

Connecting current and future suitable climates to facilitate species movement under climate change

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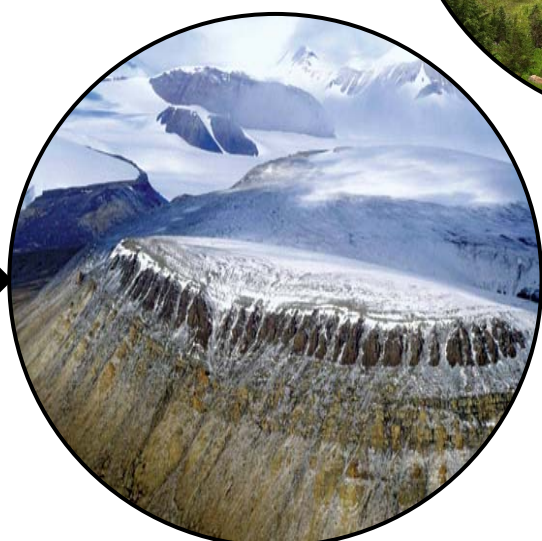
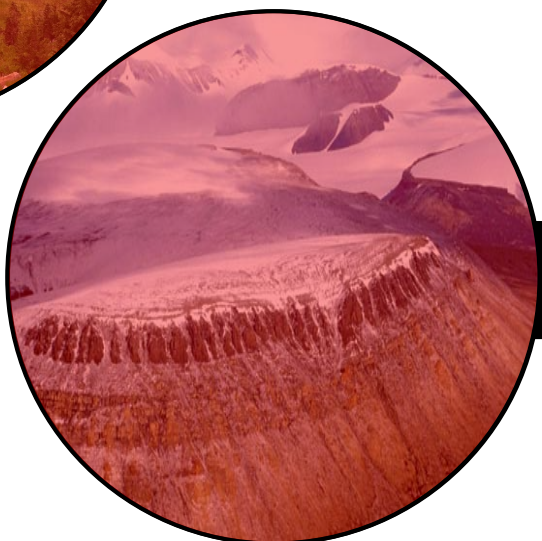
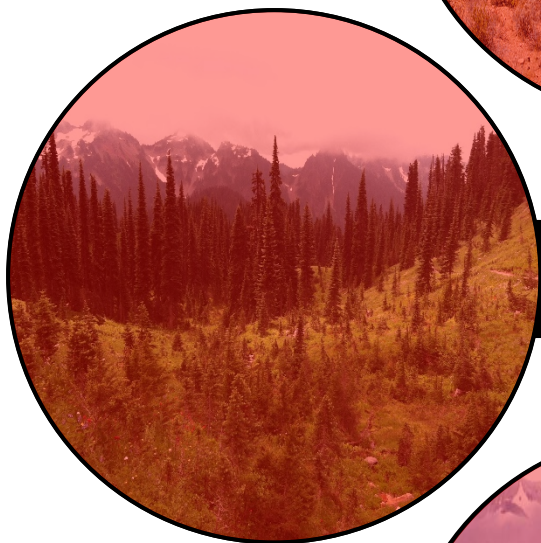
An aerial photograph of a mountainous landscape. In the foreground, a dense forest of evergreen trees covers the lower slopes. A multi-lane road with a median runs through the forest. In the background, a large mountain peak is visible, partially covered in snow. The sky is clear and bright. A semi-transparent white rectangular box is overlaid on the center of the image, containing text.

Goal

Predict landscape connectivity, taking into consideration the accessibility of suitable climate conditions in the future.

Why?

Traditional connectivity modeling may be missing important routes for species movement under climate change.



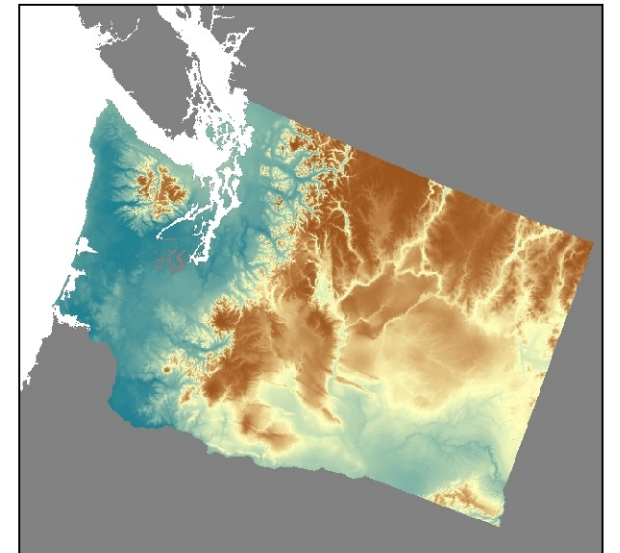
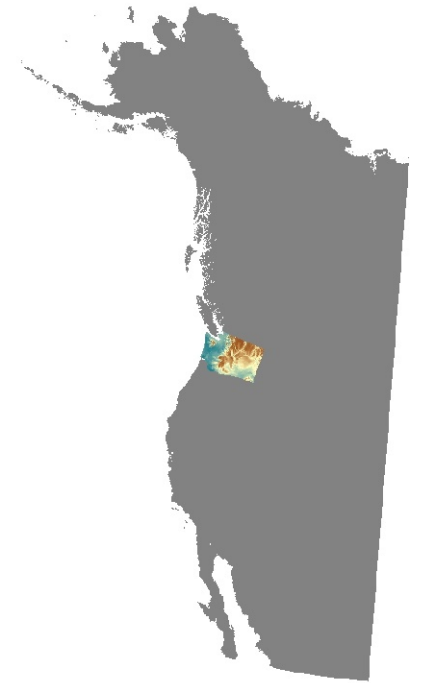
Approach:

Identify climate analogs: places in the future that will harbor today's climate conditions.

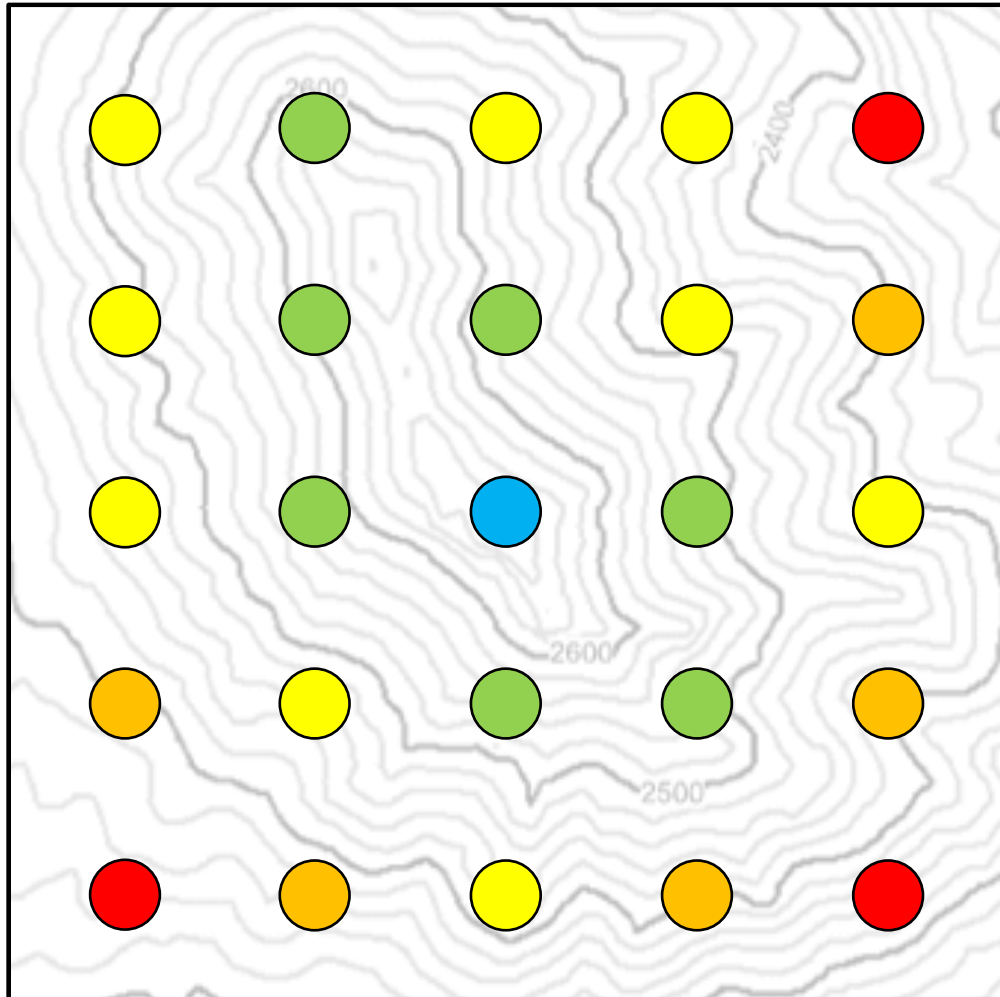
Connect climate analogs (Circuitscape), incorporating dispersal & landscape permeability

- Climate niche breadth
- 3 GCMs from CMIP5
- RCP 8.5 emissions scenario

How do climate projections affect modelled activity, and do they shift the road map for species movement?



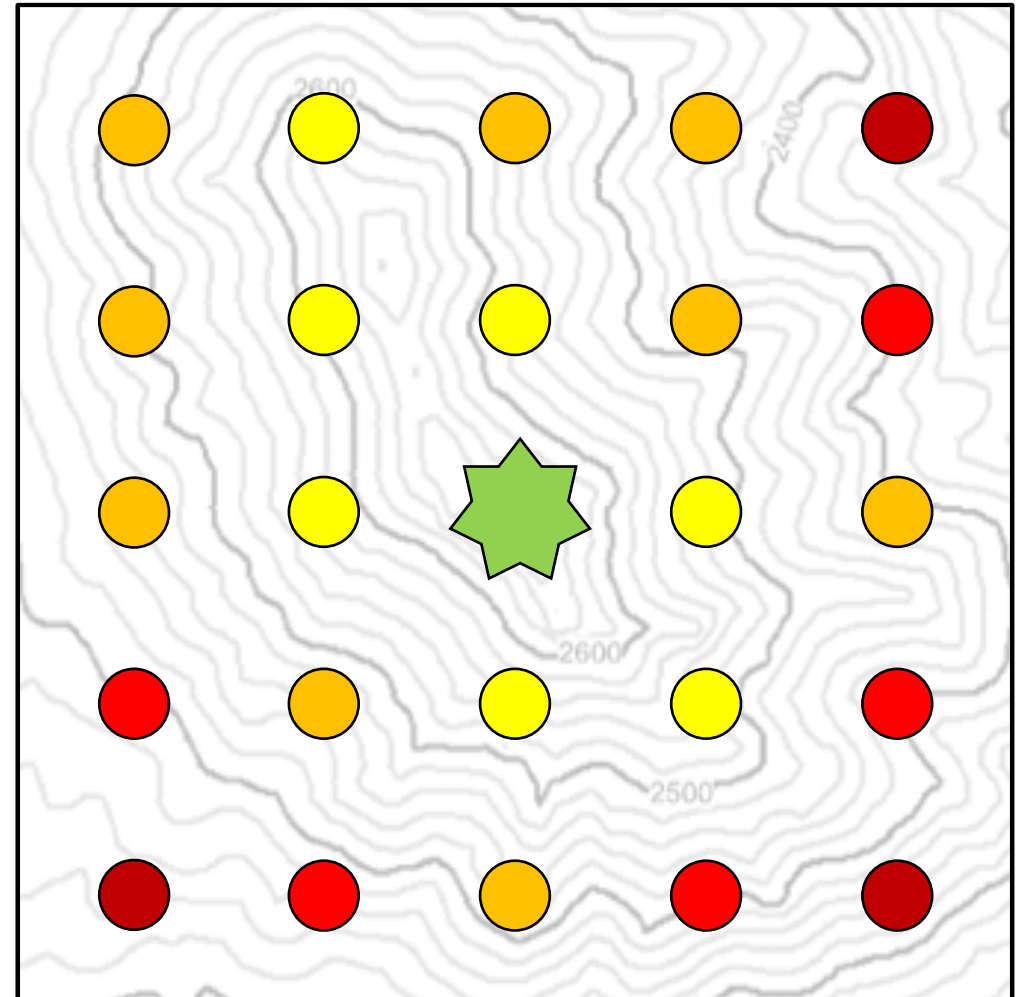
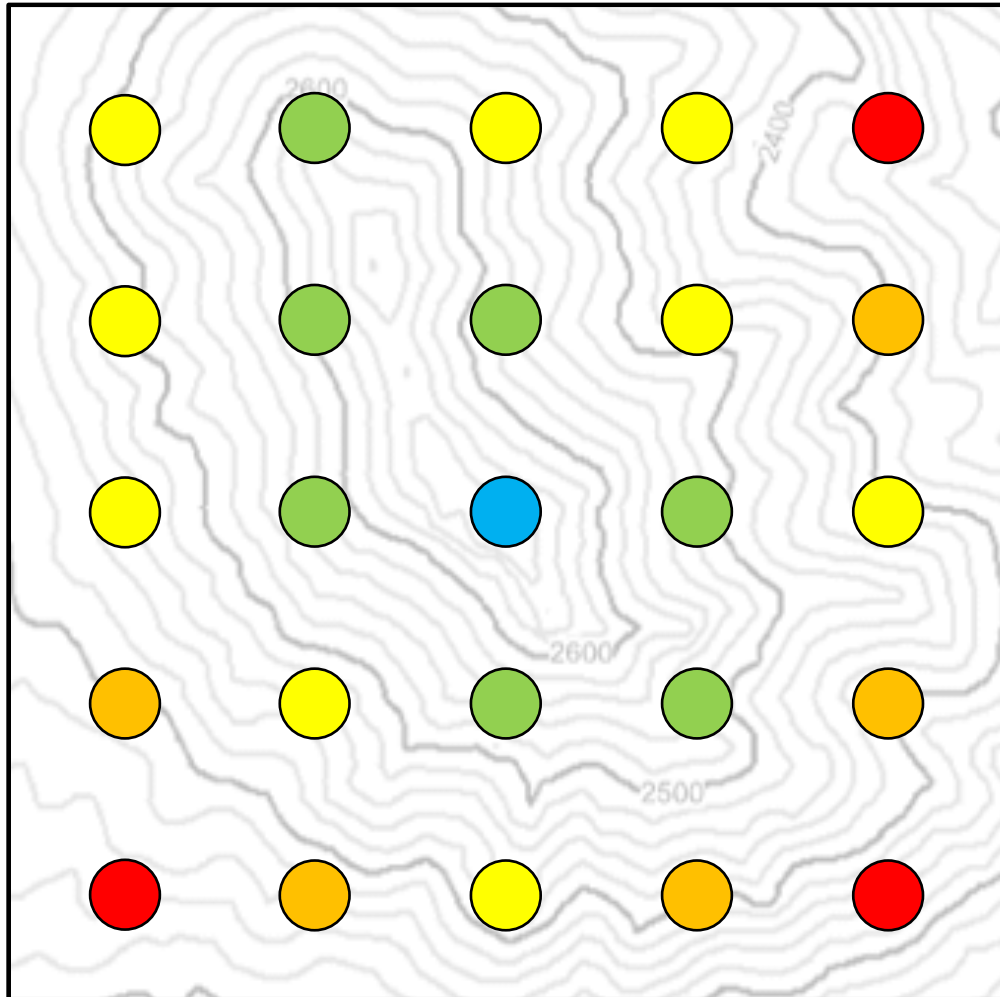
today



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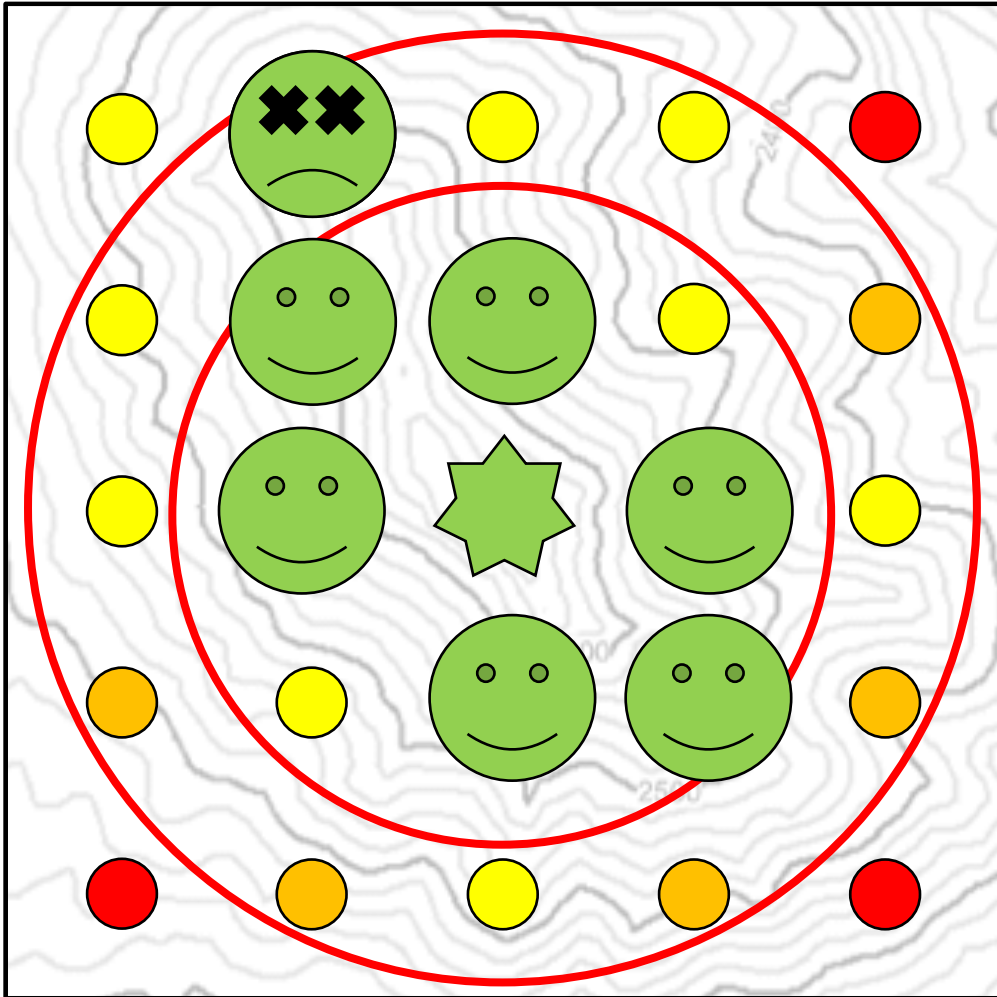
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future

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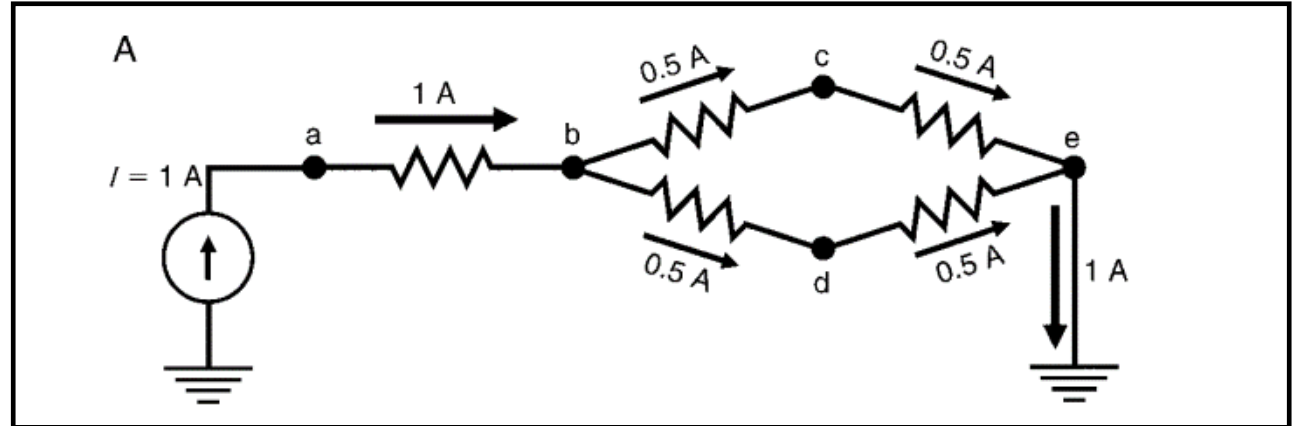
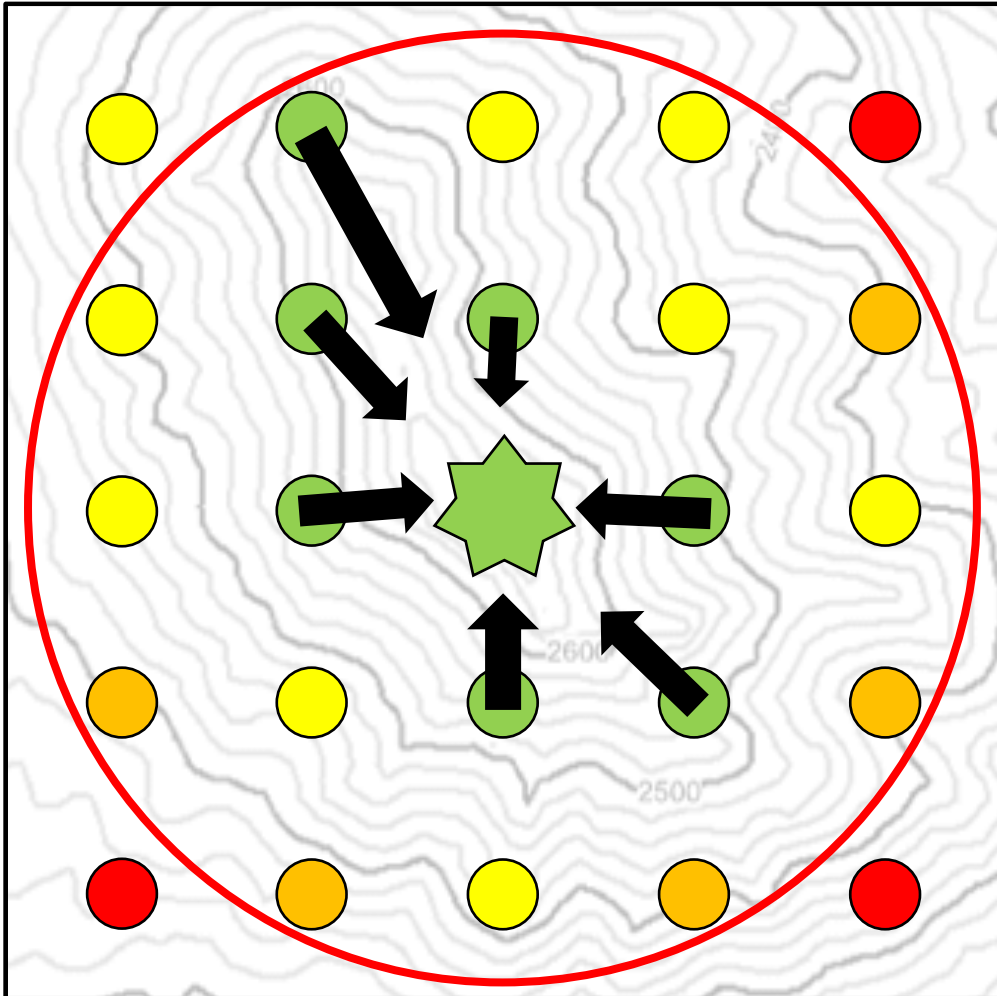
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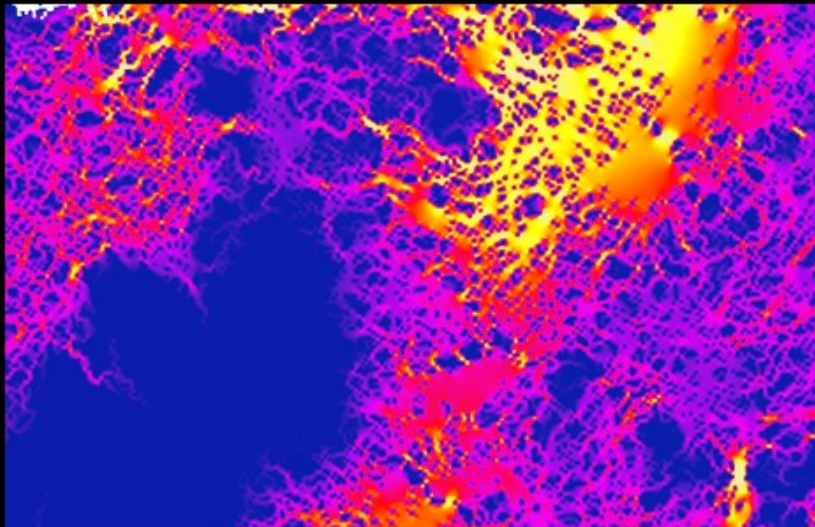
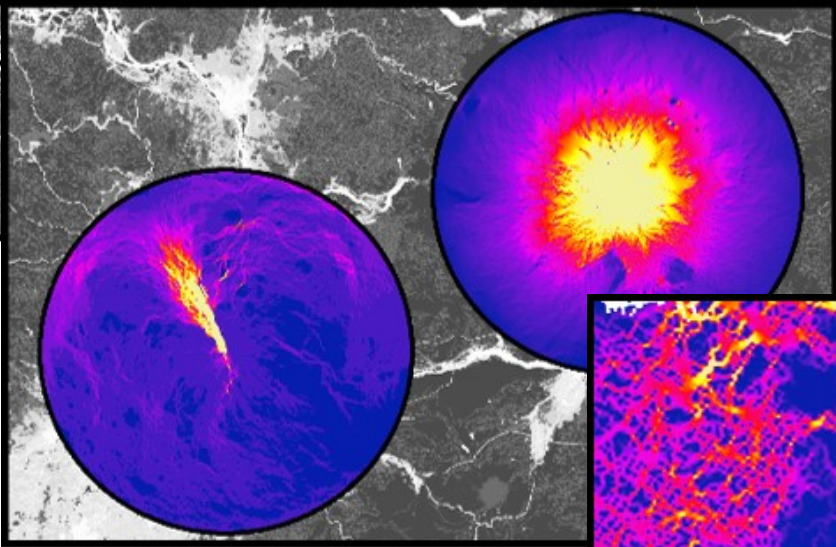
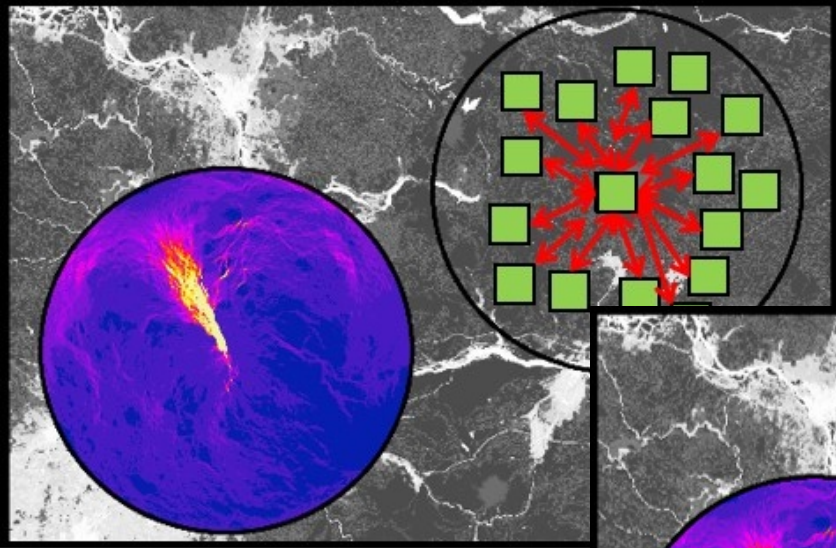
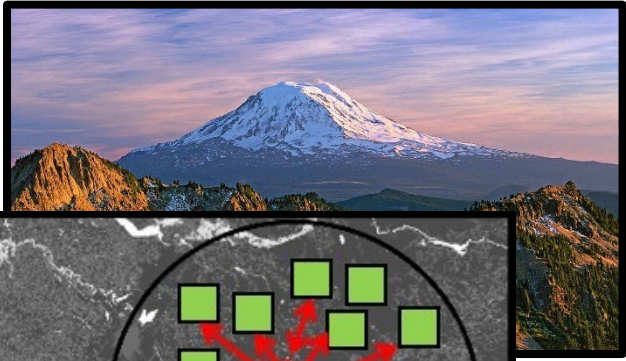
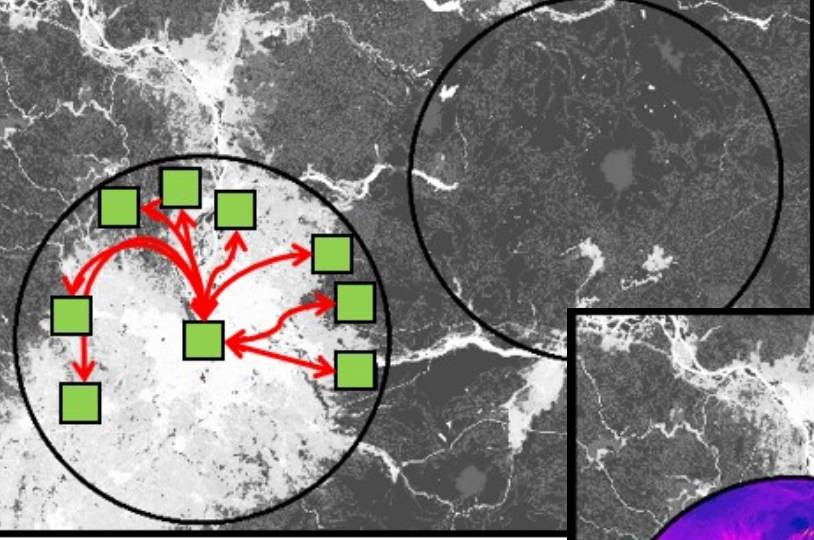


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McRae et al.
2008 Ecology

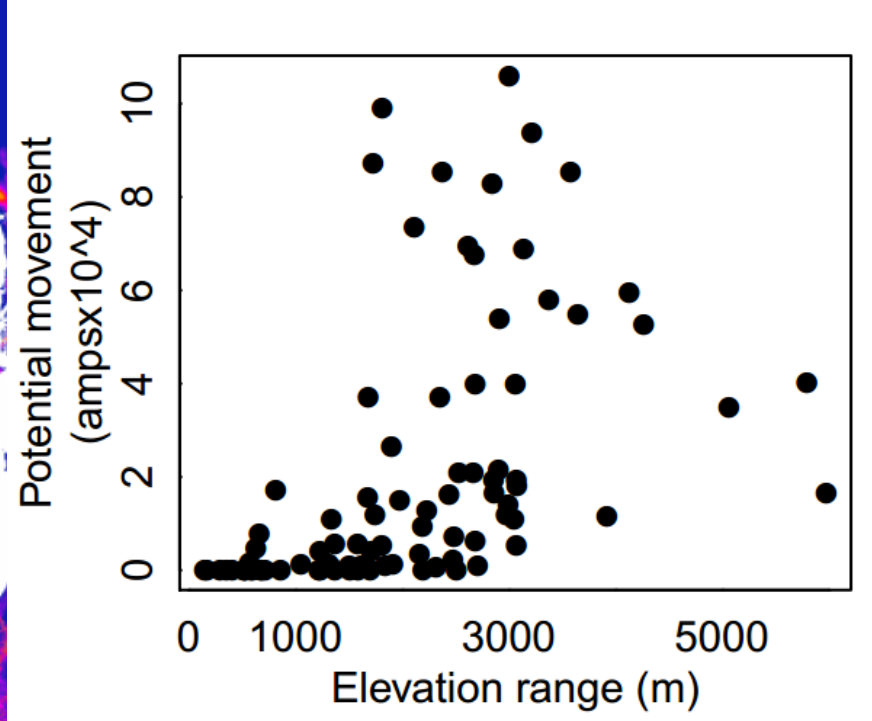
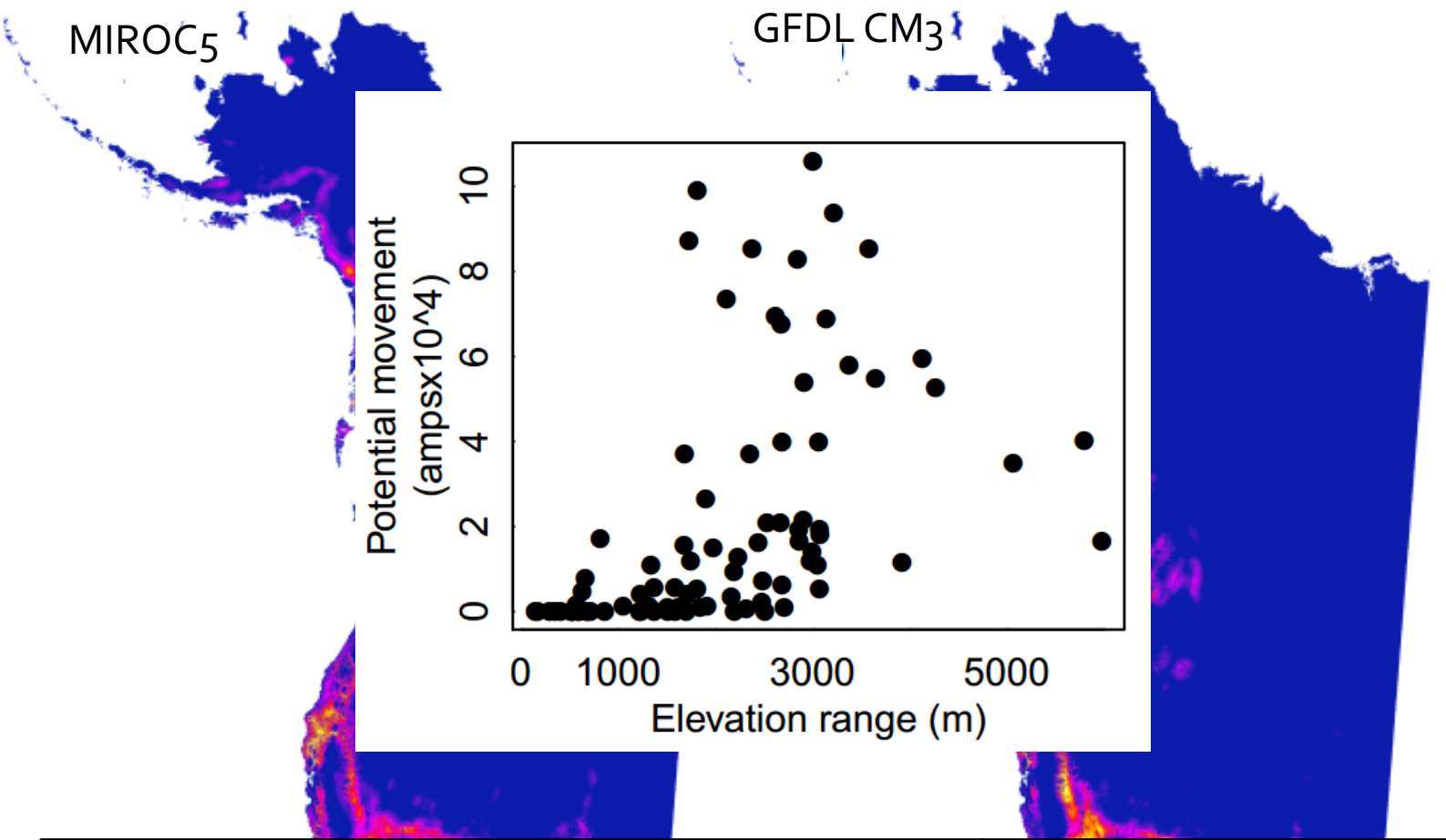
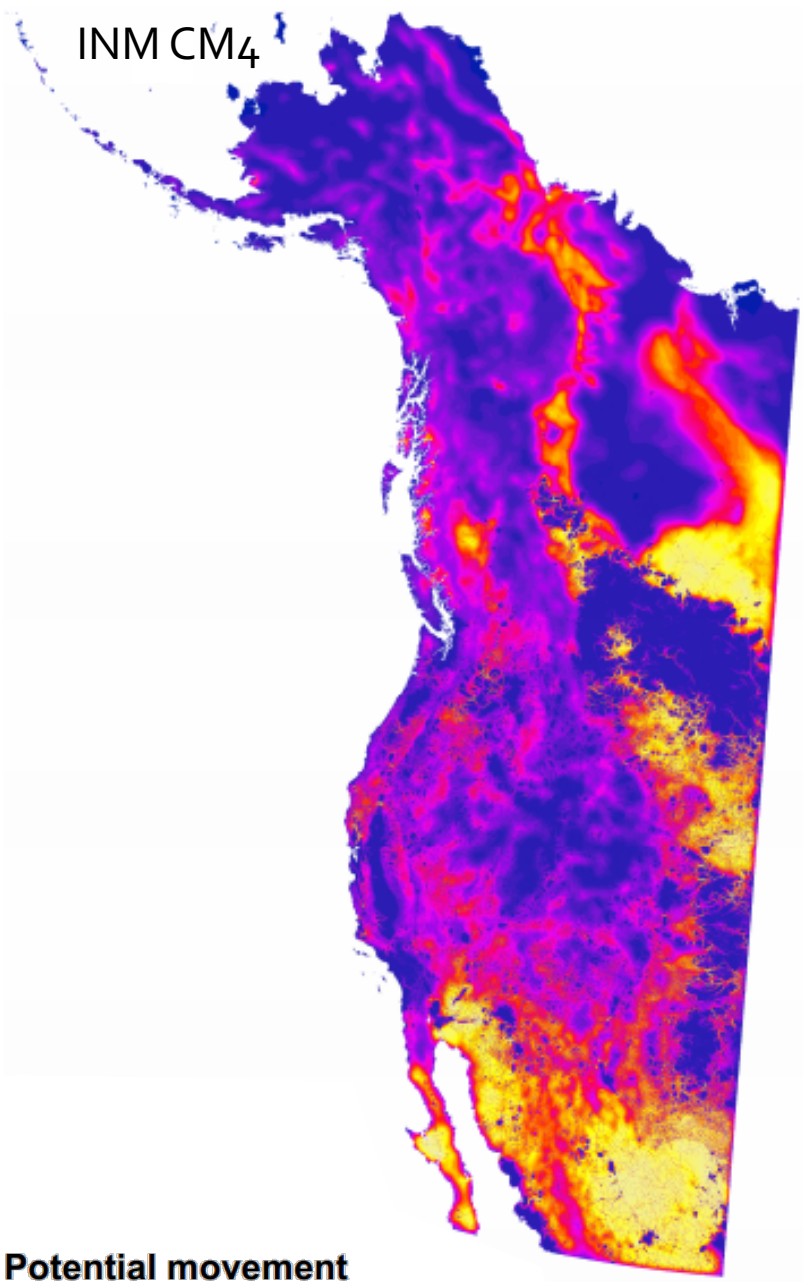


What areas are most important for climate-induced movement?

INM CM4

MIROC5

GFDL CM3



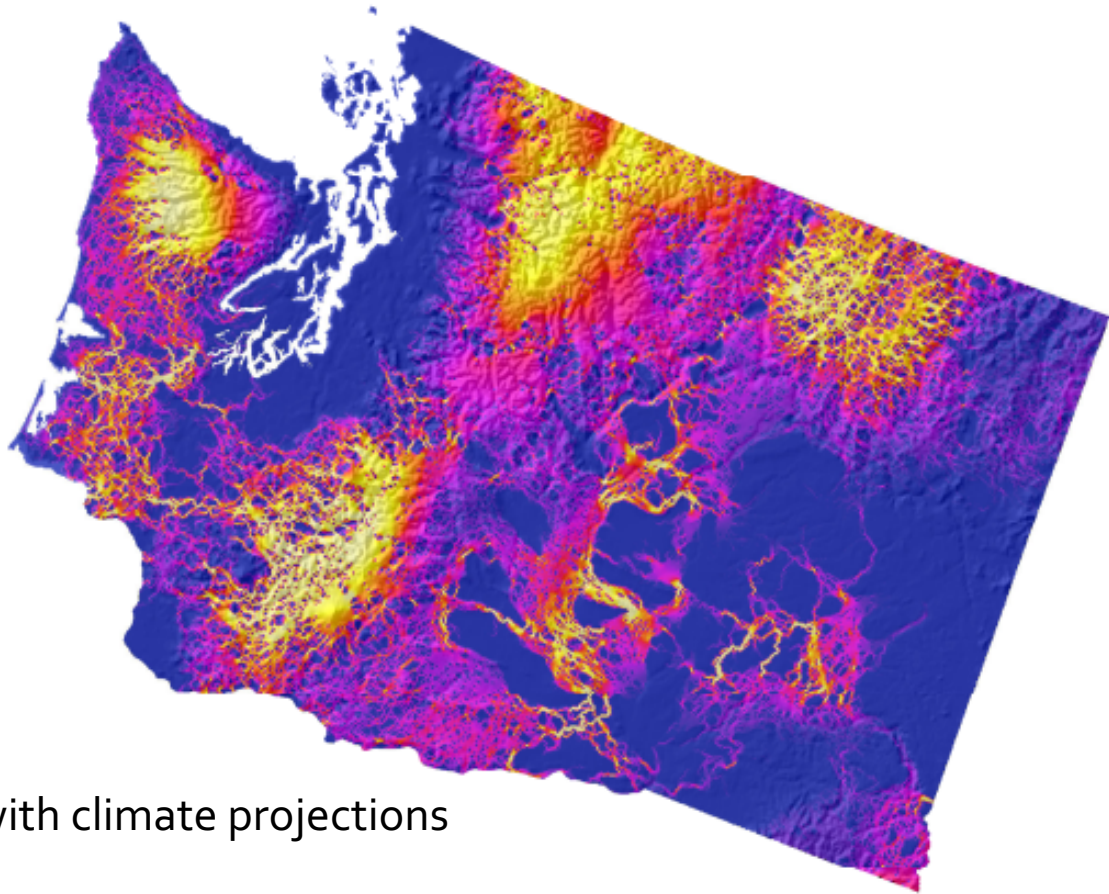
Potential movement

High
Low

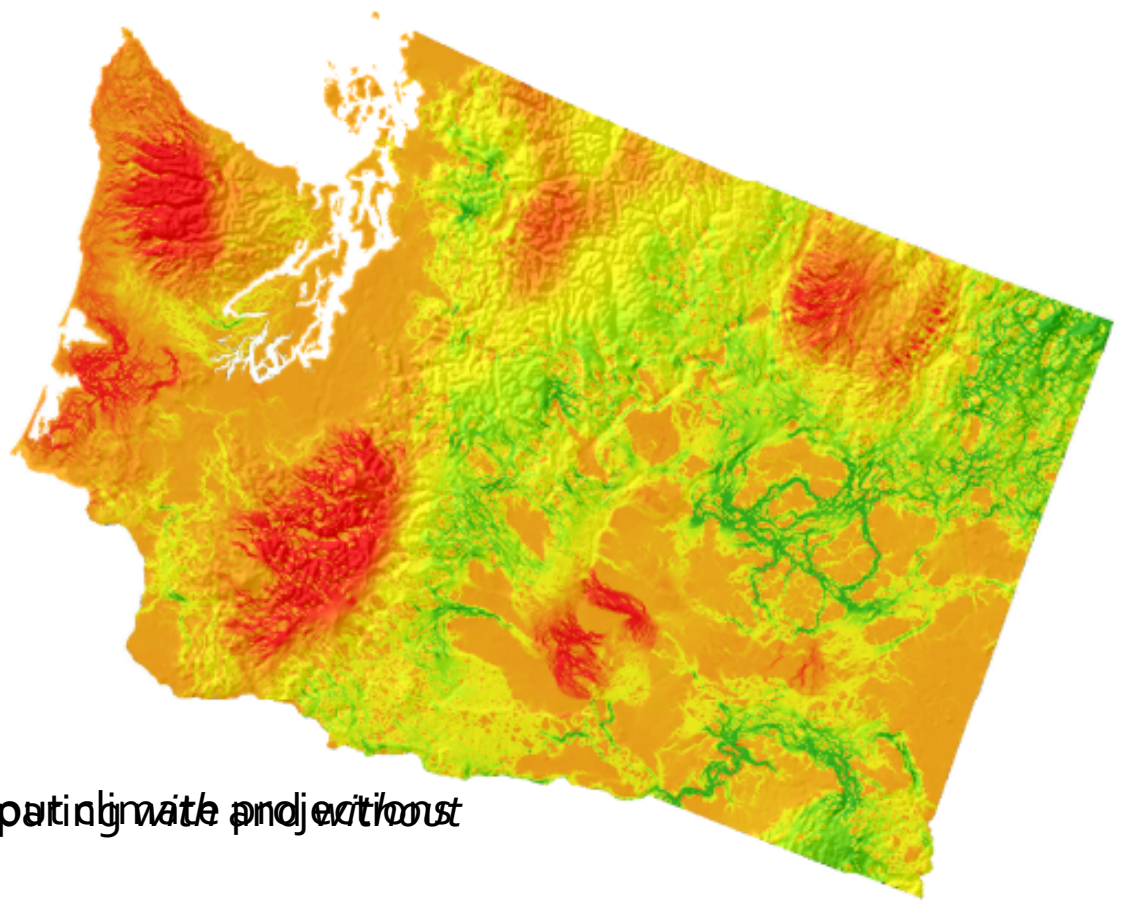


→→→Severity of projected climate change →→→

**How does this compare to
connectivity that *doesn't*
include climate projections?**



with climate projections

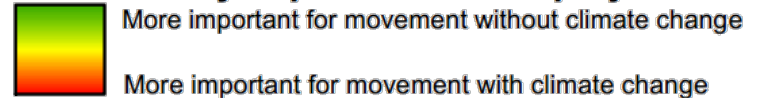


with climate projections

Potential movement



Connectivity impact of climate projections



**Isn't climate change
unfolding continuously?**

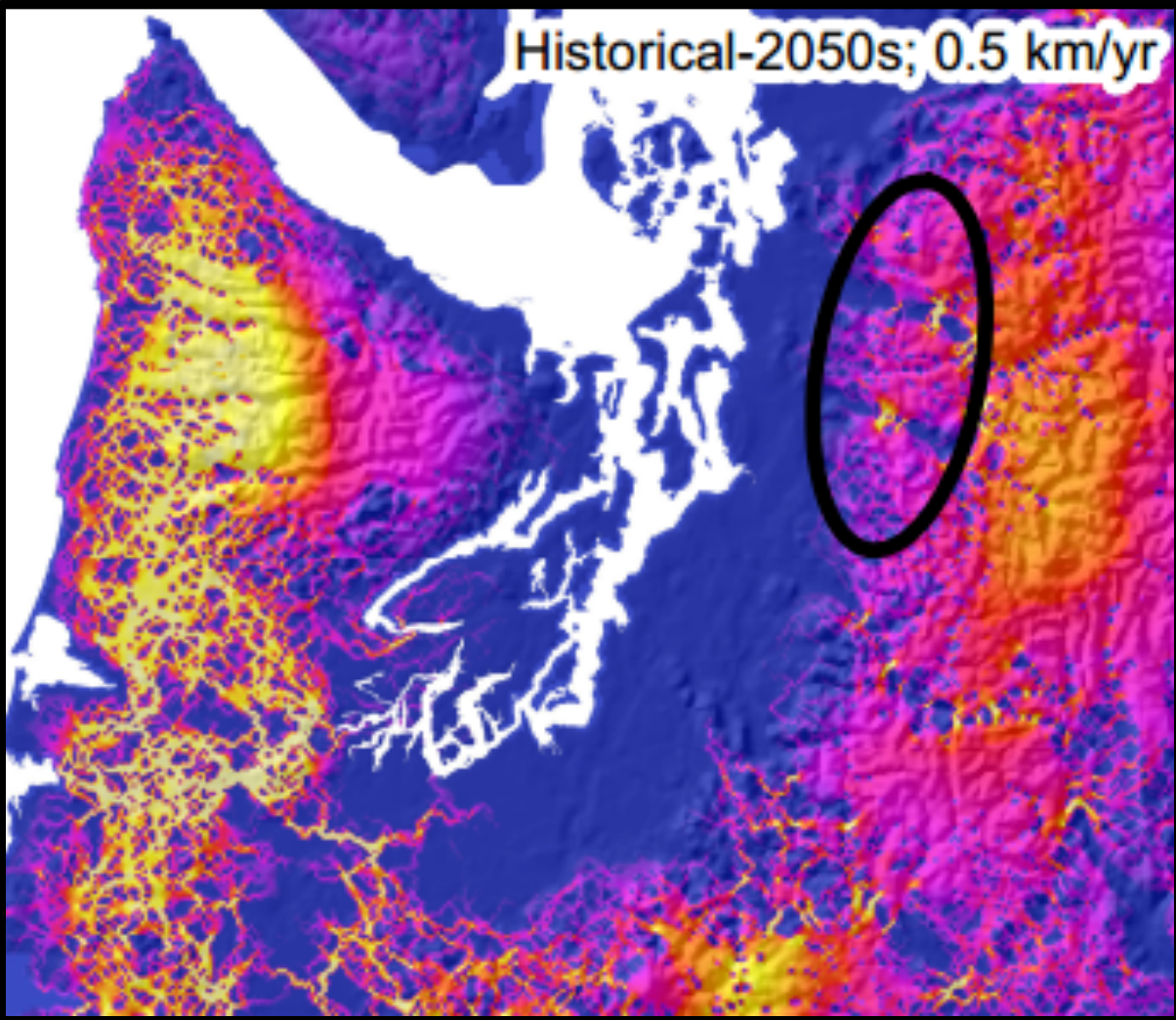
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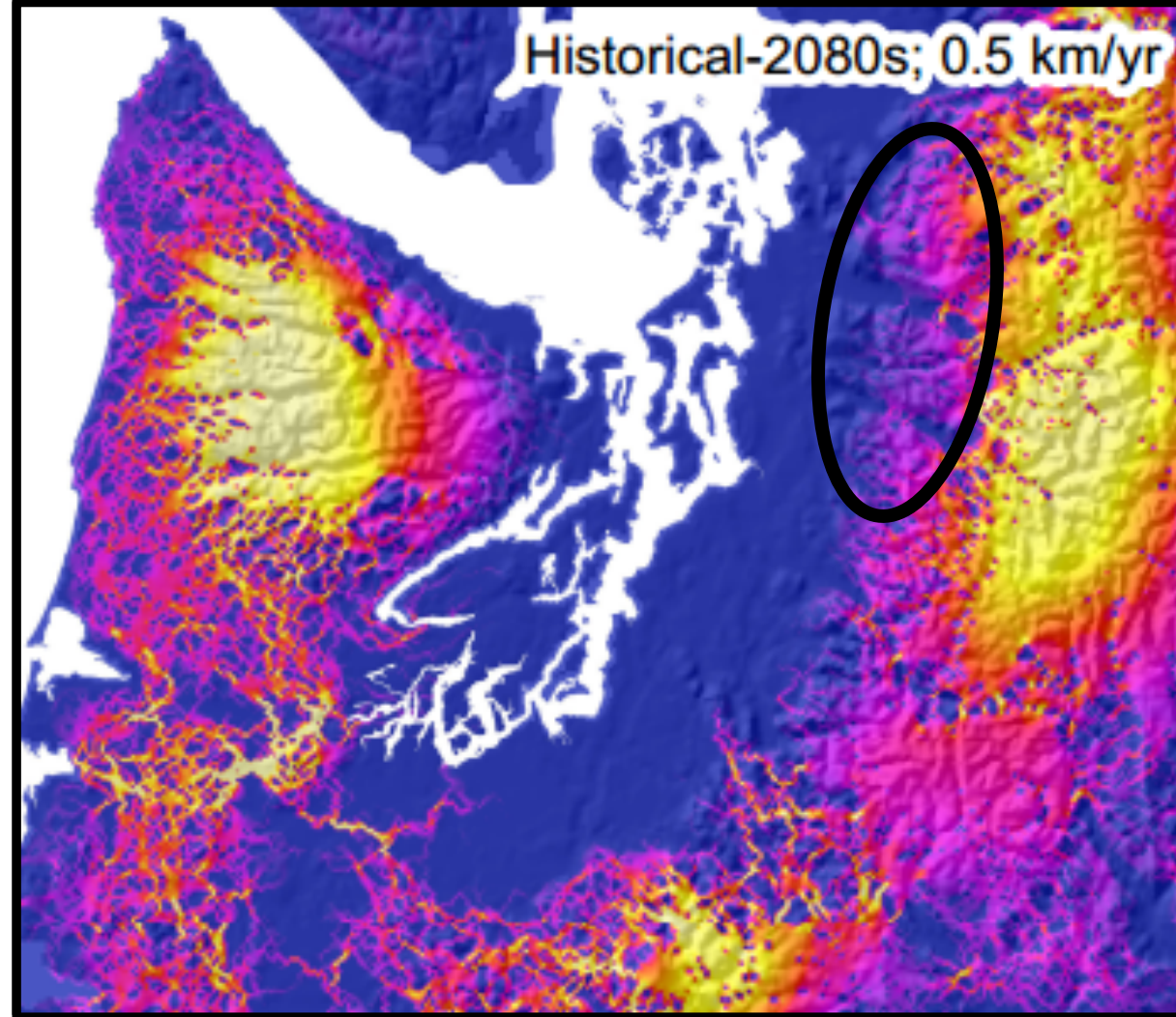
future



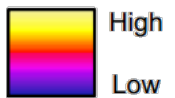
Historical-2050s; 0.5 km/yr



Historical-2080s; 0.5 km/yr



Potential movement



Take-aways?

Including climate projections...

- shifts important areas for movement to a smaller proportion of the landscape
- predicts less *net* and less *even* movement than connectivity based solely on human modification

and...

- modeling climate change incrementally shifts the relative importance of pathways

A scenic mountain landscape featuring a semi-transparent white text box in the center. The background shows a range of dark, jagged mountains under a bright blue sky with scattered white clouds. In the foreground, there are rolling hills covered in vibrant, multi-colored vegetation (yellow, orange, red, and green), suggesting a high-altitude or alpine environment. A narrow dirt path winds through the lower slopes of the hills.

Connectivity enhancement based on human modification alone or simplifying the temporal resolution of climate change may overestimate movement and miss critical pathways.

Questions?

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Acknowledgements

Wilburf
AdaptW

f the
project

Nation

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World Climate ReseaBrad McRae's Working Group
on Coupled Mo1966-2017 CMIP5 dataset

Take-aways:

- Including climate projections shifts important areas for movement to a smaller proportion of the landscape.
- Connectivity maps solely driven by human modification predict more net movement, more even movement.
- Relative importance of pathways shifts when climate change proceeds incrementally in two time steps vs. in one time step.
- *Connectivity enhancement based on human modification alone or simplifying the temporal resolution of climate change may over-estimate movement and miss critical pathways.*