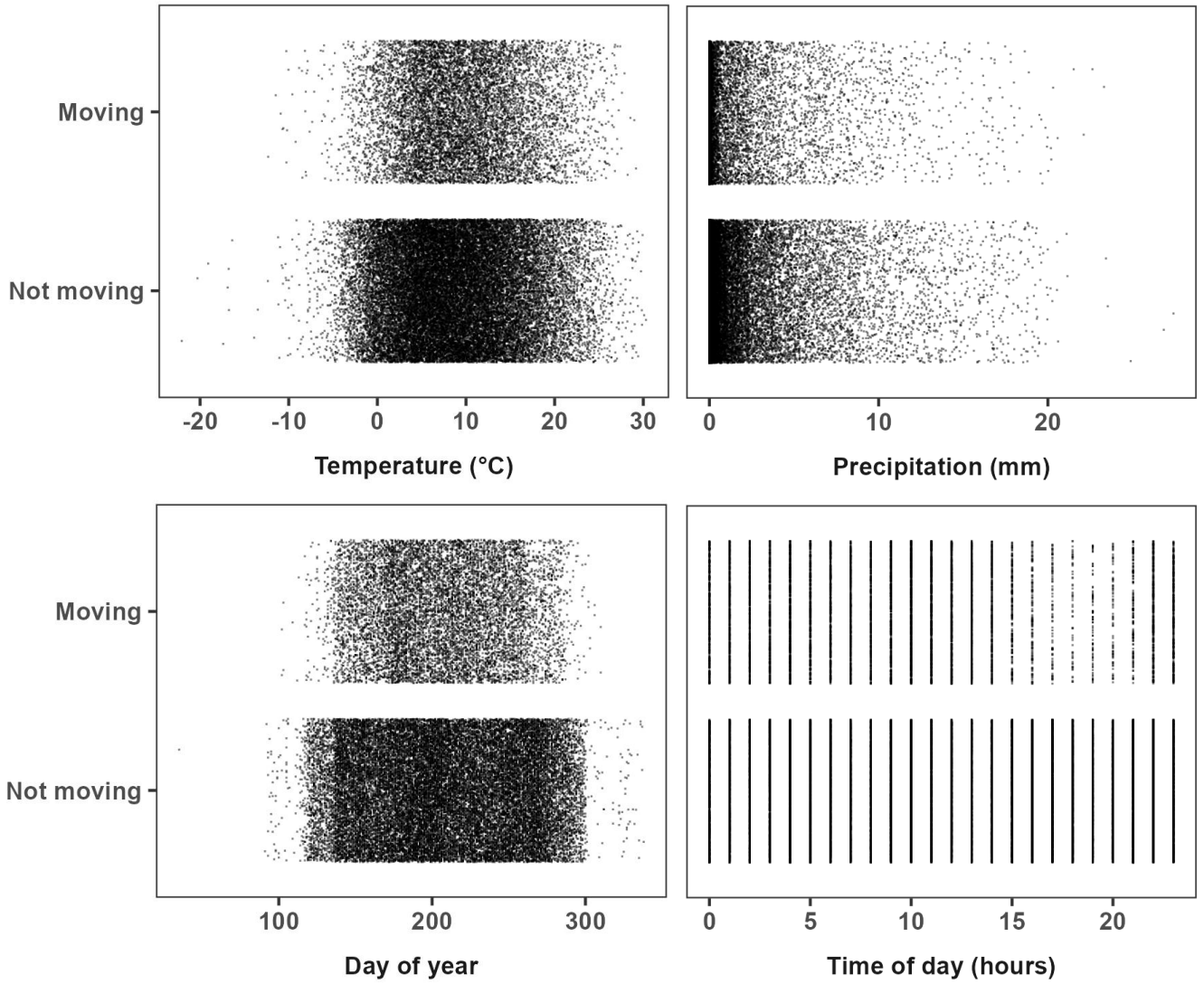


Modeling bear movement

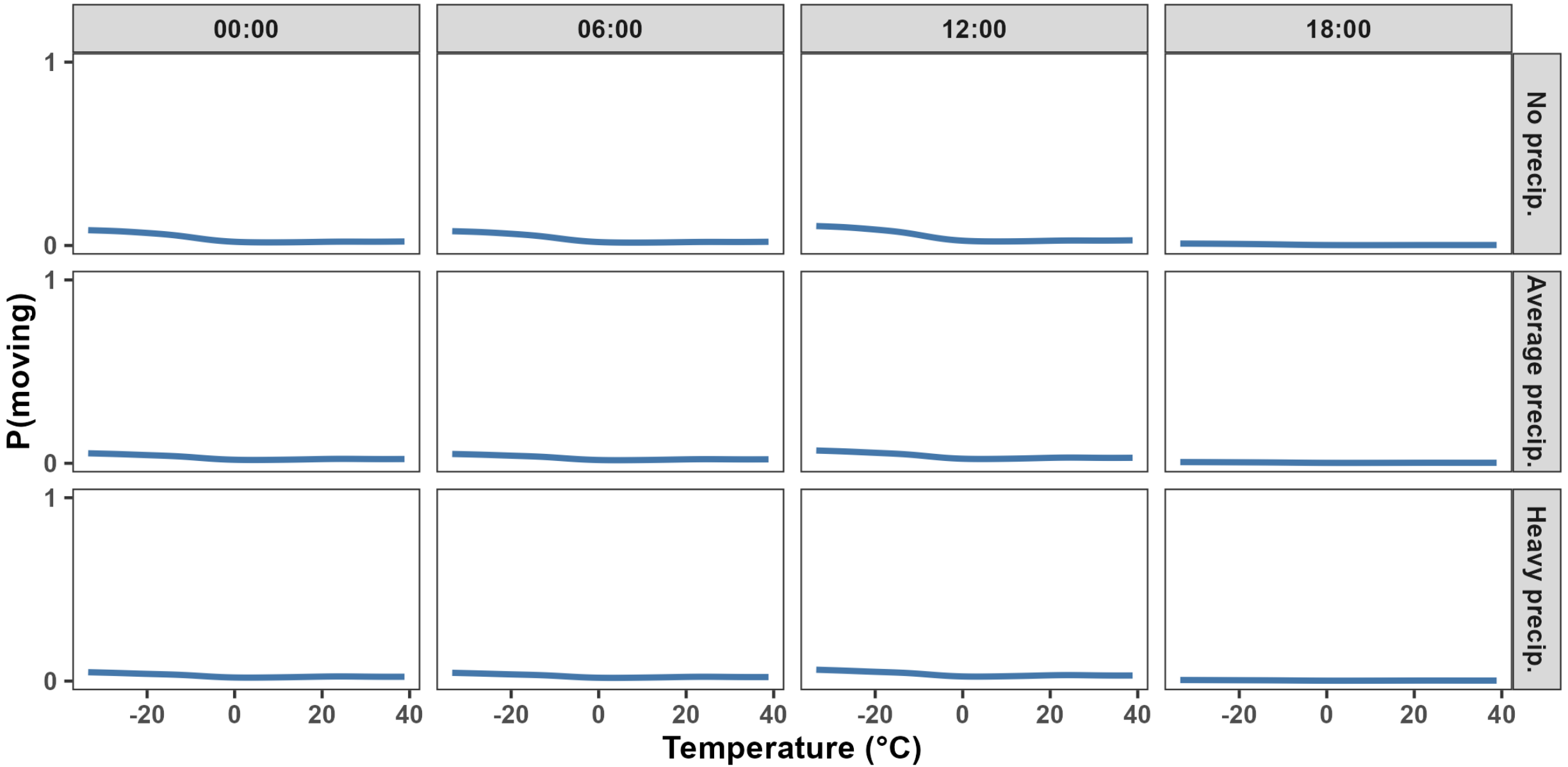
When do bears move?

Binomial model:

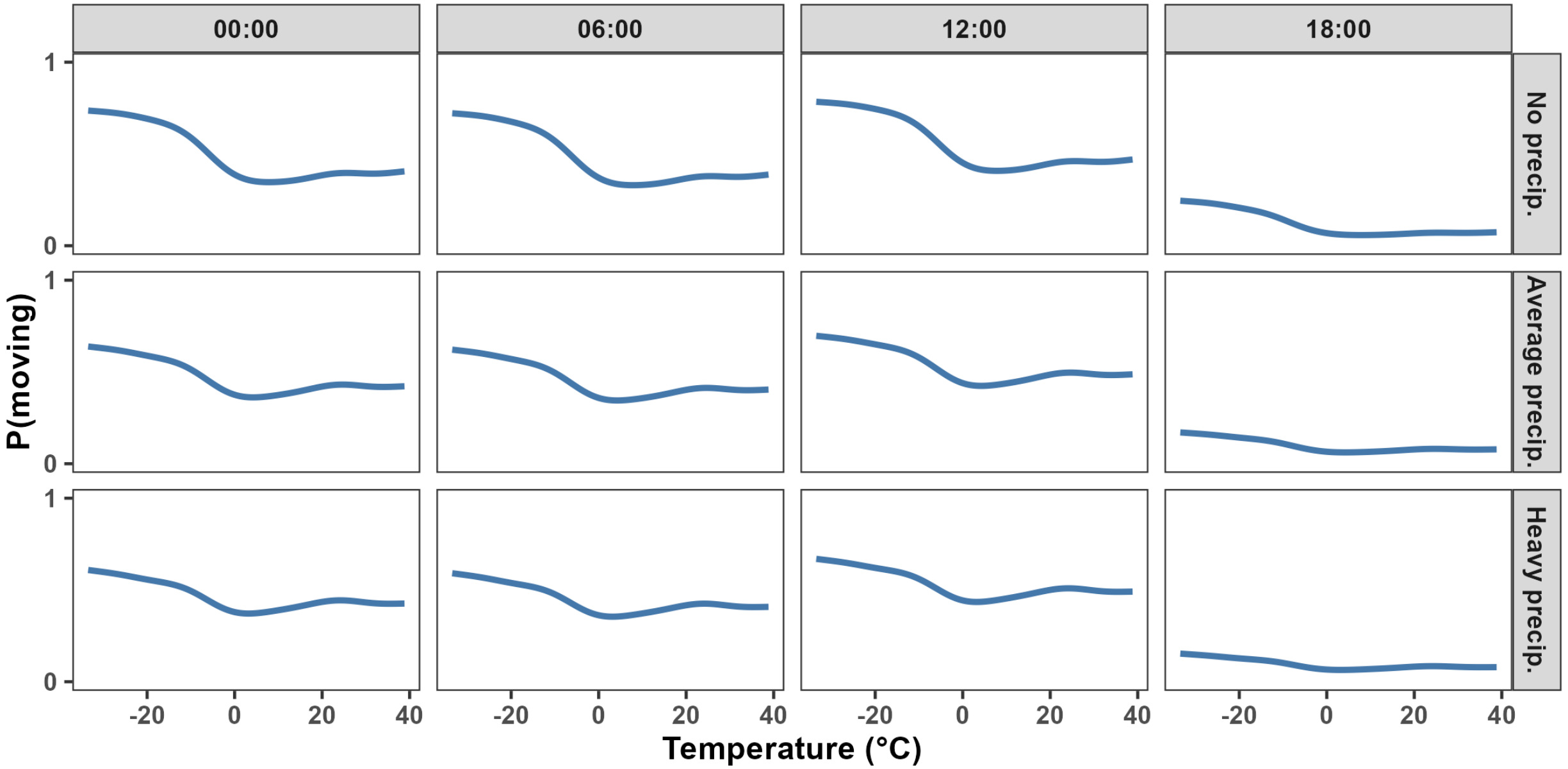
- Moving: yes/no
- Temperature (-25 to 30^{o}C)
- Precipitation (0 to 27 mm)
- Day of year (Feb to Dec)
- Time of day (00:00, 24:00)



Predicting *when* bears move (December 13th)



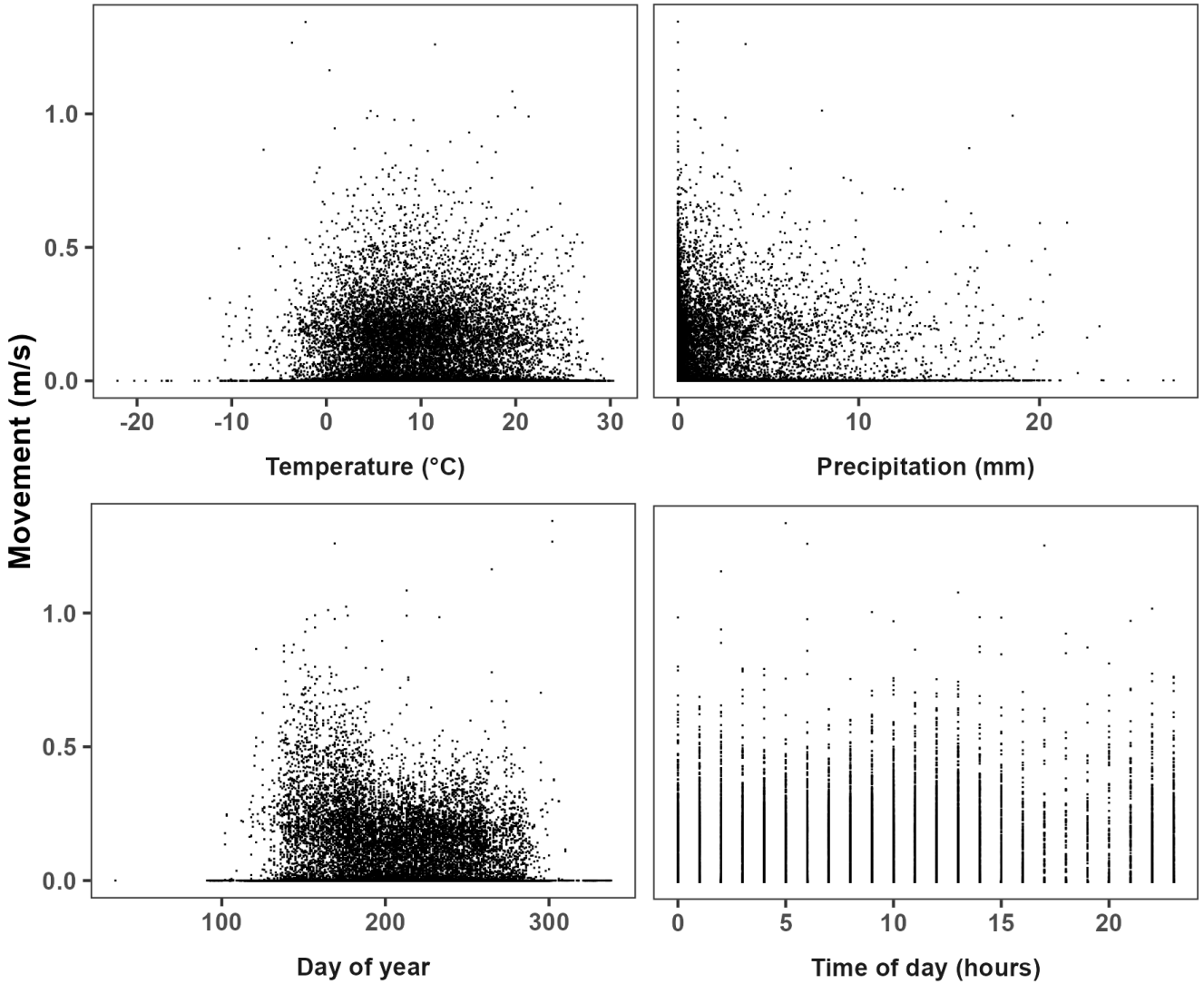
Predicting *when* bears move (June 15th)



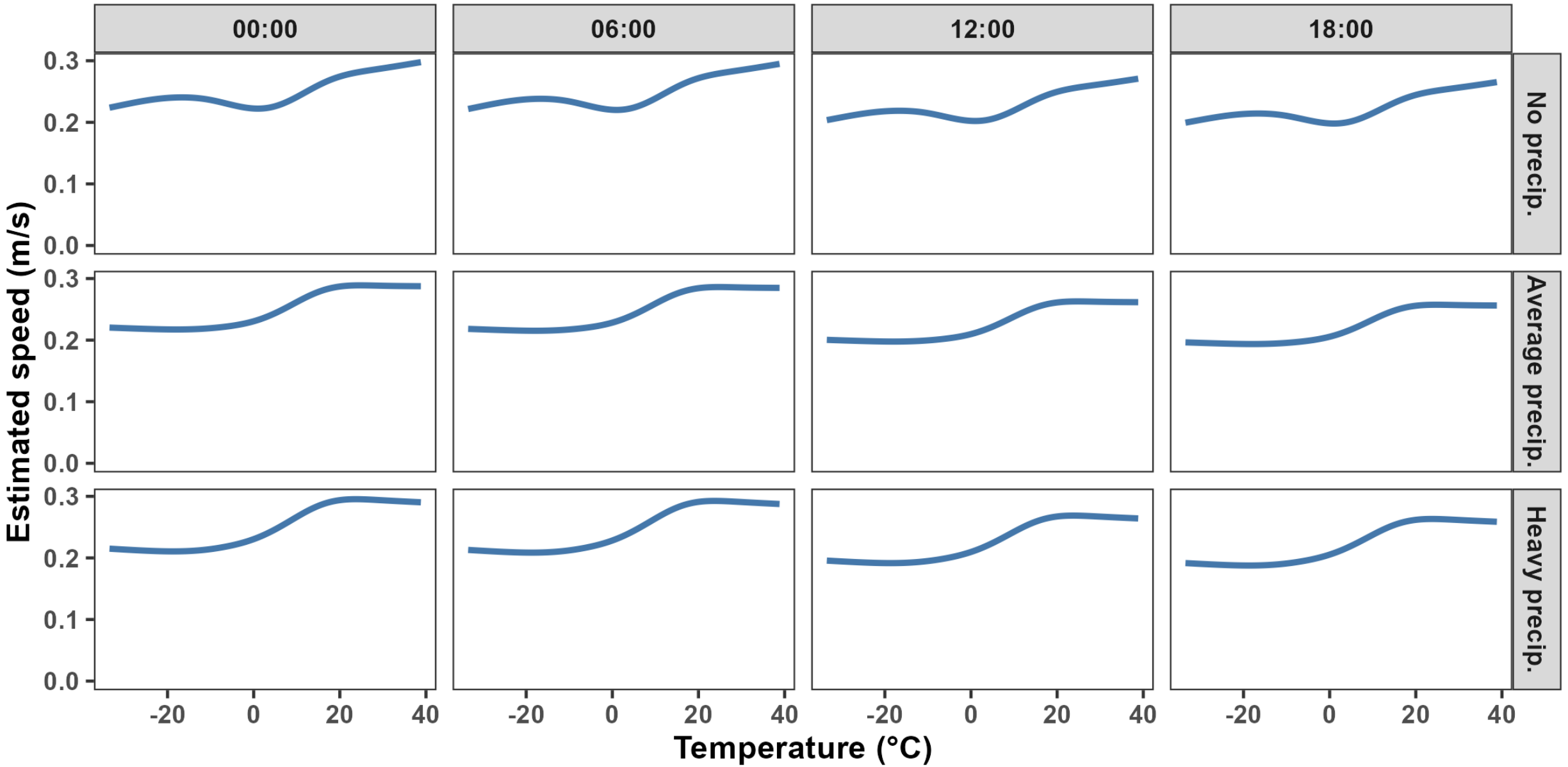
How much do bears move?

Gamma model:

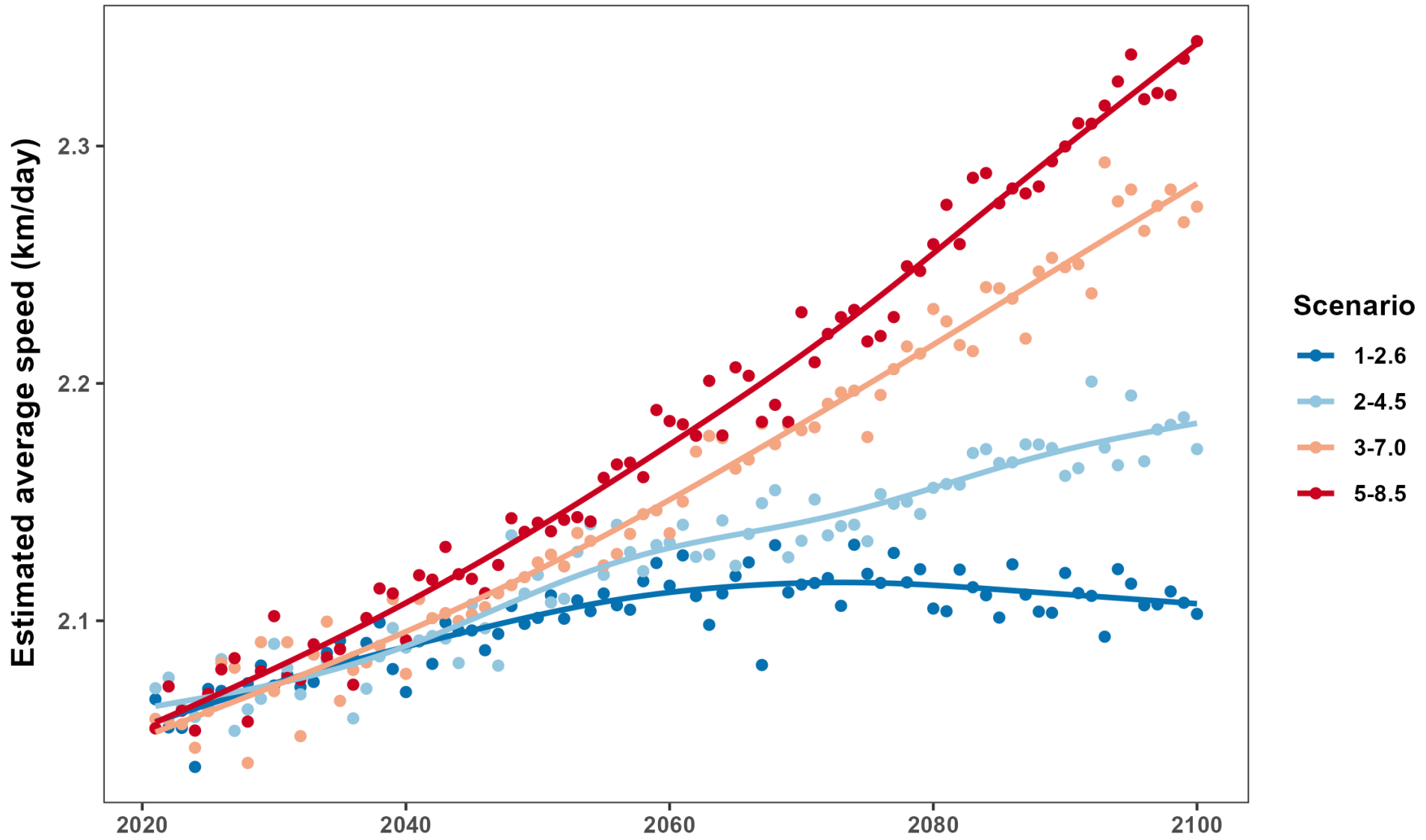
- Speed: > 0 m/s
- Temperature (-25 to 30^{o}C)
- Precipitation (0 to 27 mm)
- Day of year (Feb to Dec)
- Time of day (00:00, 24:00)



Predicting *how much* bears move



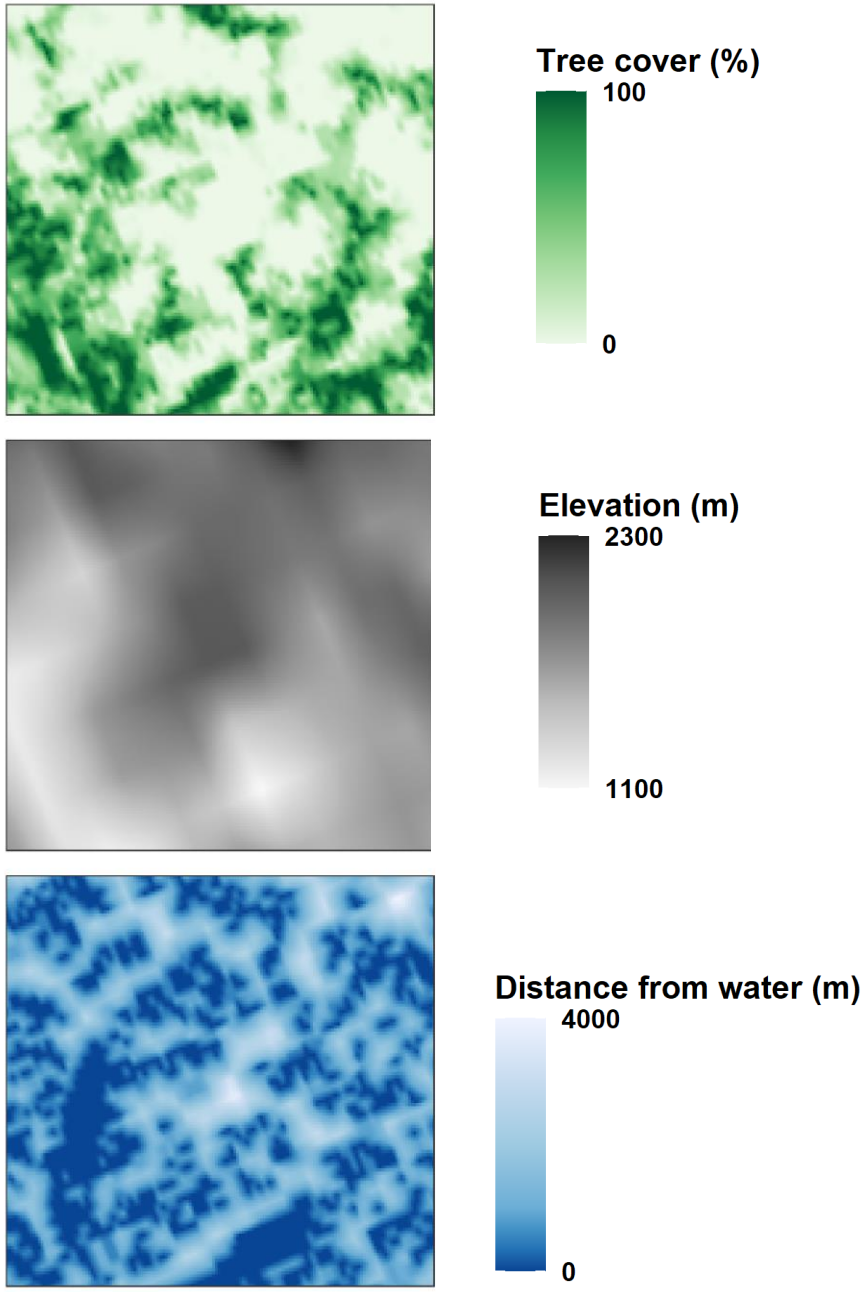
Predicting how bears will move in the future



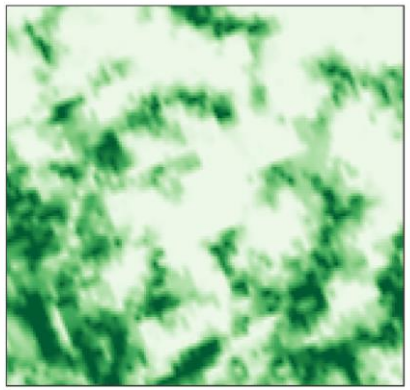
Where do bears move?

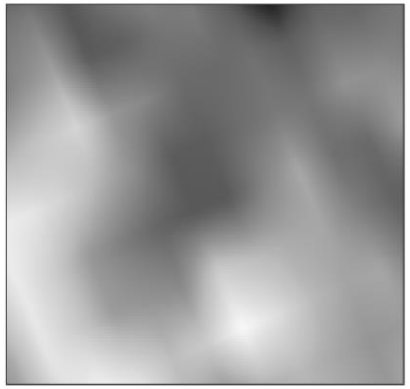
Integrated Resource Selection Function (iRSF; Alston et al. 2022):

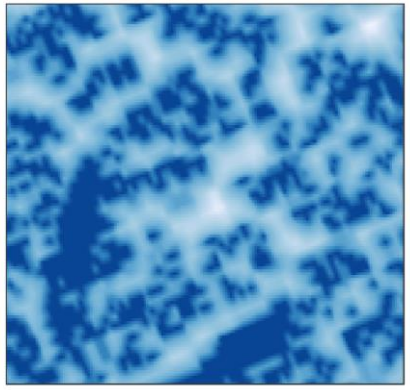
- Tree cover (0% – 100%)
- Elevation (m)
- Distance from water (m)
- Temperature interactions
- Precipitation interactions

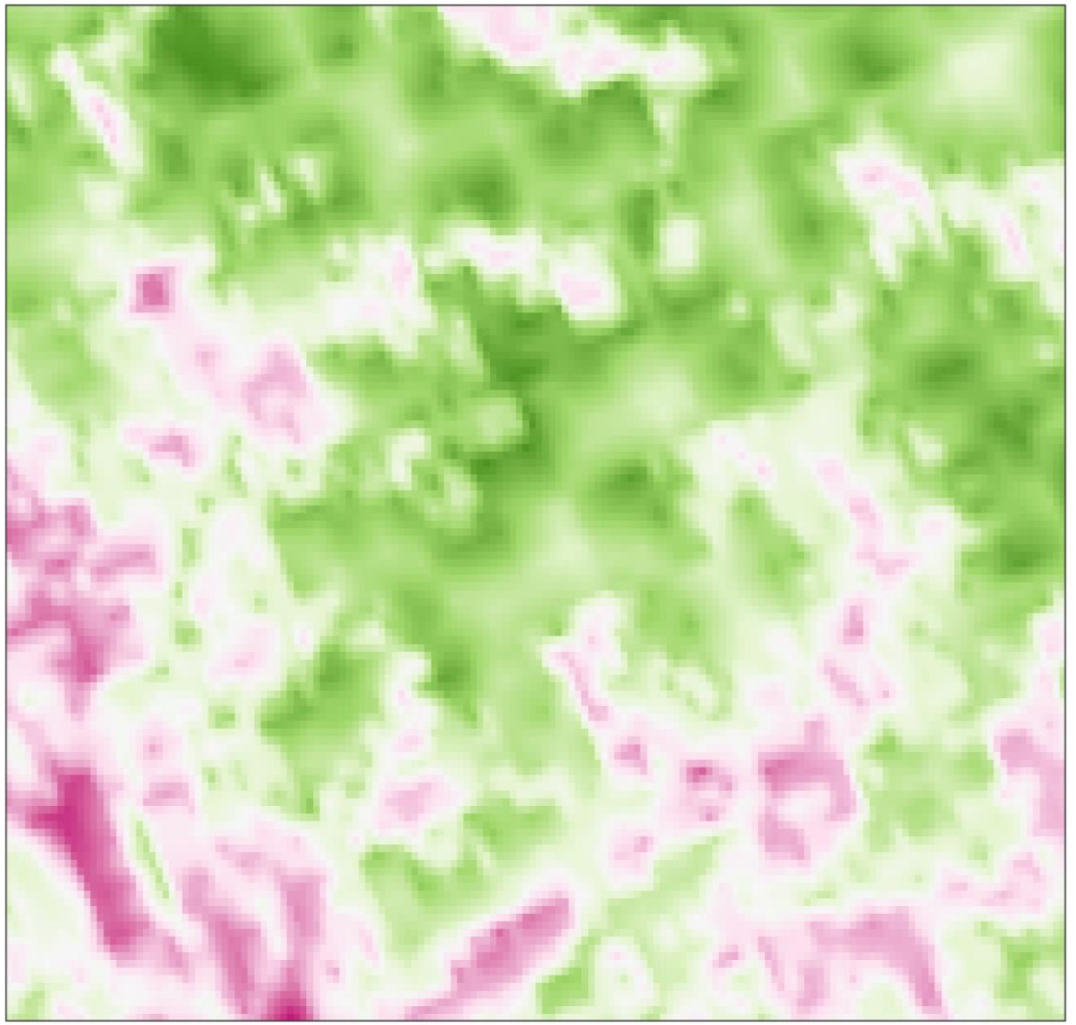


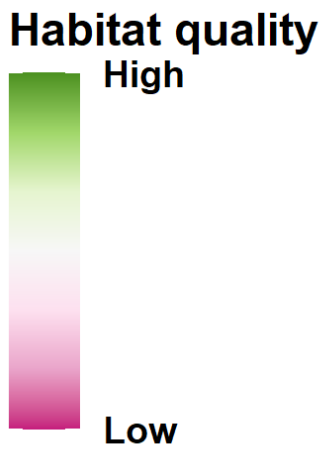
Where do bears move on a warm, dry day?



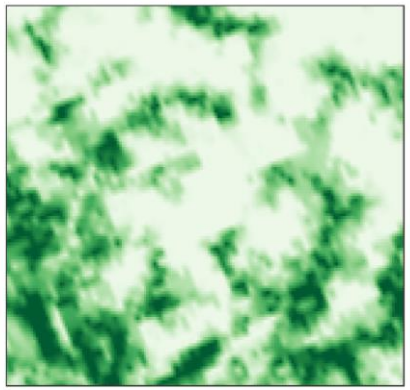


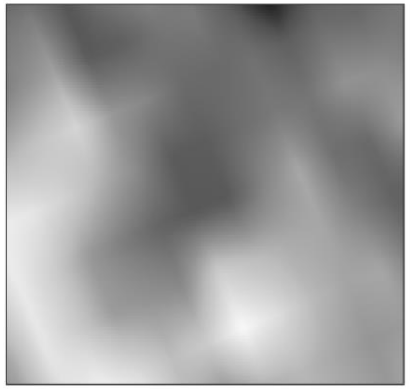


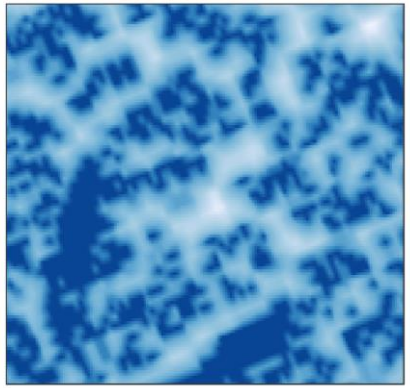


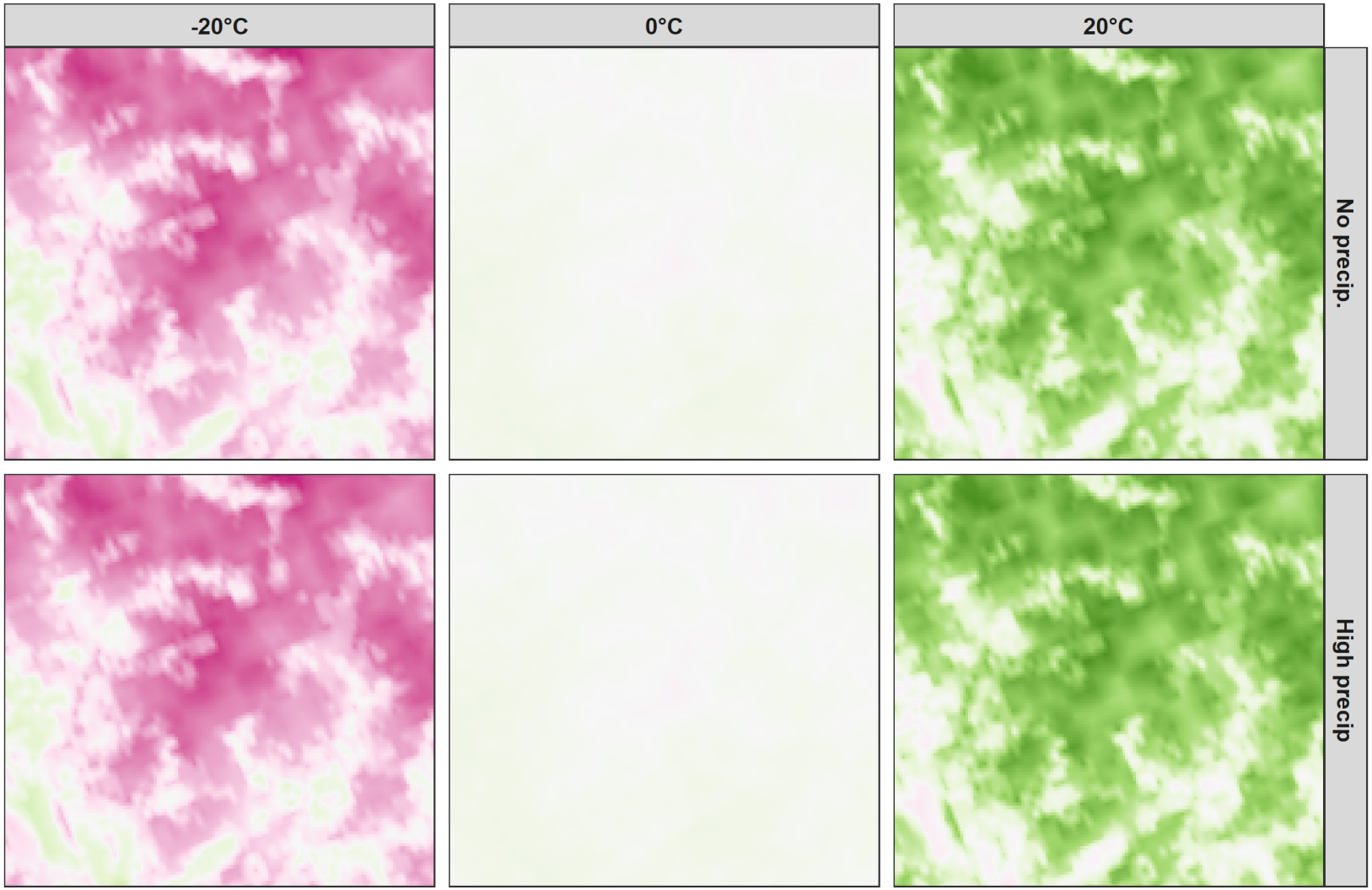


Where do bears move?



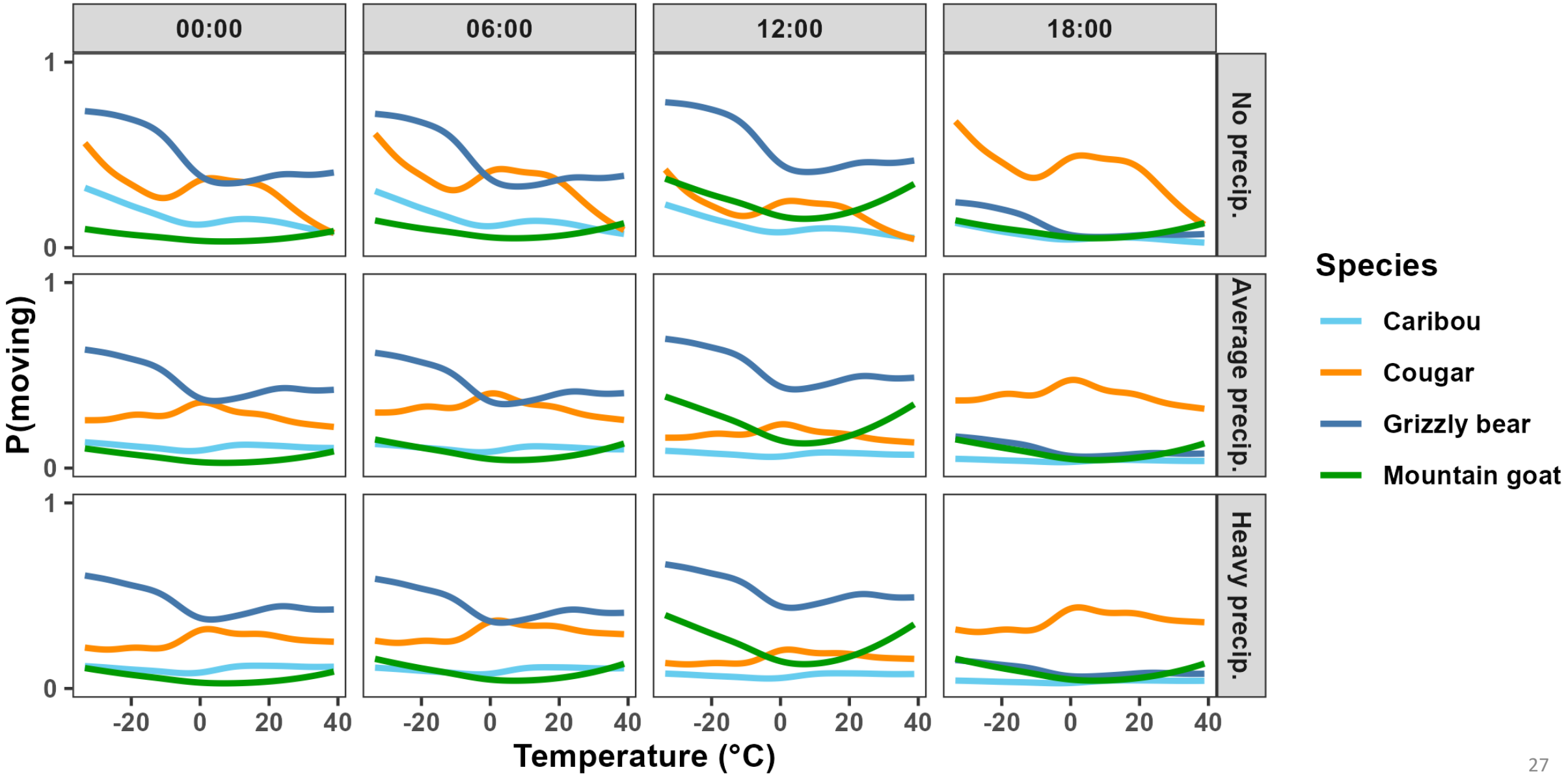




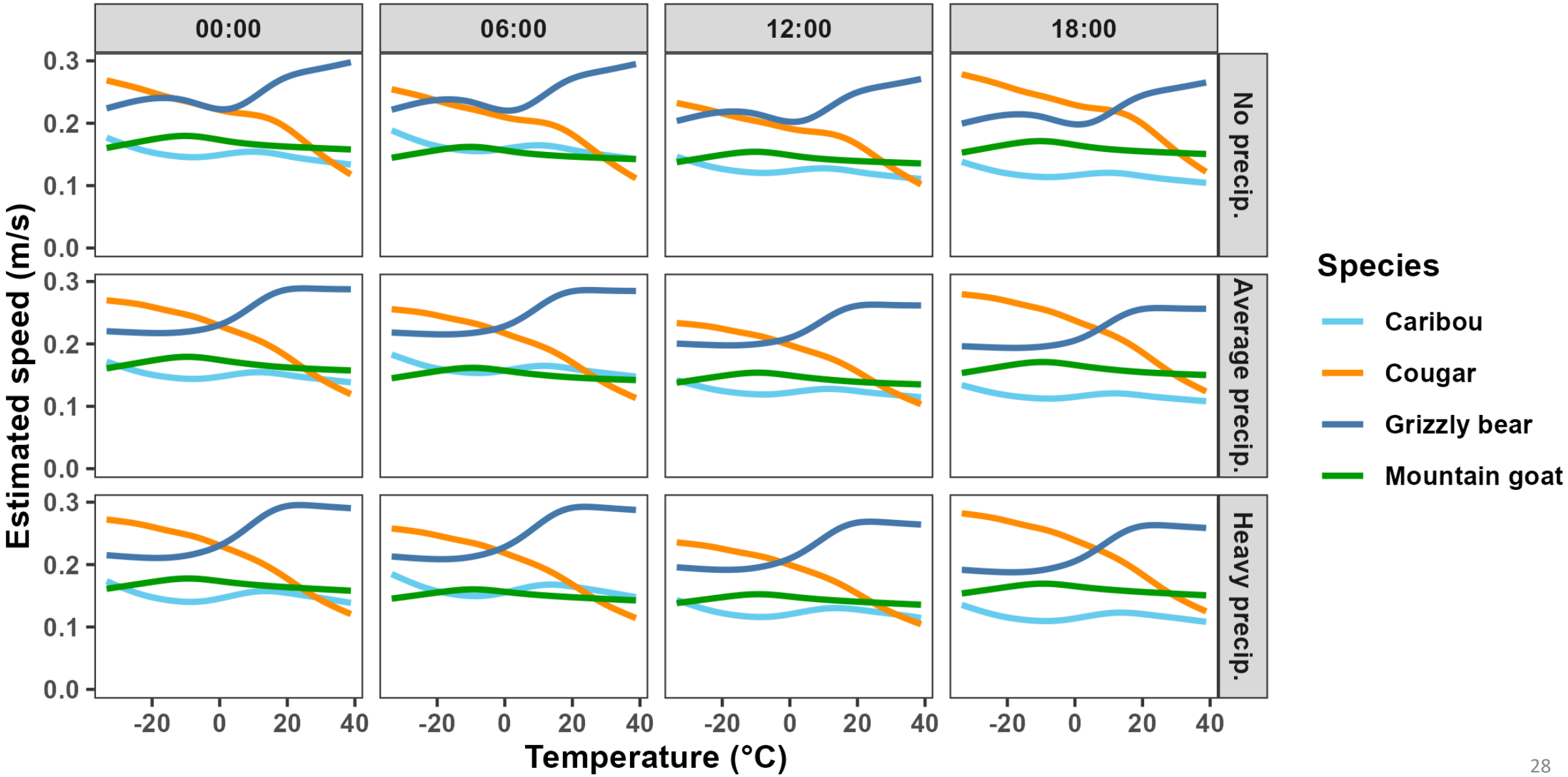


Including more species

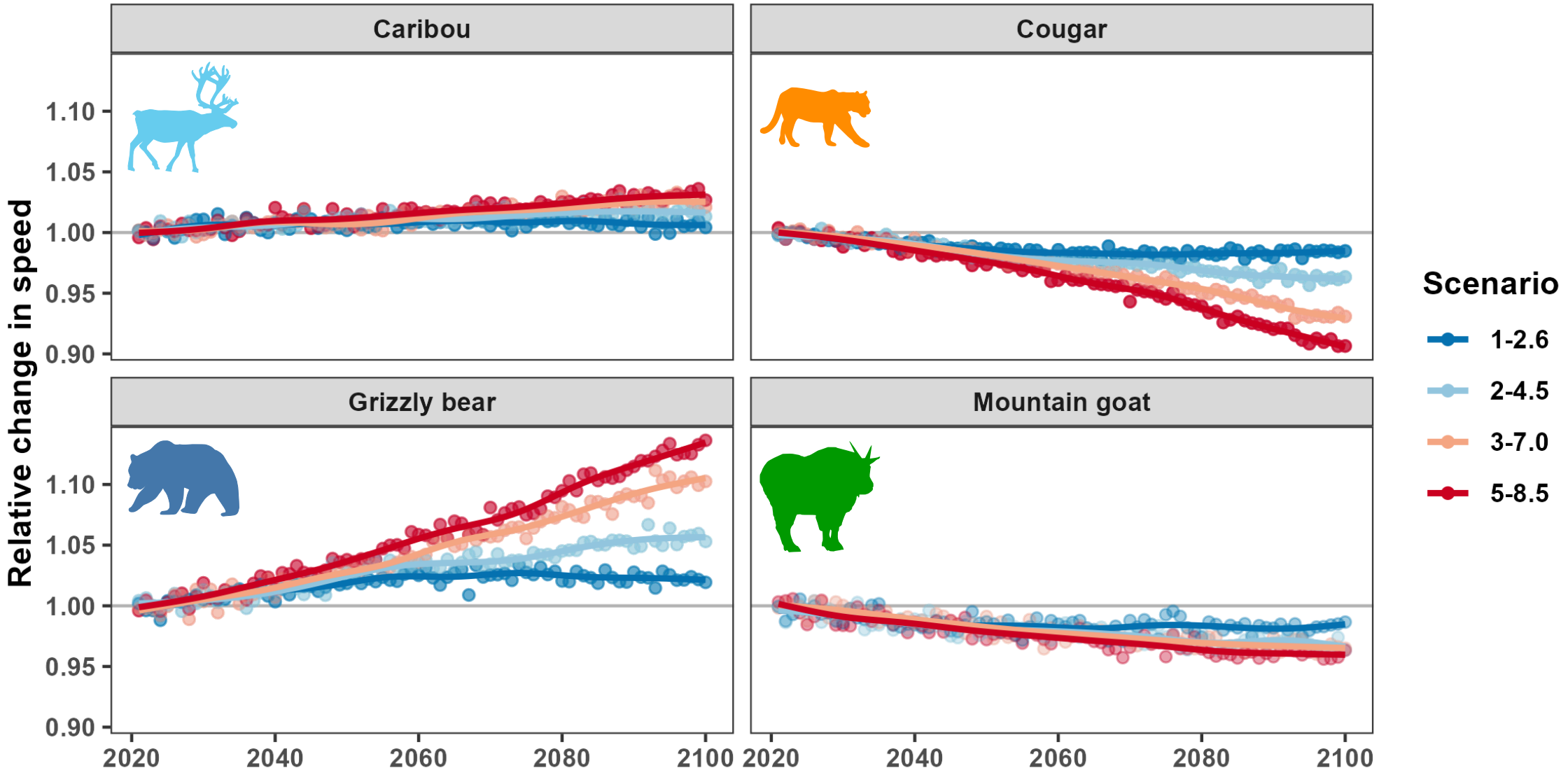
P(moving) varies strongly between species



Average speeds vary strongly between species

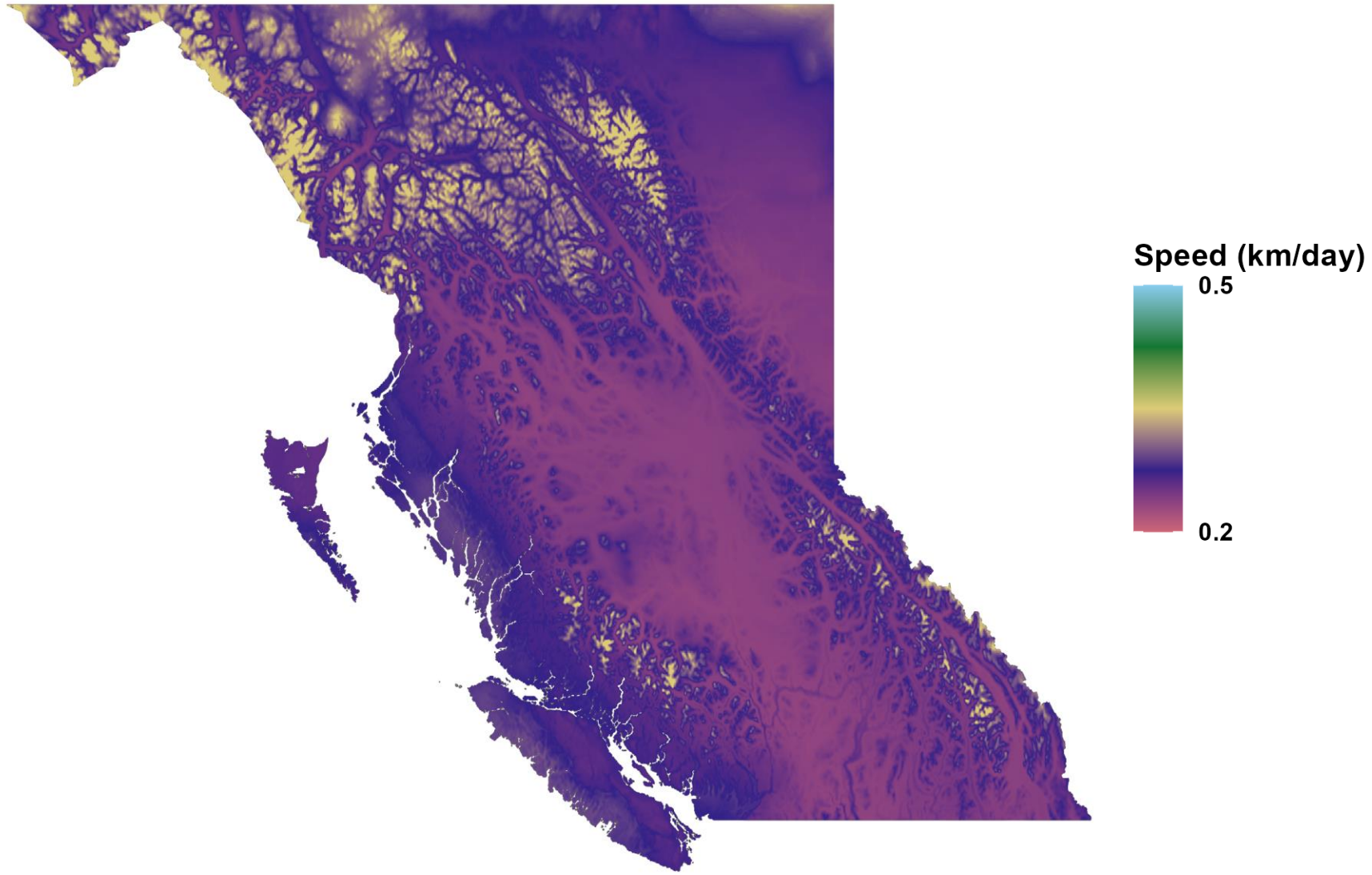


Predicting into the future

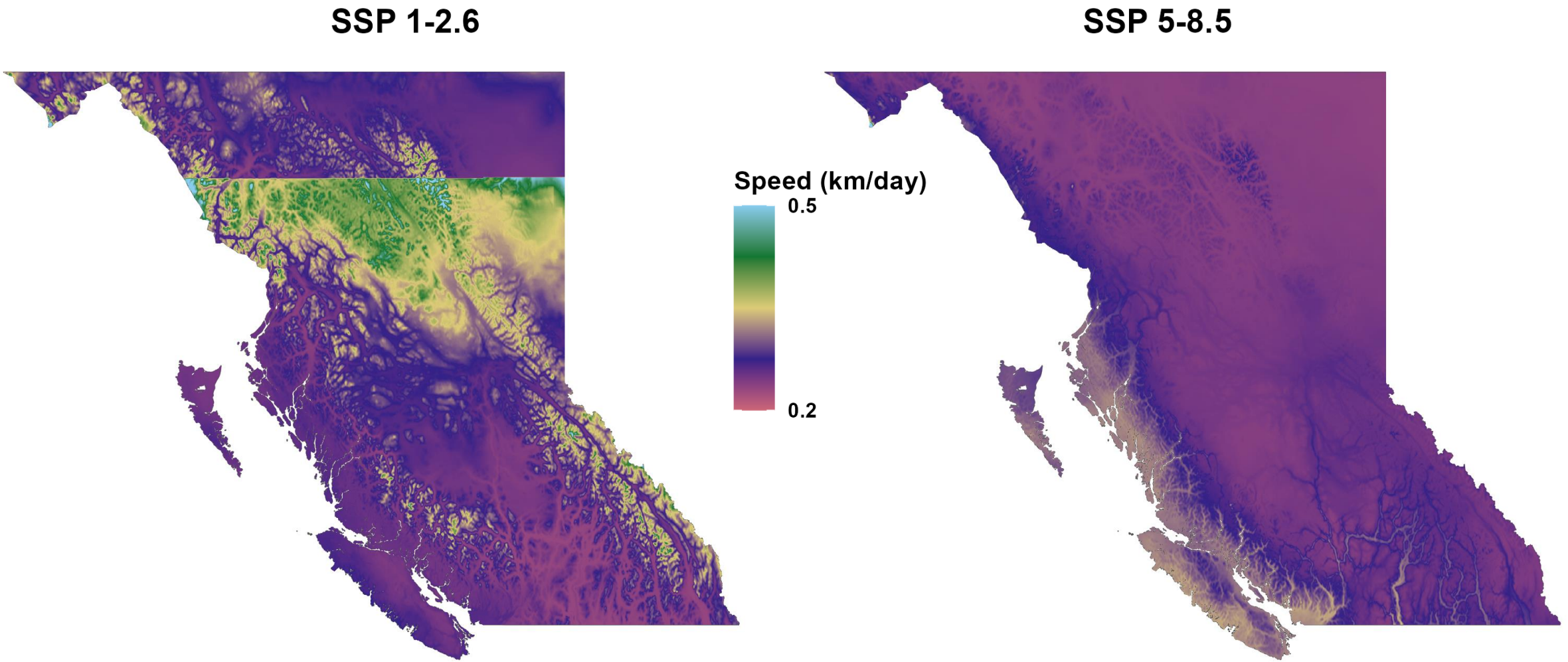


Applications for conservation

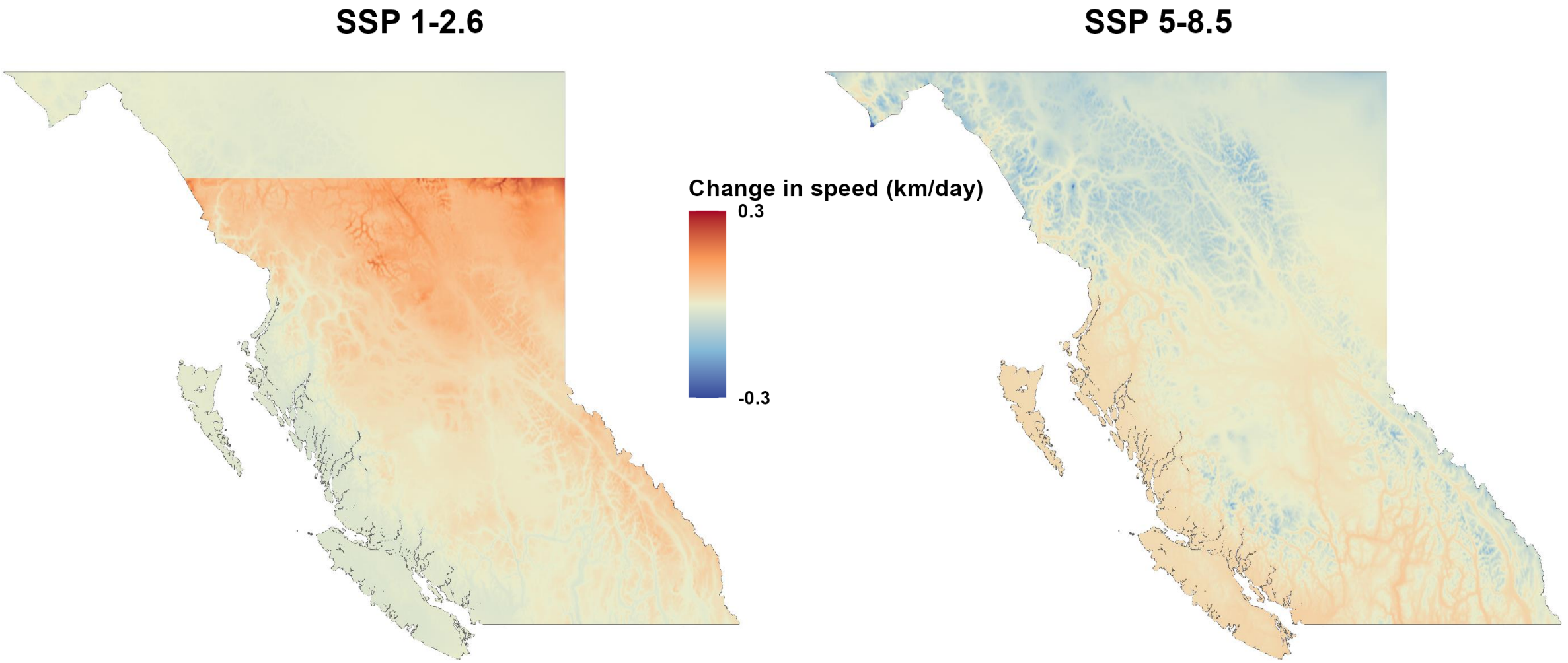
Bear speed depends on the location



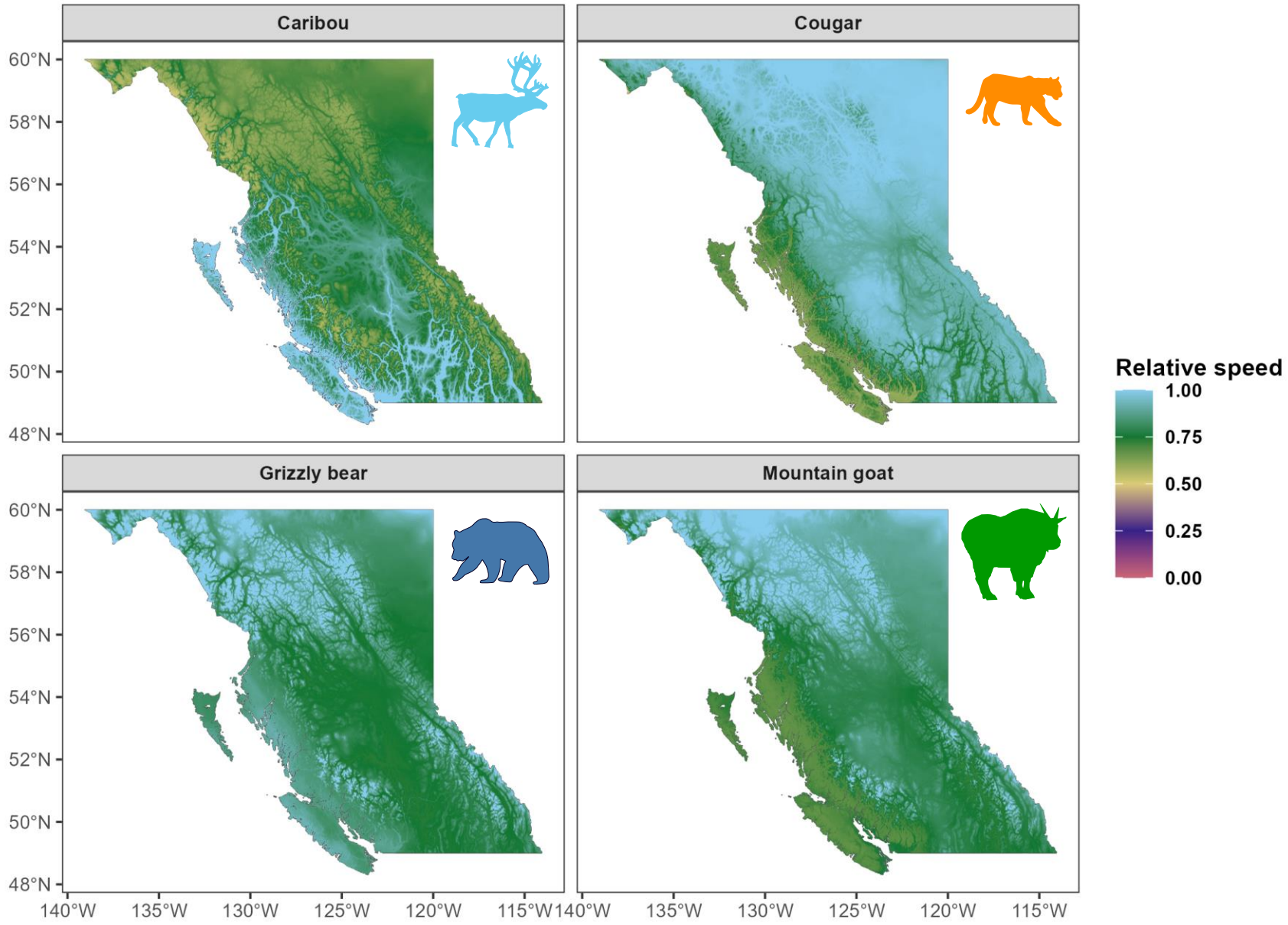
Bear speed depends on the climate scenario



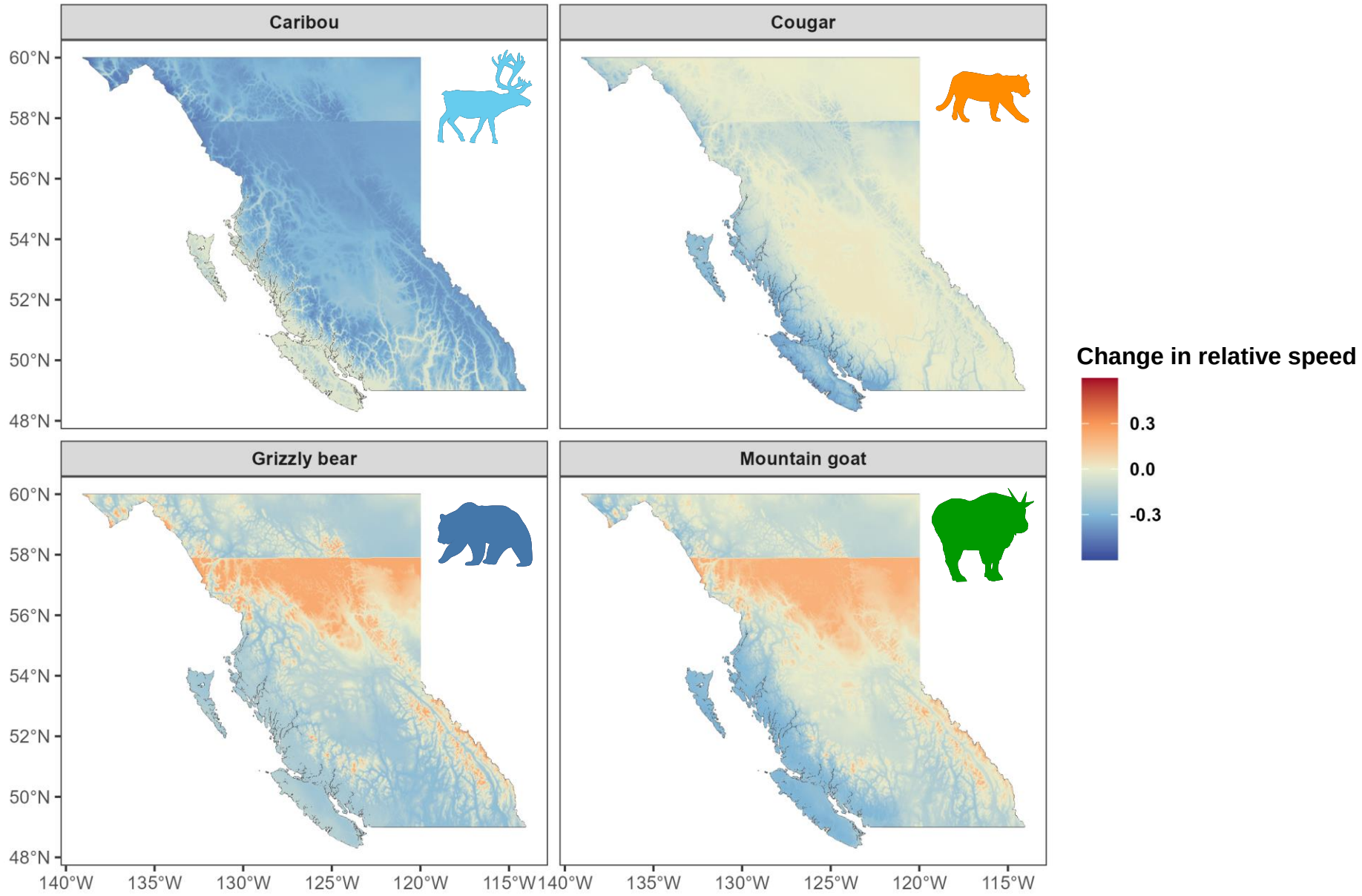
Changes in bear speed depend on the climate scenario



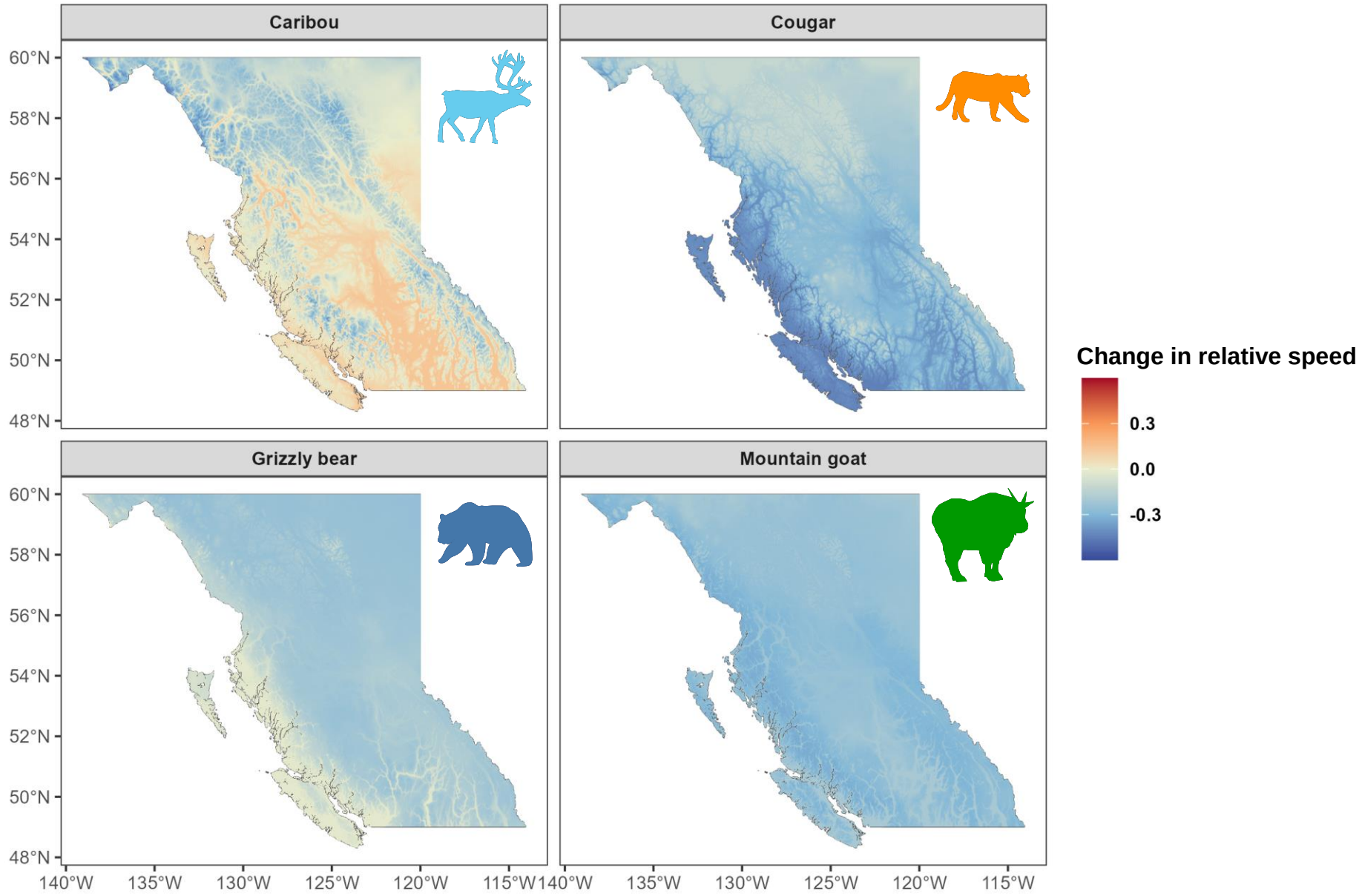
Estimating animal speeds in BC



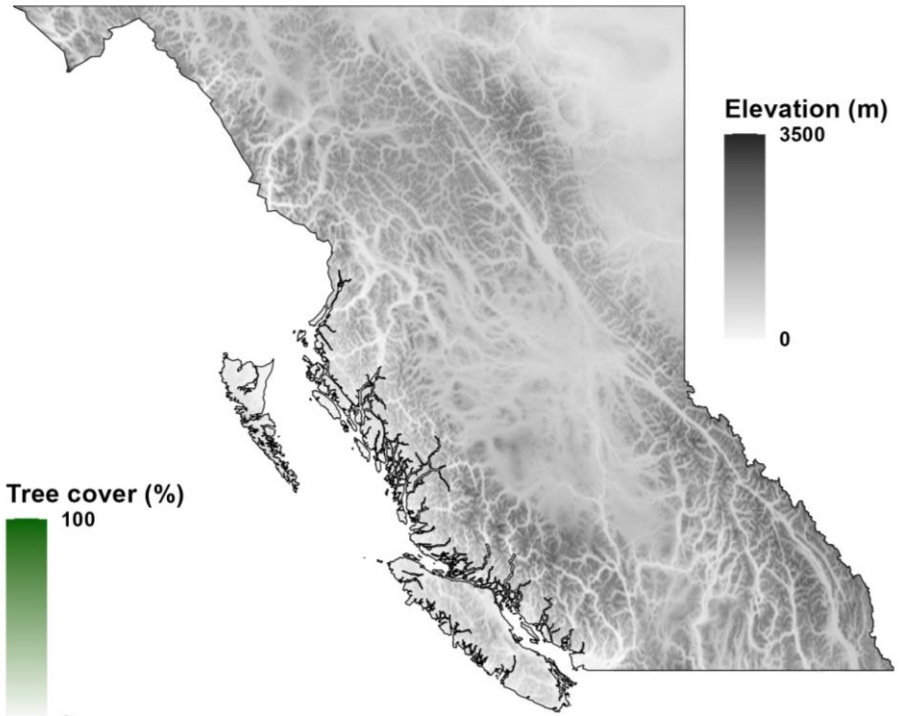
Predicting animal speeds in 2100 (best-case scenario)

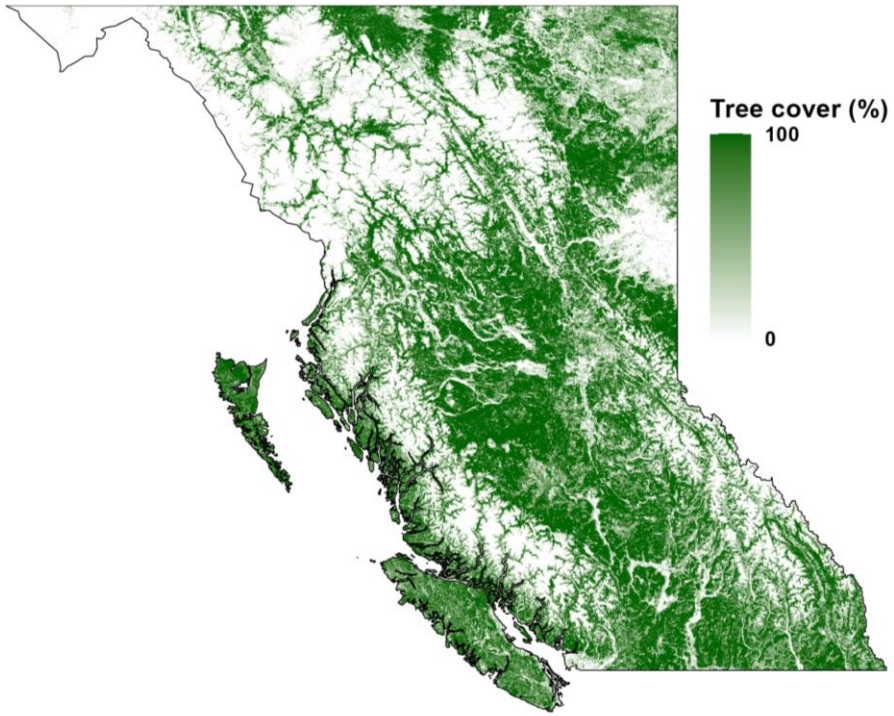


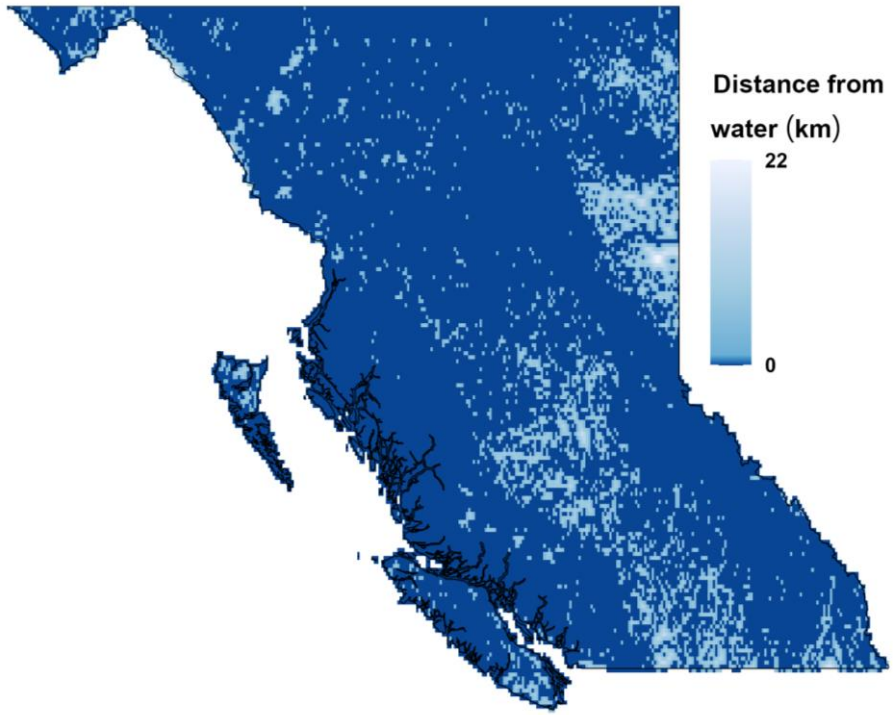
Predicting animal speeds in 2100 (worst-case scenario)



Bear habitat quality in 2005







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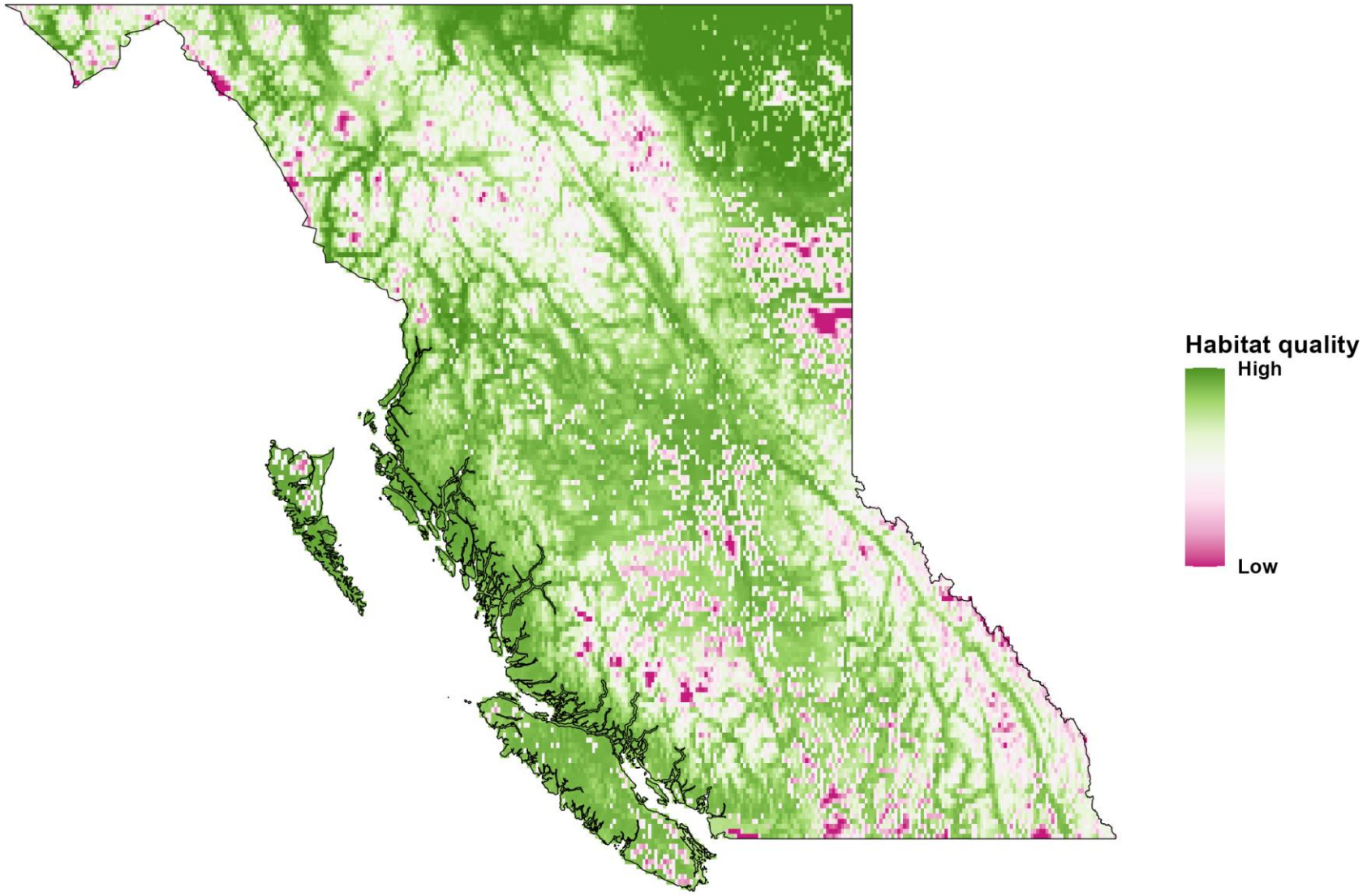
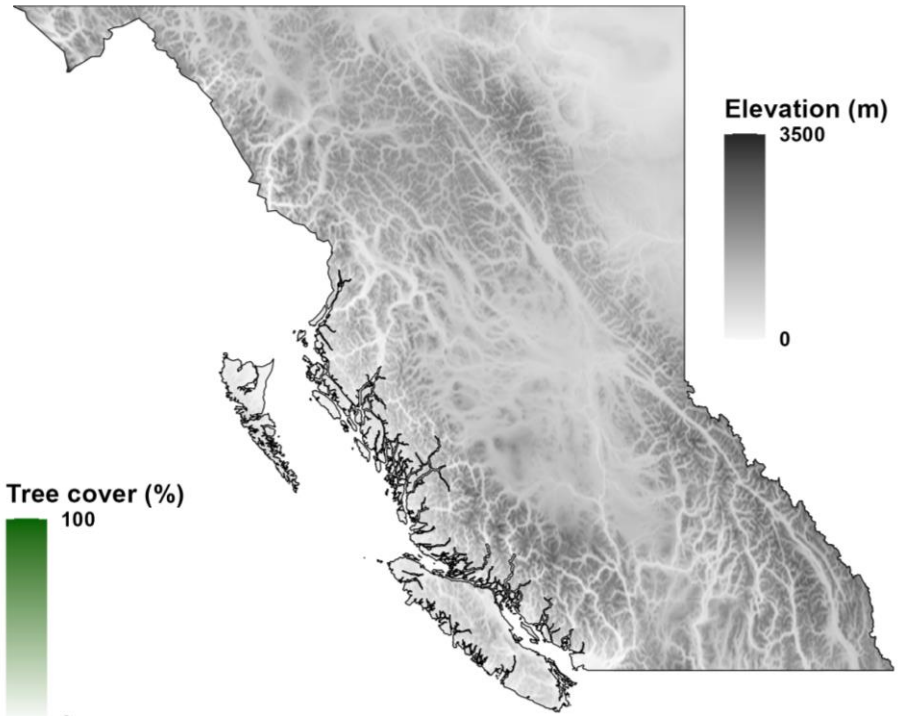
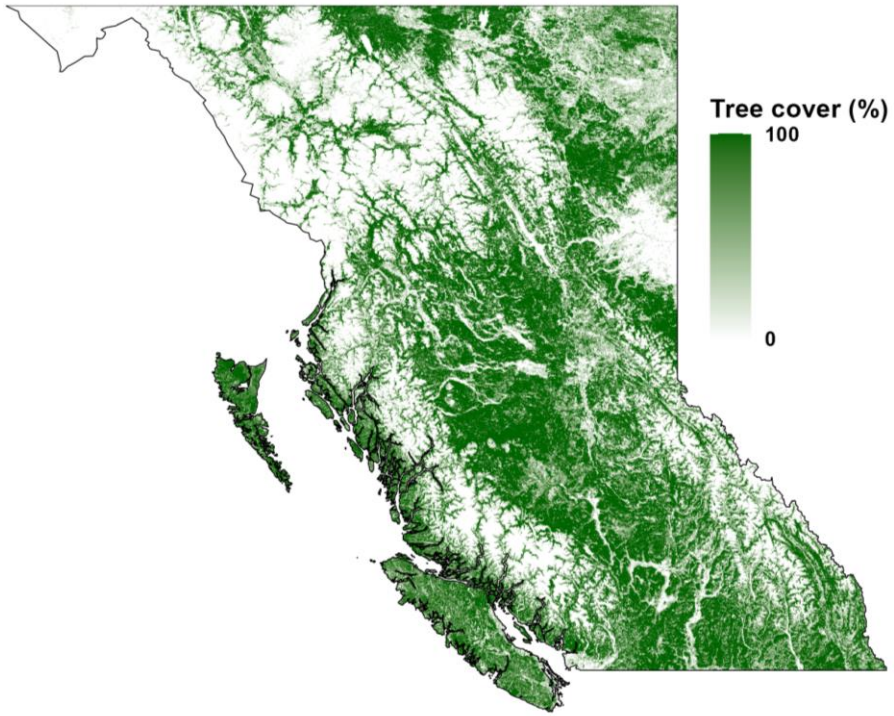
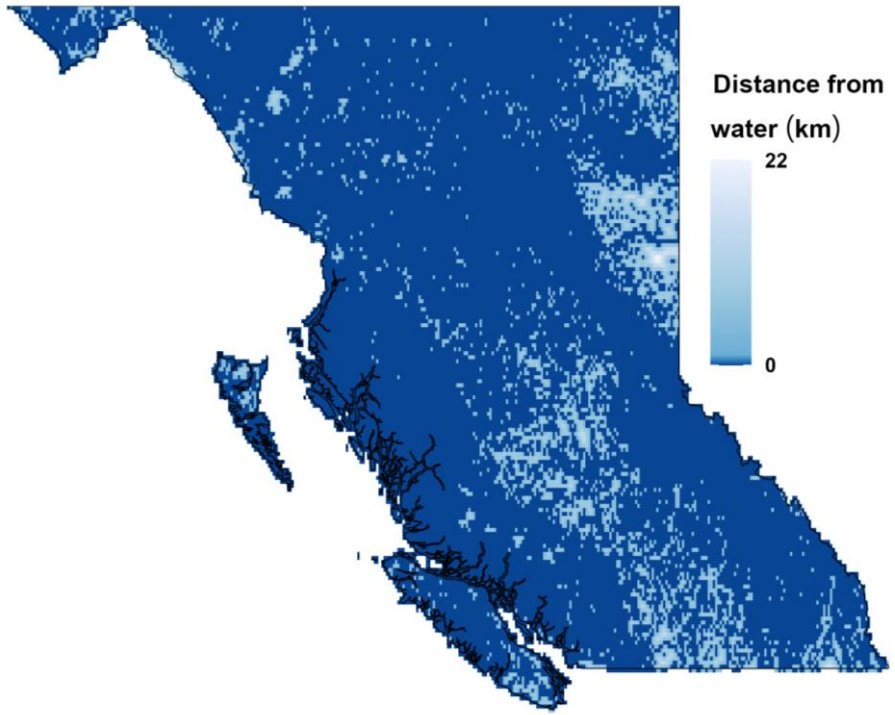


Bear habitat in 2100







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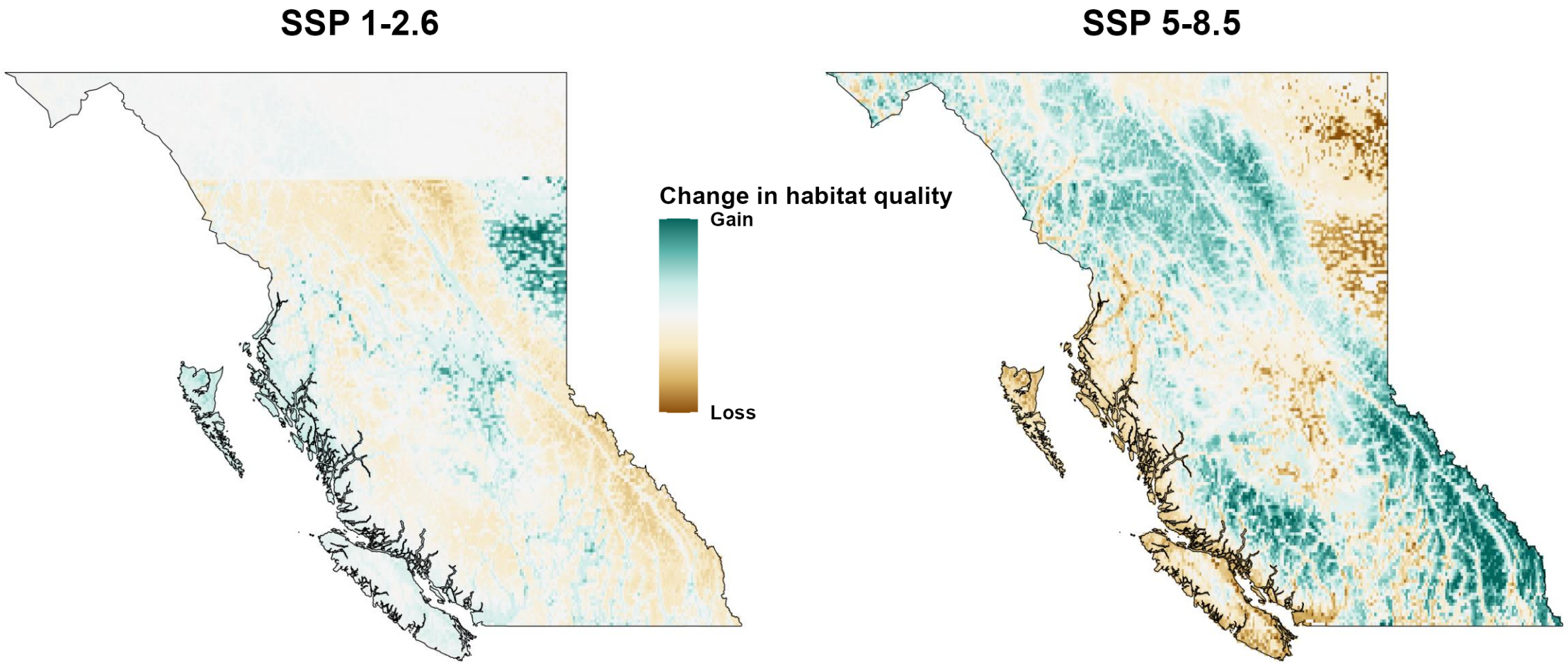

Planning for the future

- 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

BC Parks LIVING LAB

BC Parks

THE UNIVERSITY OF BRITISH COLUMBIA
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Okanagan Campus

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Quantitative Ecology Lab
UBC Okanagan

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Planning for the future

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References and credits

- Brown JH, Gillooly JF, Allen AP, Savage VM & West GB (2004). Toward a metabolic theory of ecology. *Ecology* **85**, 1771–1789. https://doi.org/10.1890/03-9000
- Taylor CR, Heglund NC, & Maloiy GM (1982). Energetics and mechanics of terrestrial locomotion. I. Metabolic energy consumption as a function of speed and body size in birds and mammals. *Journal of Experimental Biology*, **97**(1), 1–21. https://doi.org/10.1242/jeb.97.1.1
- Alston JM, Fleming CH, Kays R, Streicher JP, Downs CT, Ramesh T, Reineking B, & Calabrese, JM (2022). Mitigating pseudoreplication and bias in resource selection functions with autocorrelation-informed weighting. Methods in Ecology and Evolution, 2041-210X.14025. https://doi.org/10.1111/2041-210X.14025

Phylopic silhouettes: