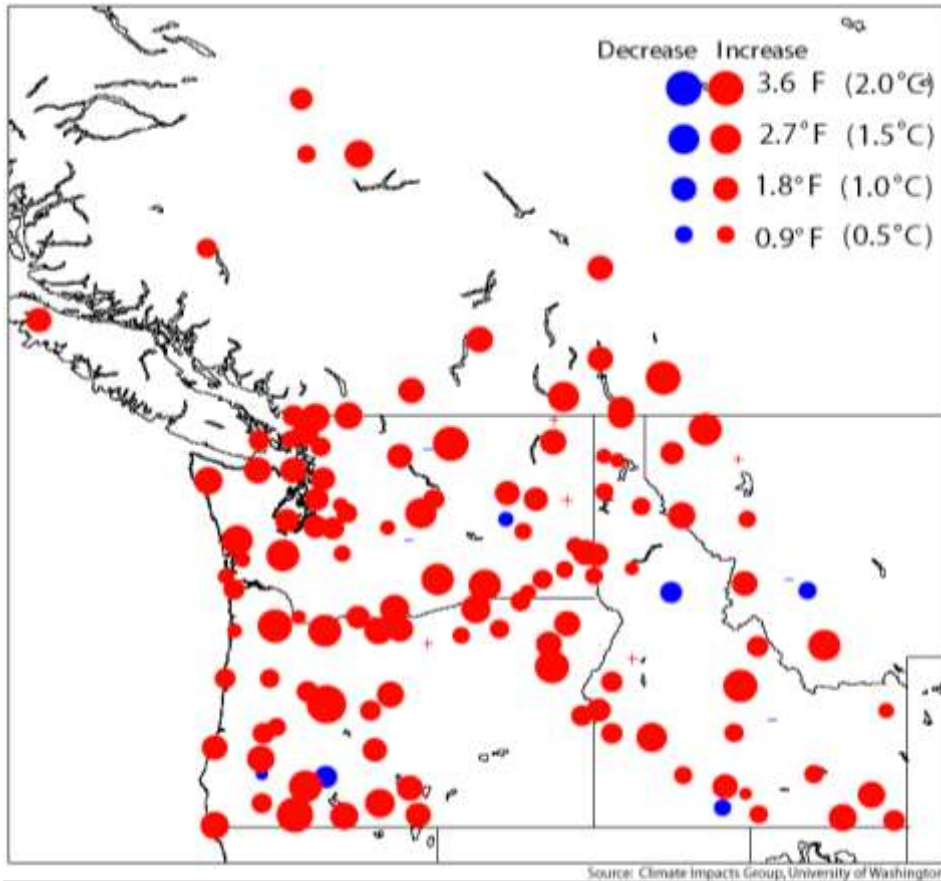


The background image is a composite of three photographs. The top section shows a close-up of evergreen trees on the left and a snow-capped mountain peak against a clear blue sky with a few wispy clouds on the right. The middle section is a semi-transparent grey band containing the title text. The bottom section shows a steep, rocky mountain slope covered in dense evergreen forest, with a rocky outcrop visible on the left side.

Plant community responses to climate change

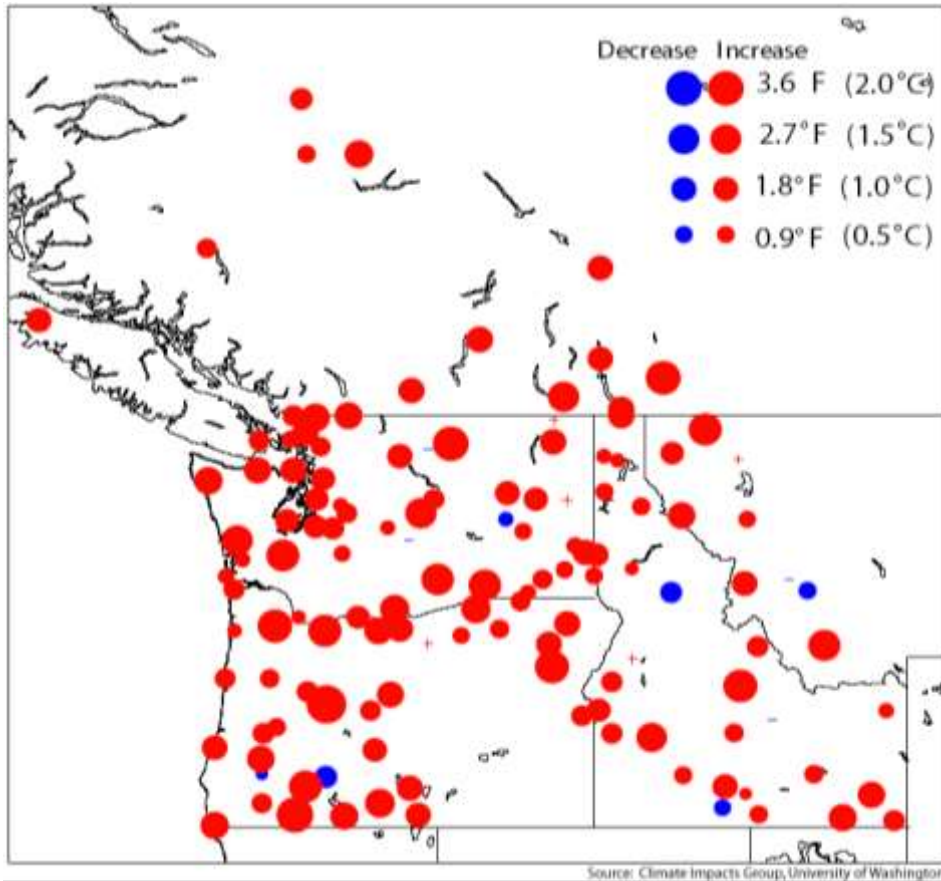
Kavya Pradhan; Hille Ris Lambers Lab
Washington Botanical Symposium
3/4/2020

Climate change and consequences

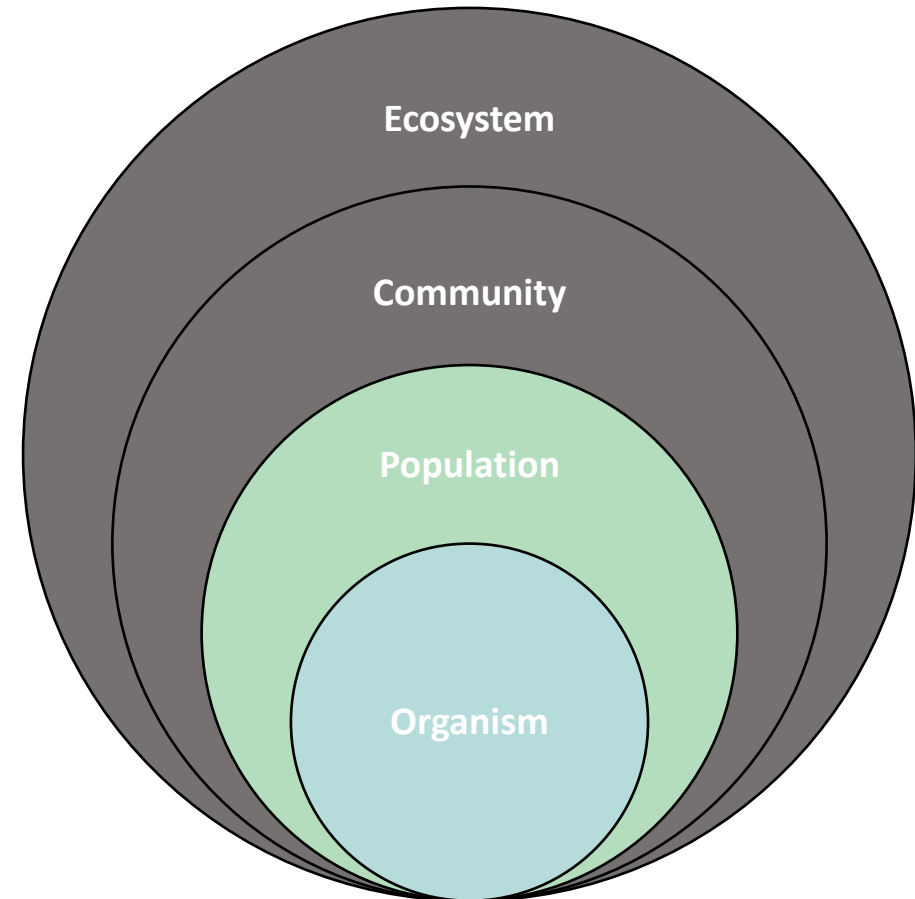


Climate Impacts Group (UW): <https://cig.uw.edu/>

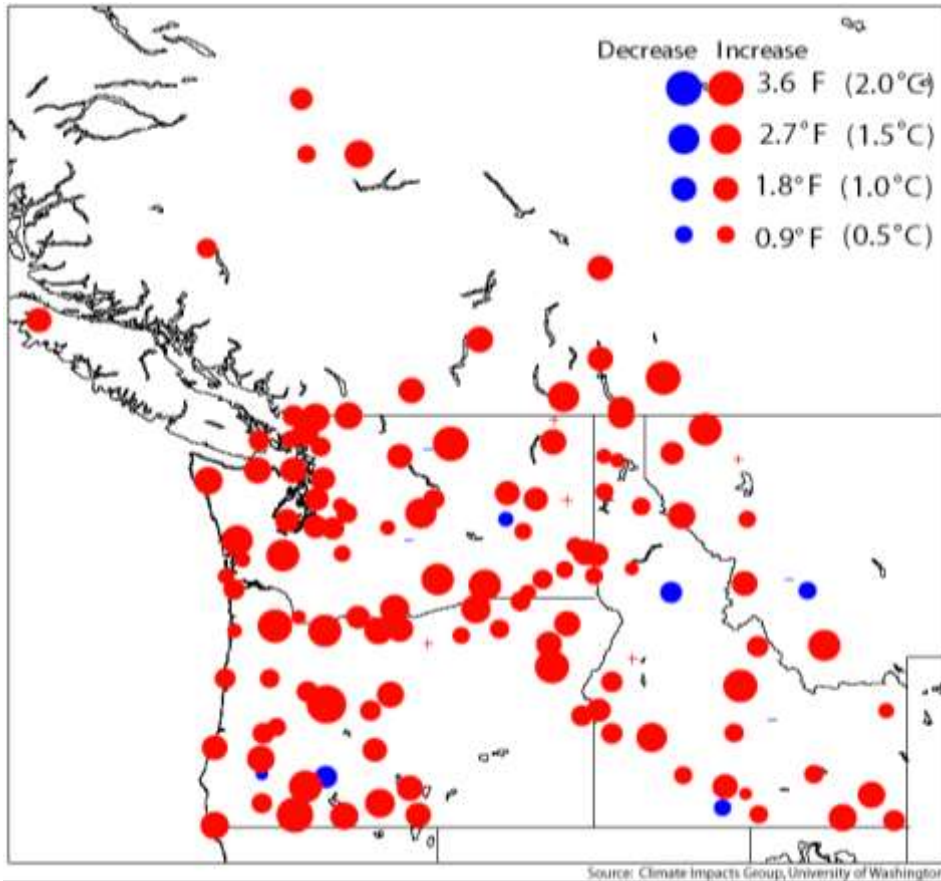
Climate change and consequences



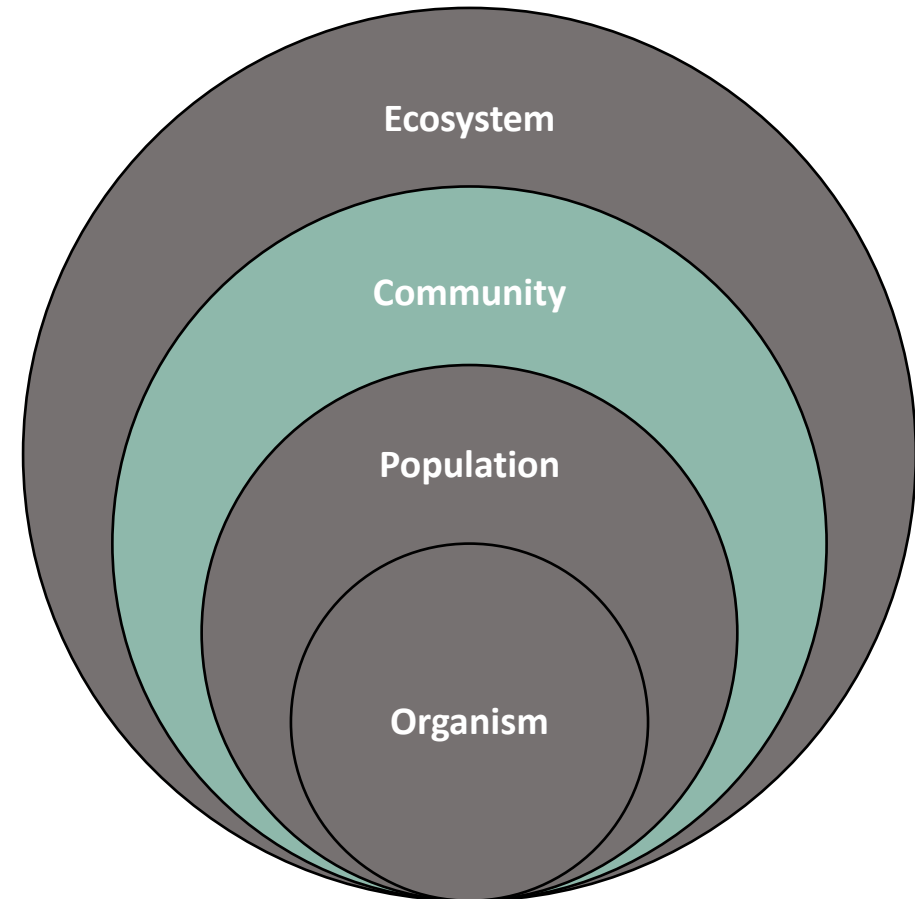
Climate Impacts Group (UW): <https://cig.uw.edu/>



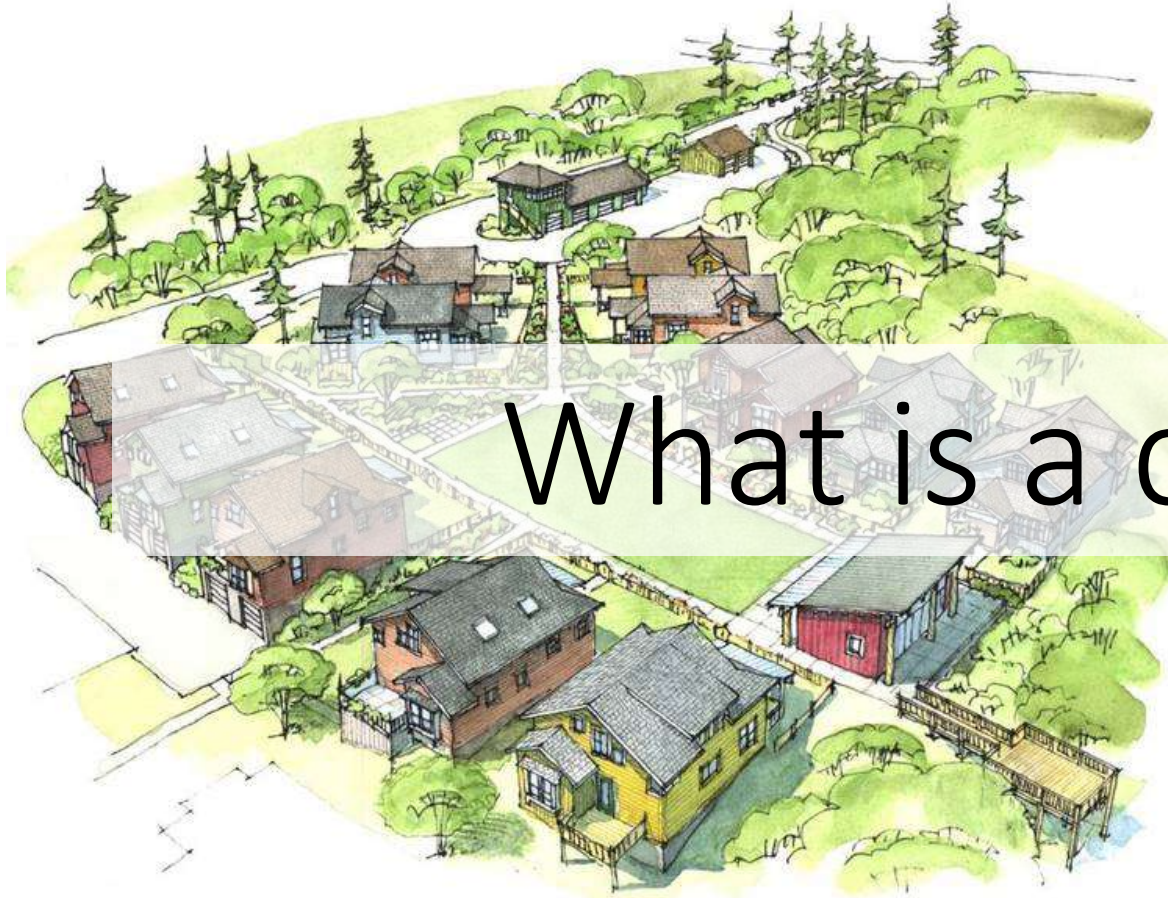
Climate change and consequences



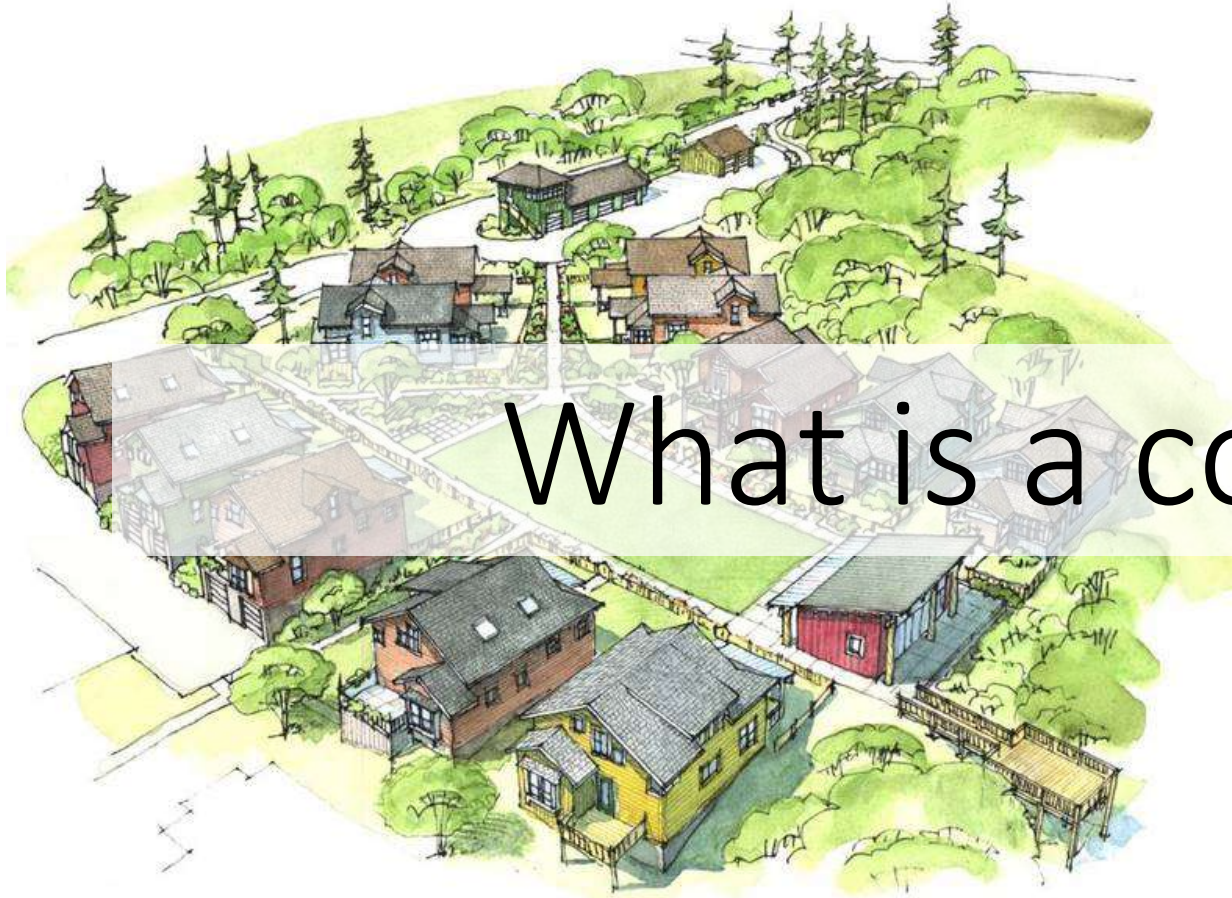
Climate Impacts Group (UW): <https://cig.uw.edu/>



What is a community?



What is a community?



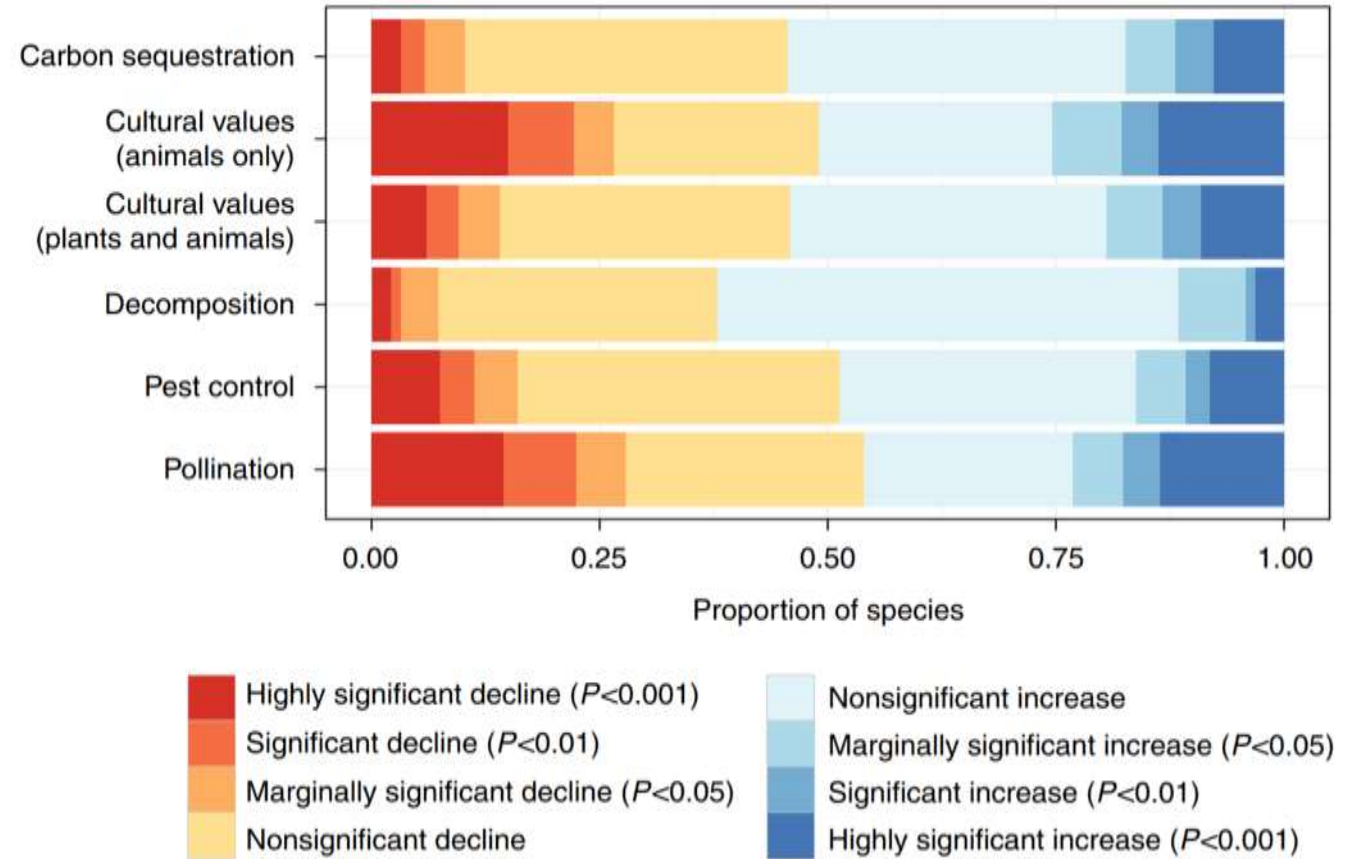
What is a community?



Why do we care about communities?



Why do we care about communities?



Oliver *et al.* 2015

How are communities responding to climate?

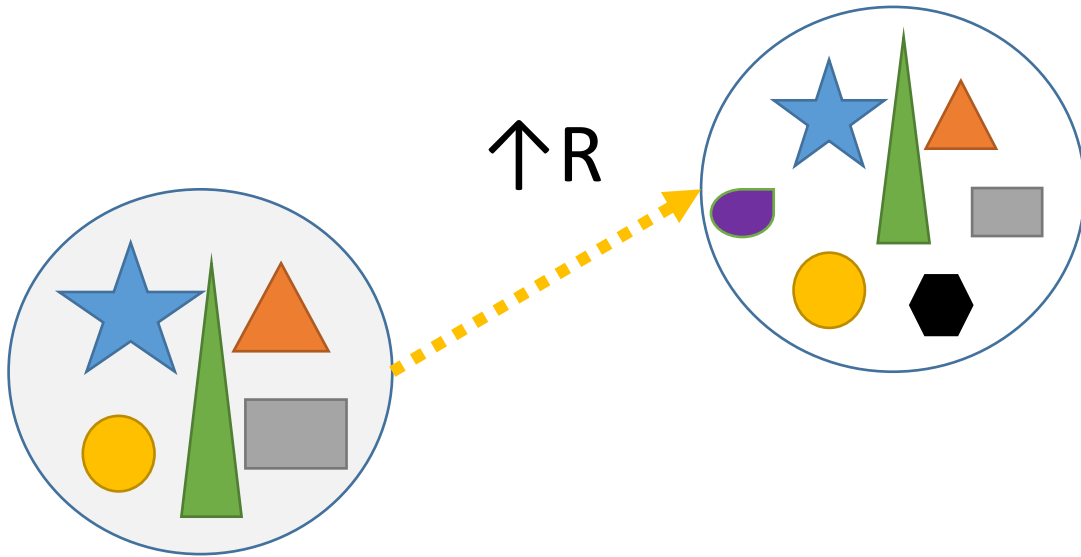
How are communities responding to climate?

Species richness



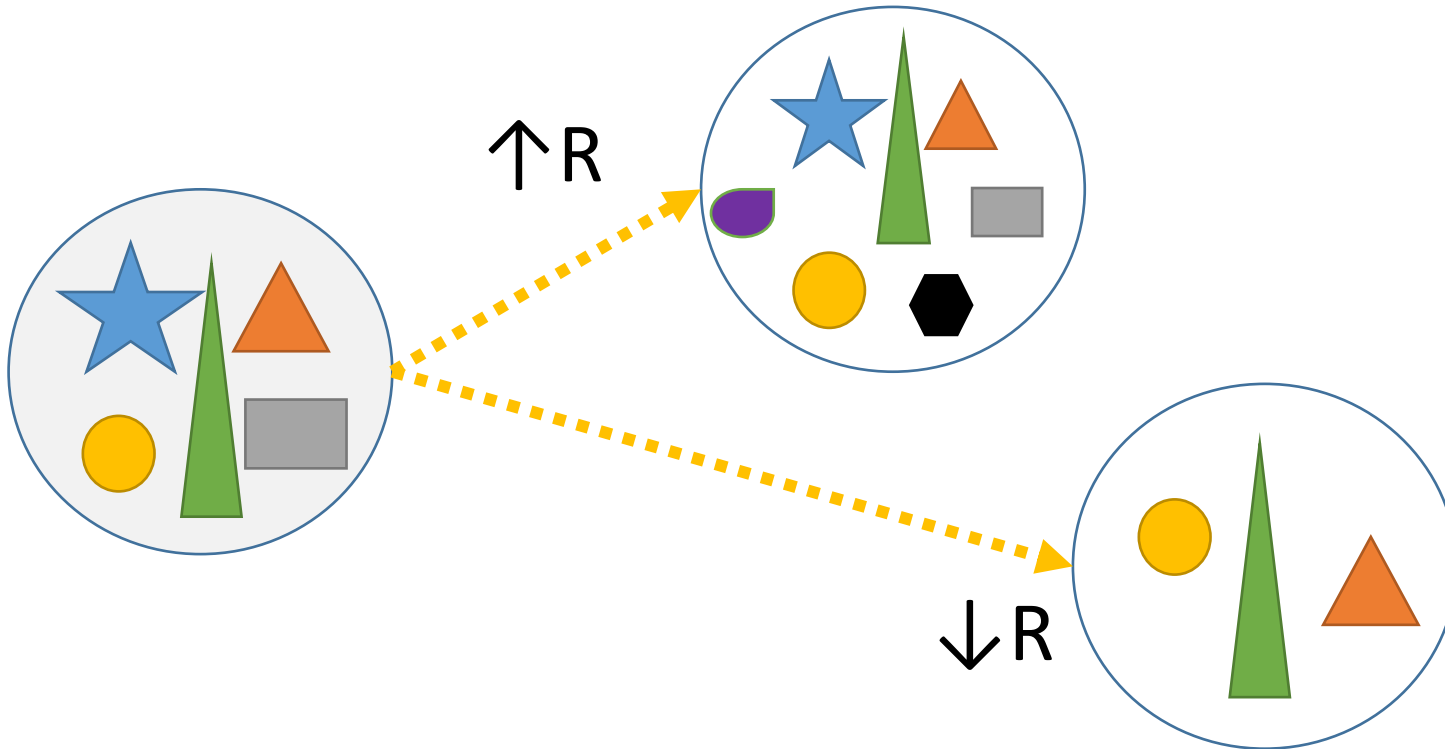
How are communities responding to climate?

Species richness



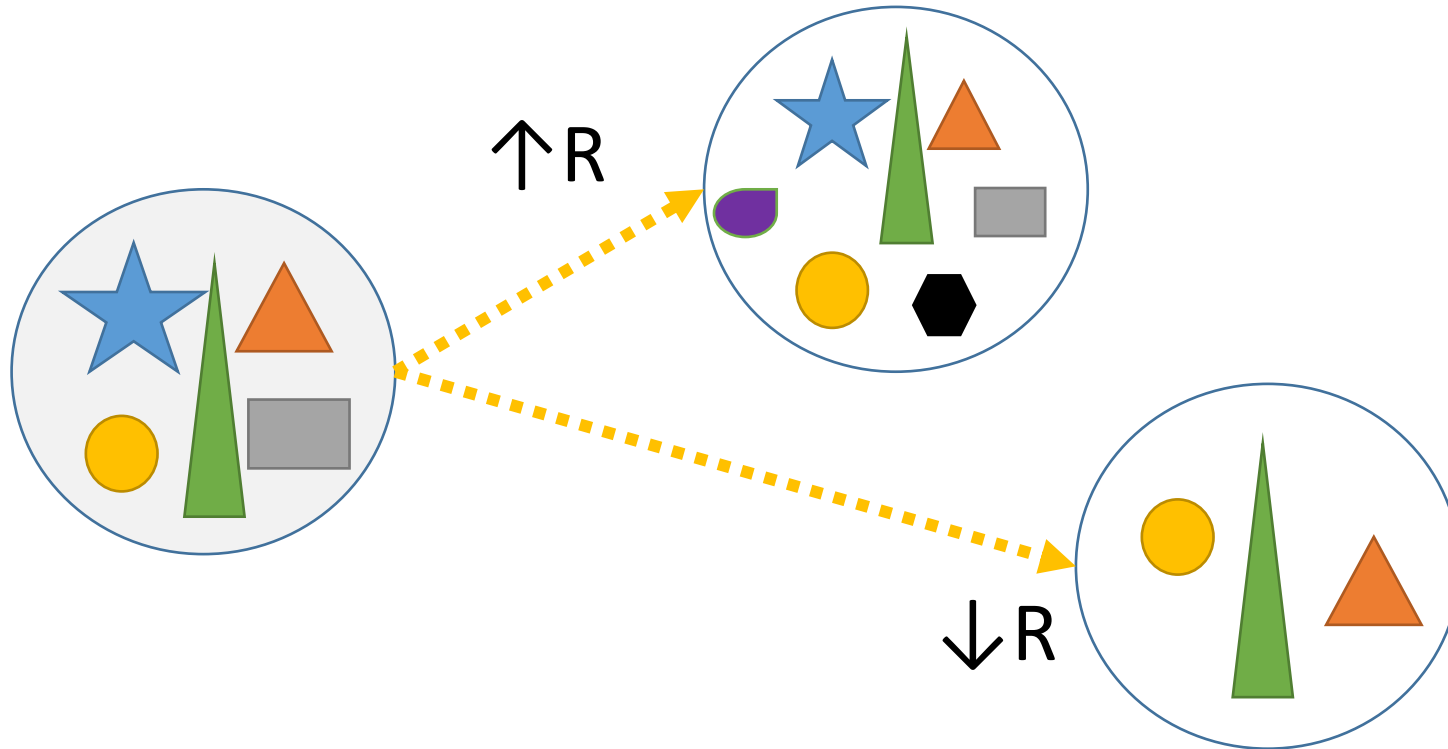
How are communities responding to climate?

Species richness

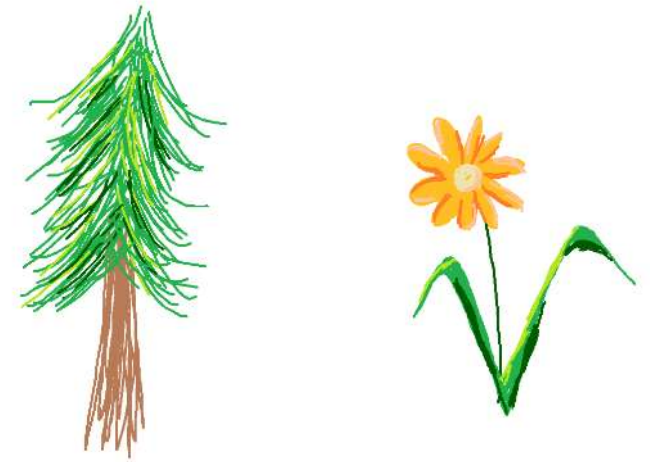


How are communities responding to climate?

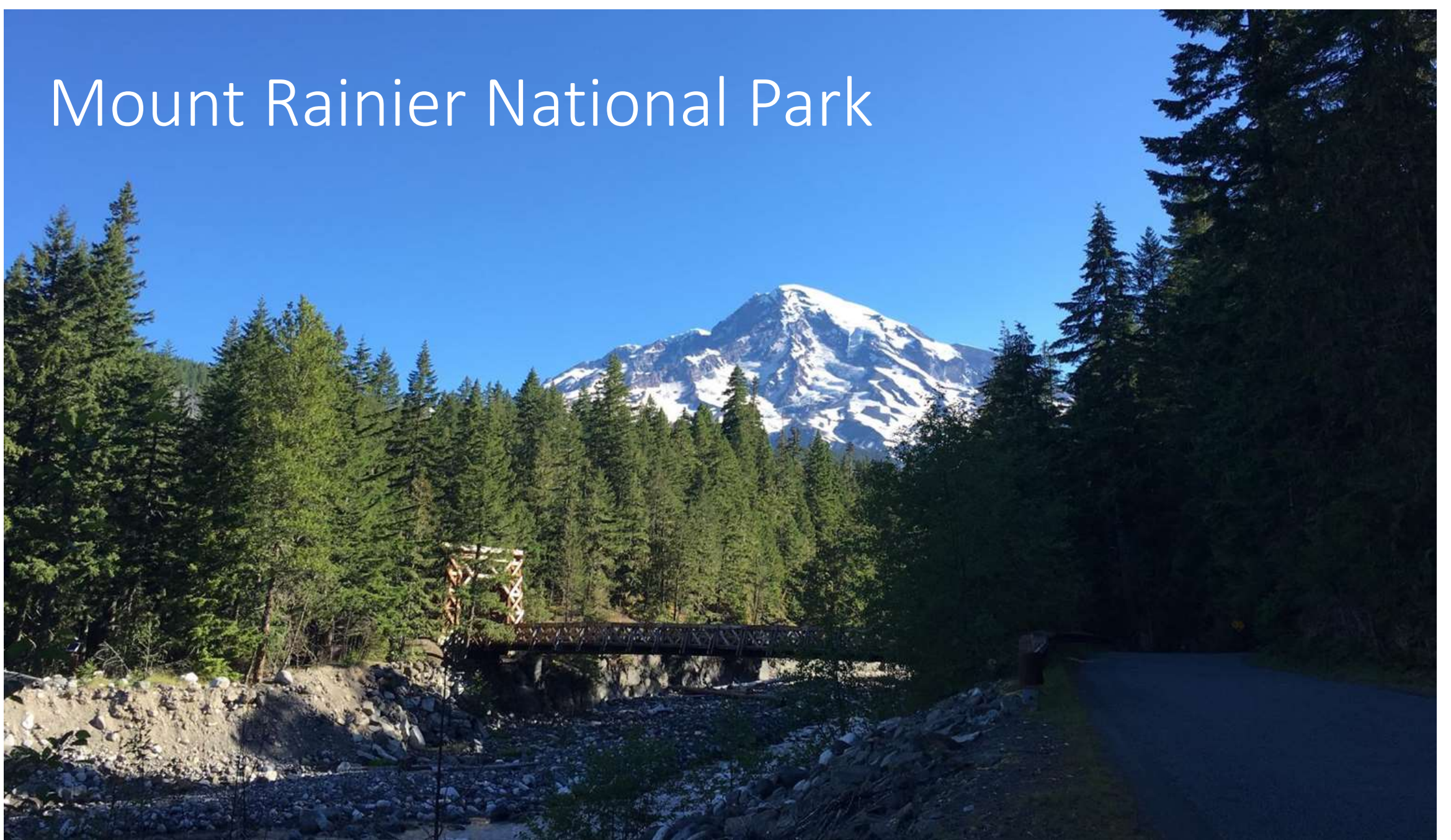
Species richness



Tree vs. Understory



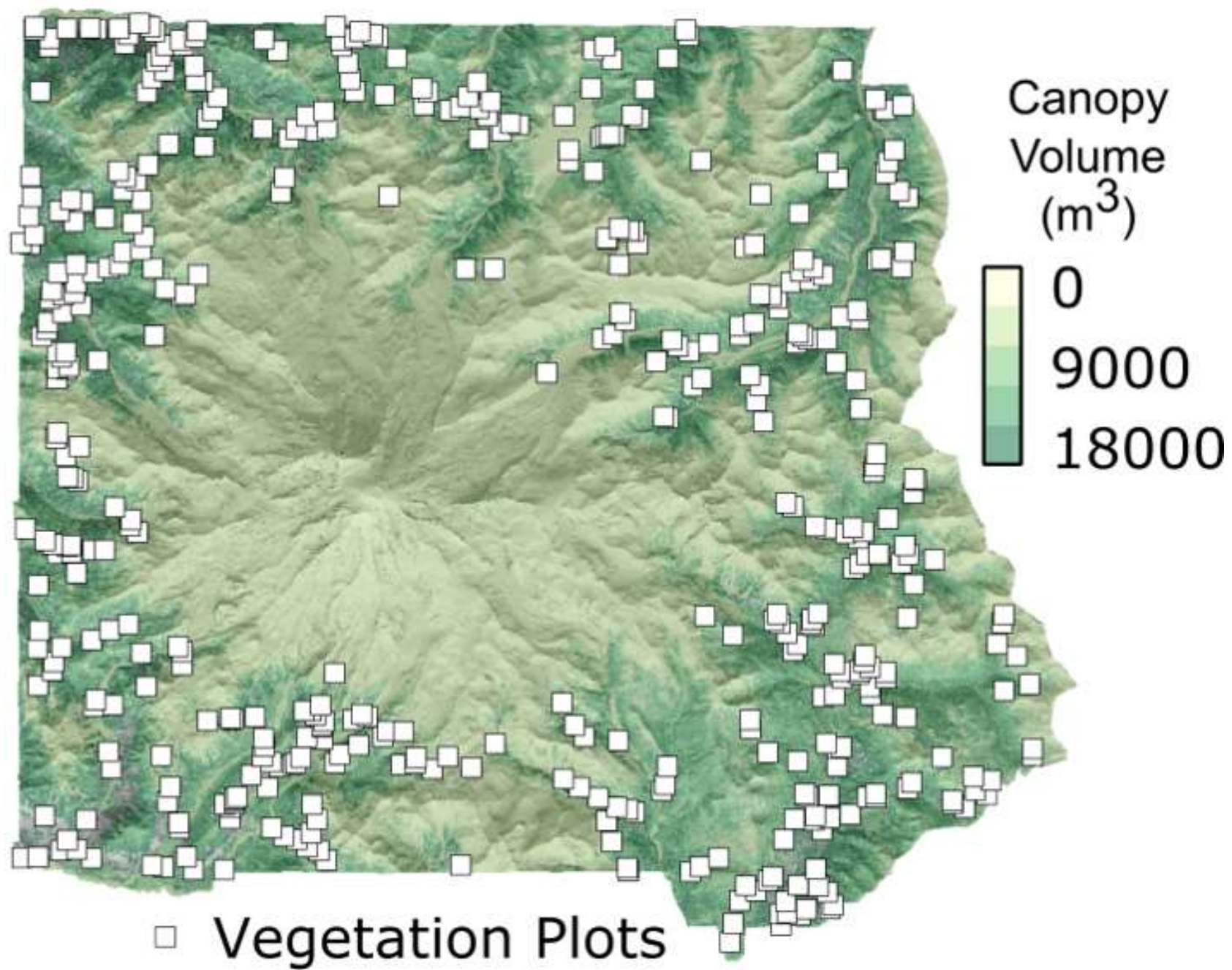
Mount Rainier National Park



THE FOREST
COMMUNITIES
OF MOUNT RAINIER
NATIONAL PARK



JERRY F. FRANKLIN
WILLIAM H. MOIR MILES A. HEMSTROM
SARAH E. GREENE BRADLEY G. SMITH

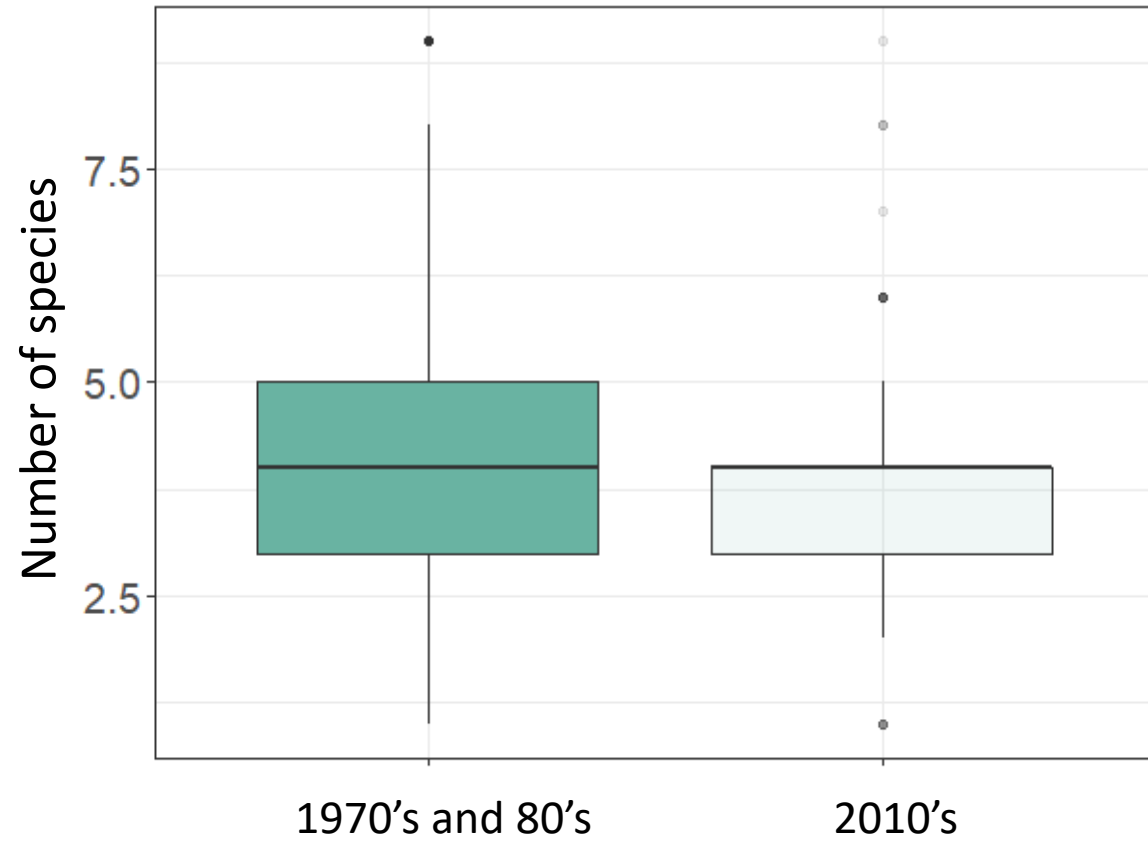




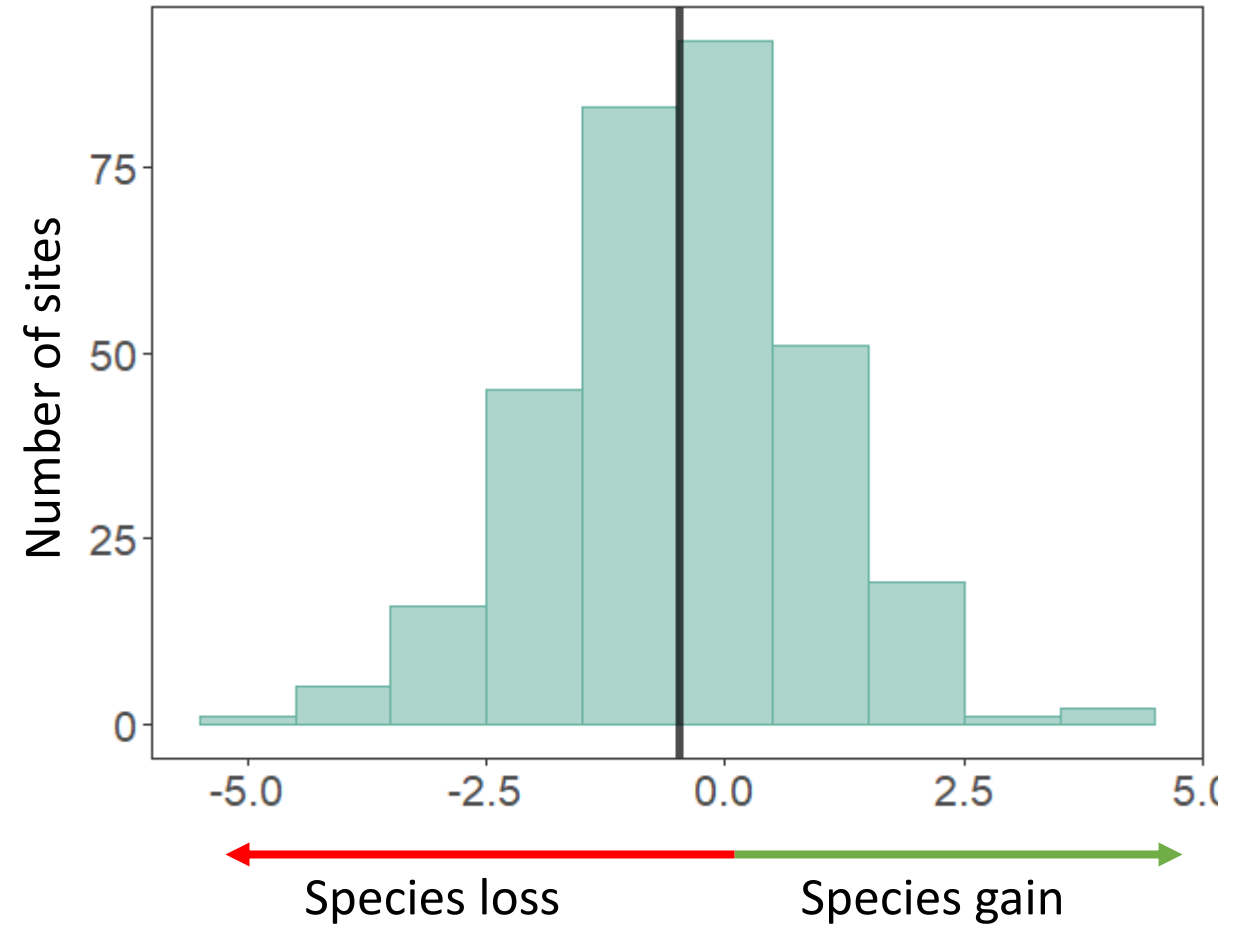
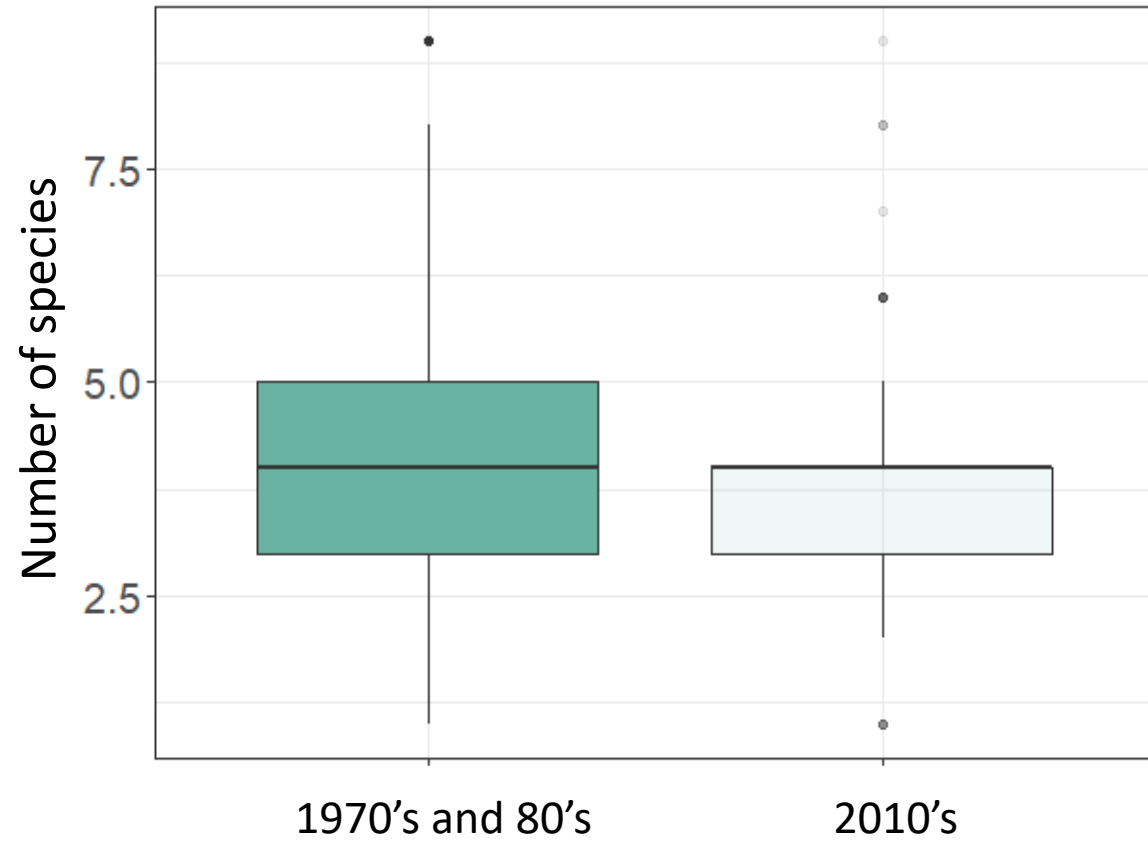




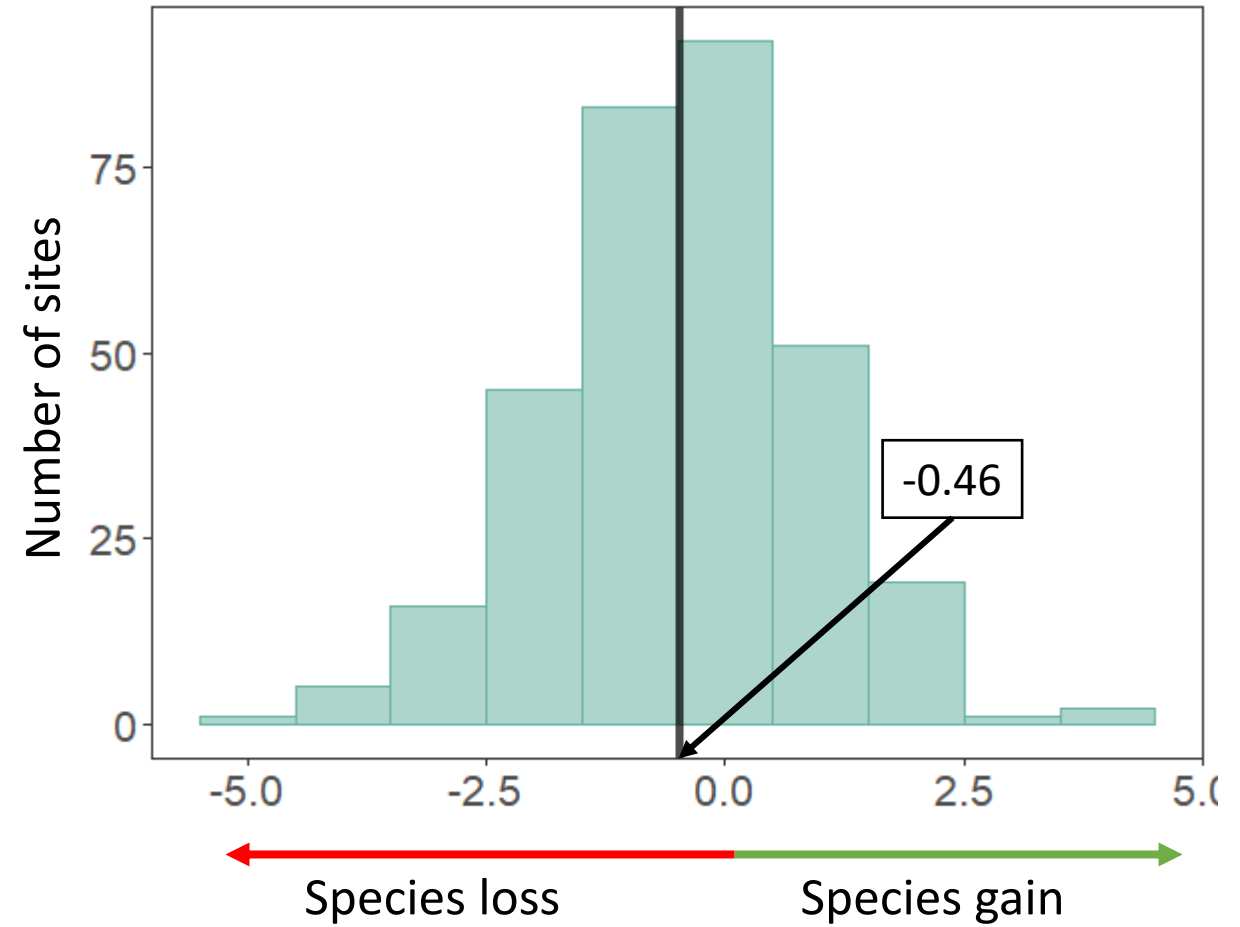
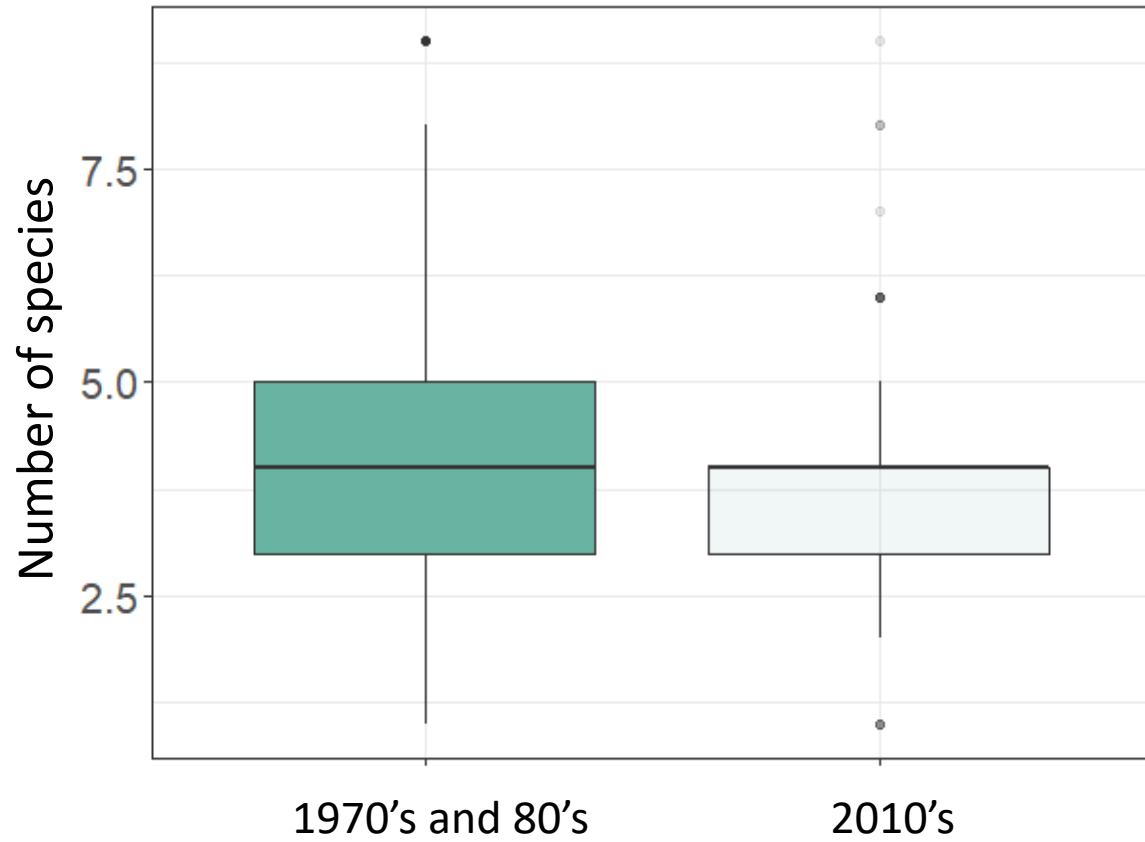
Species richness - Trees



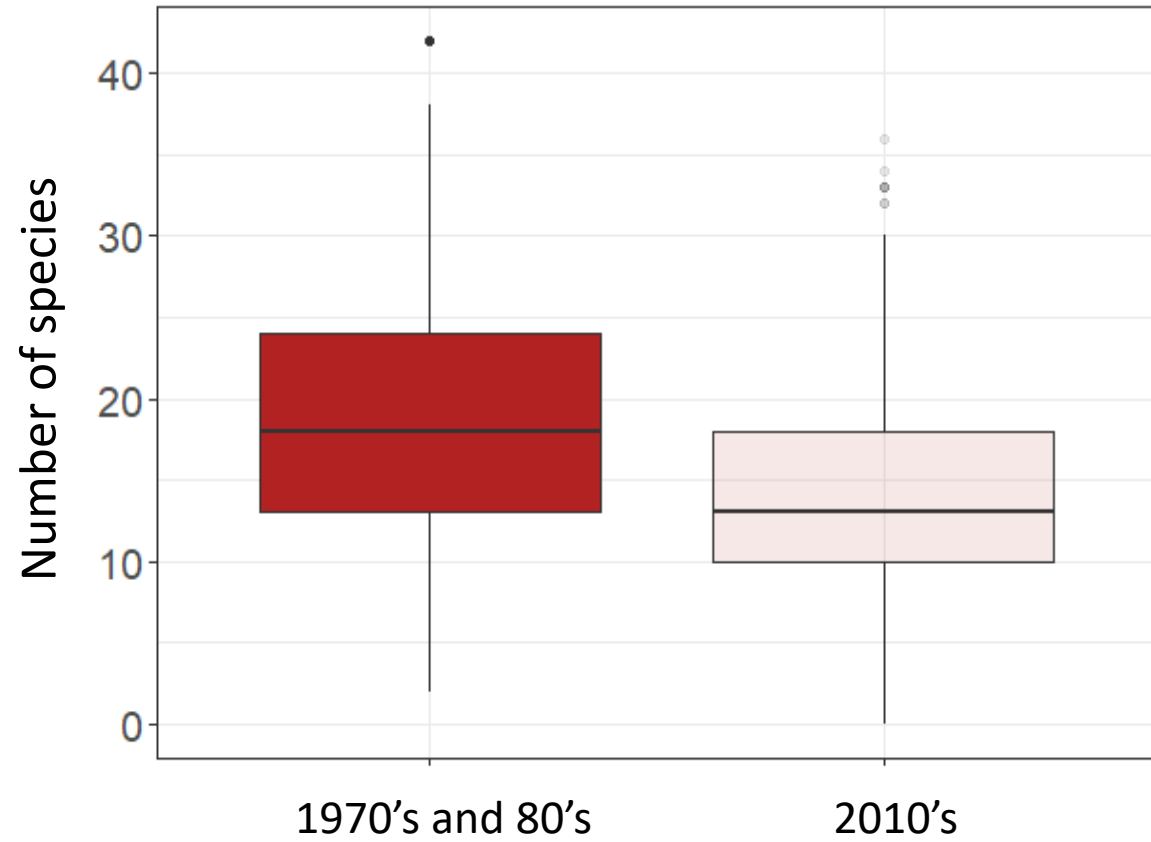
Species richness - Trees



Species richness - Trees

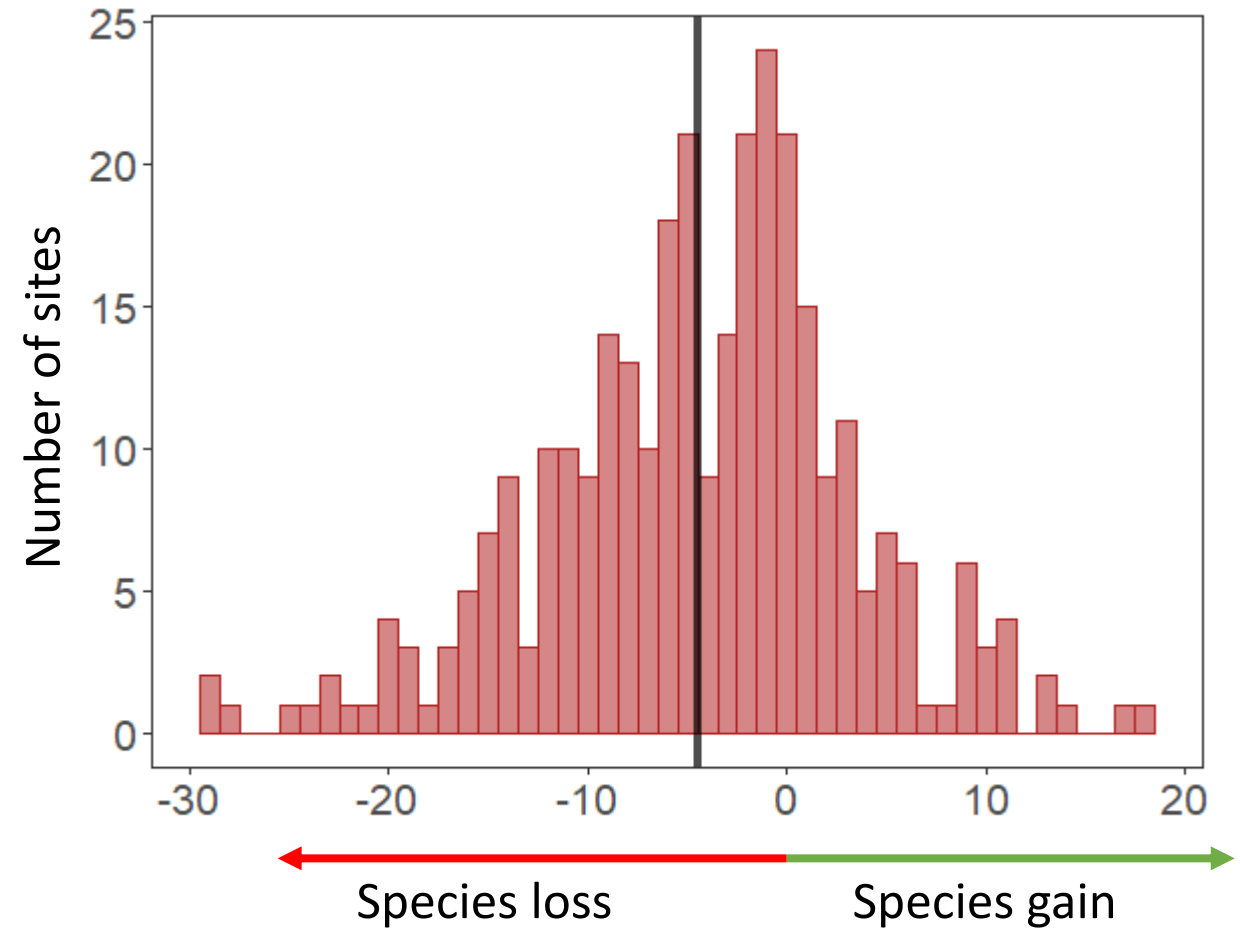
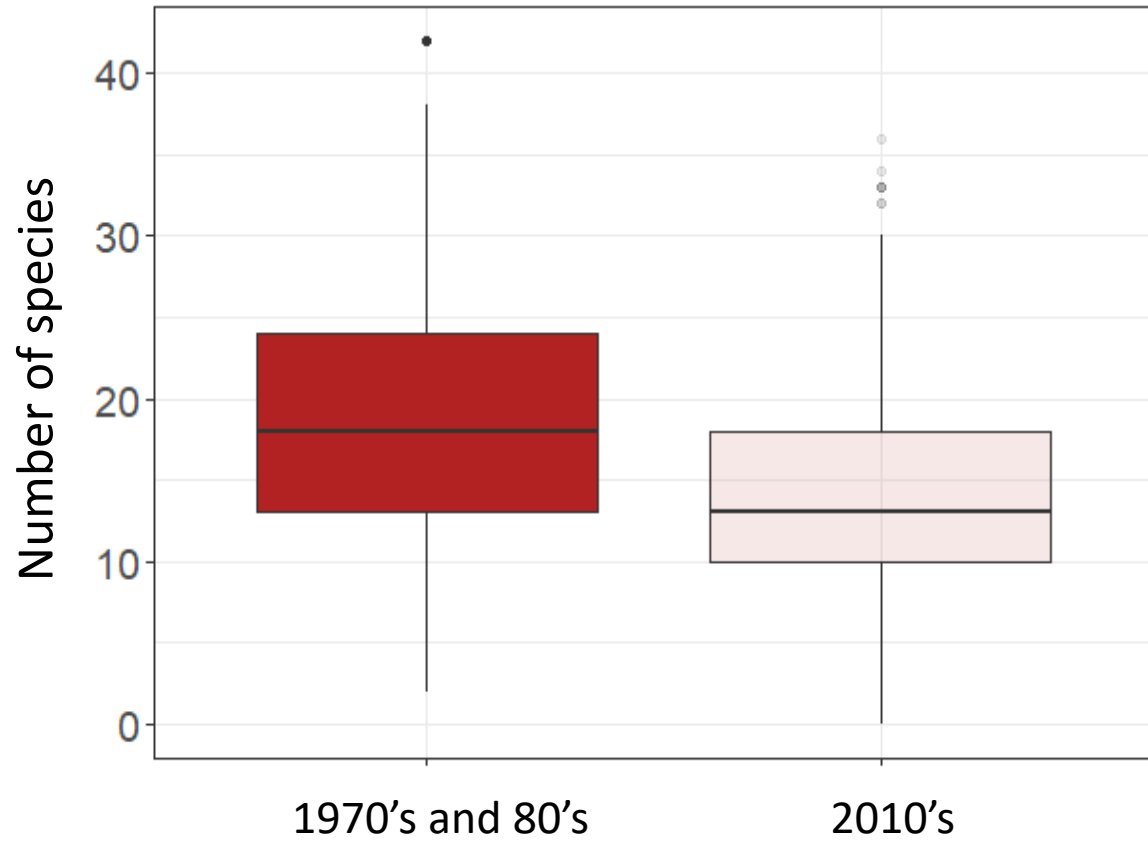


Species richness - Understory



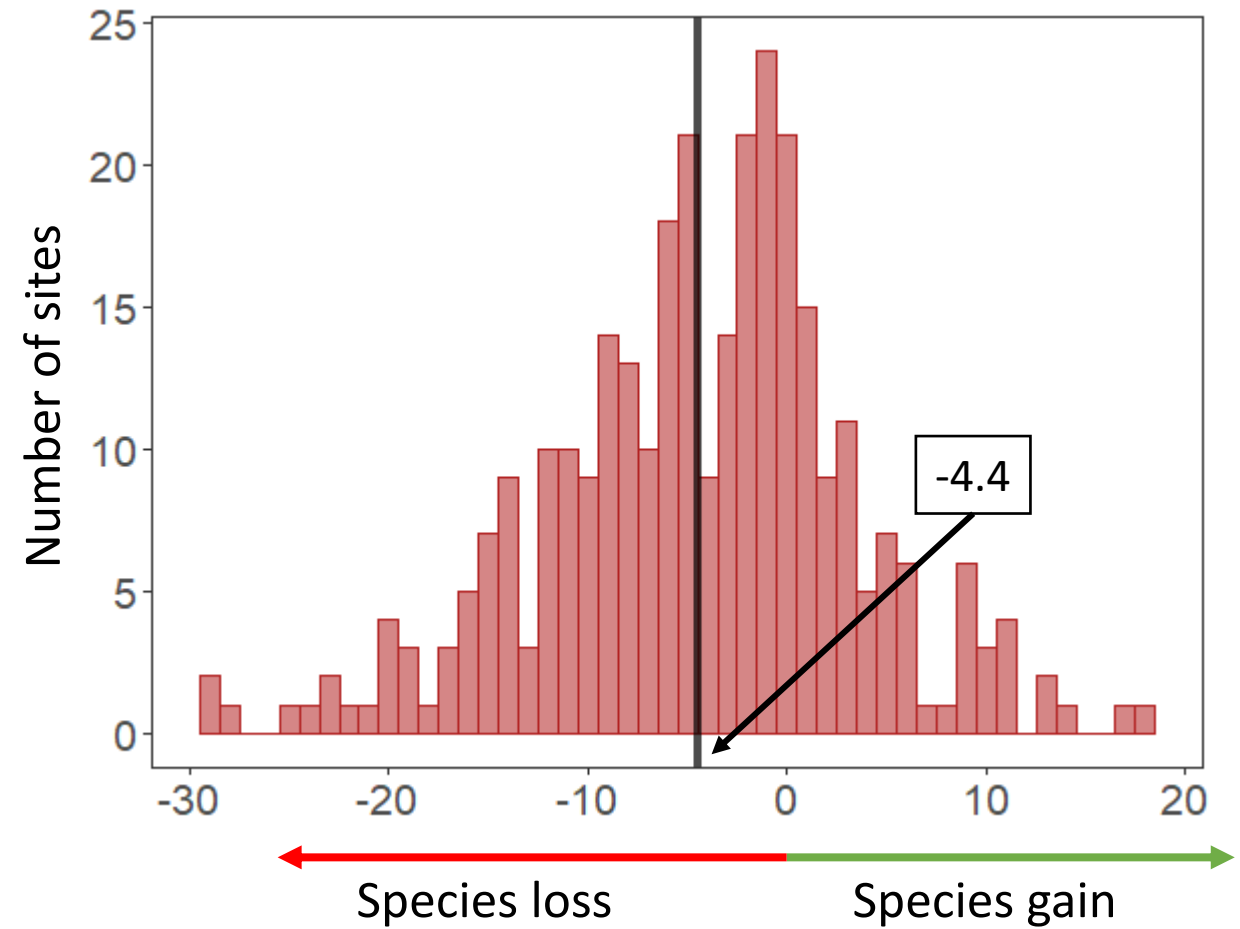
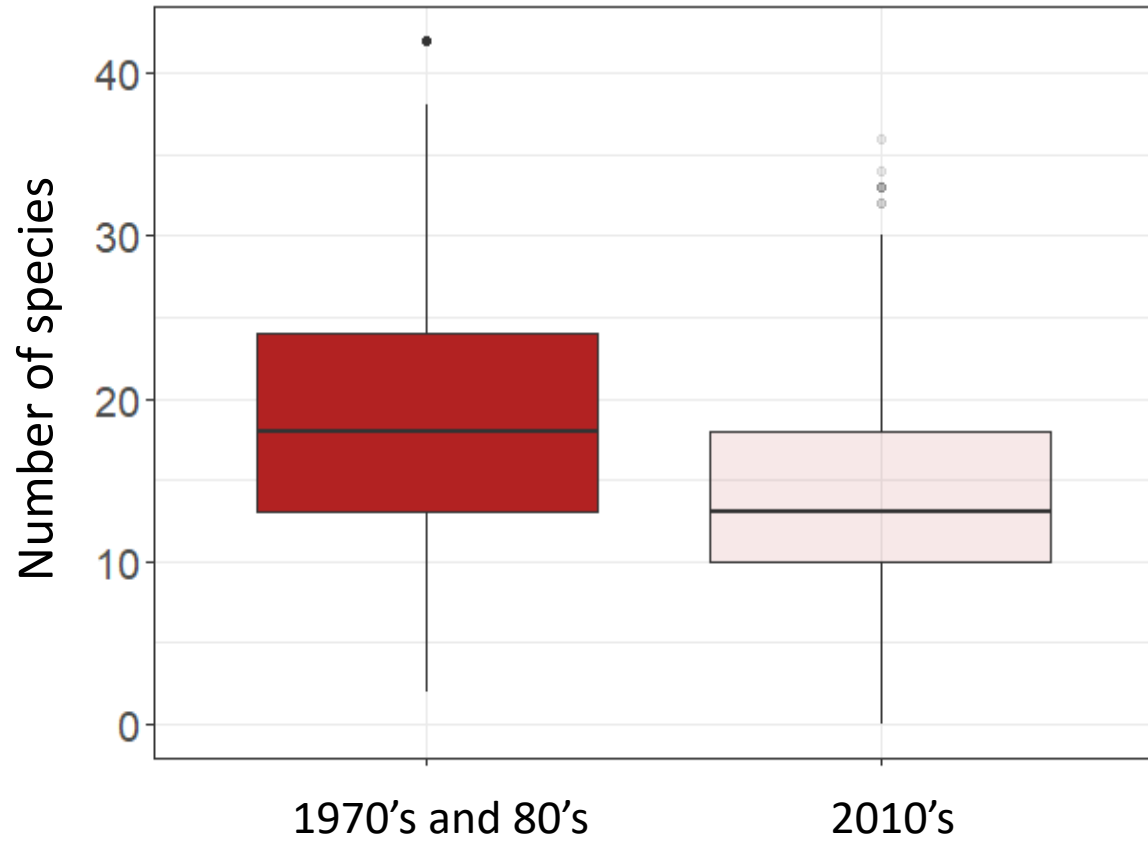


Species richness - Understory





Species richness - Understory



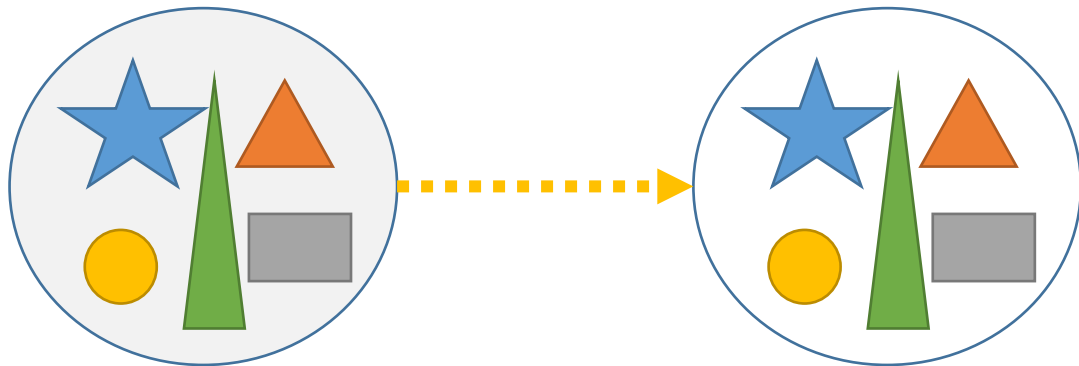
How are communities responding to climate?

Community turnover



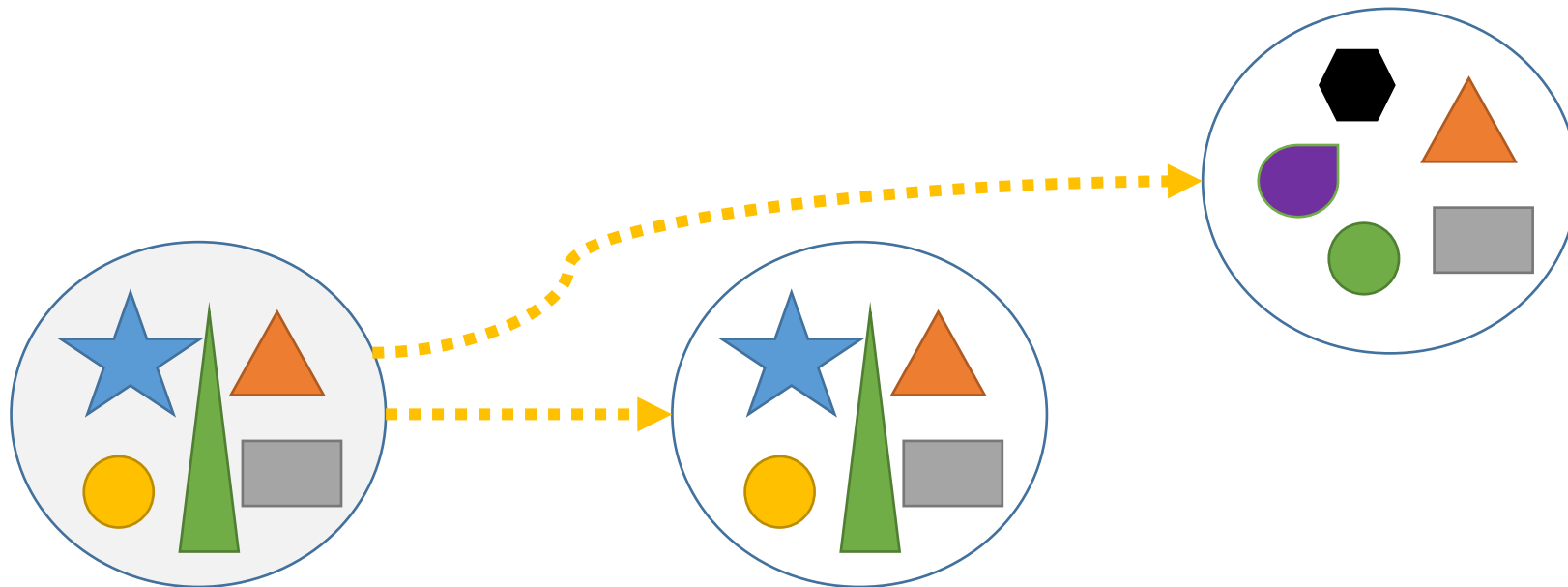
How are communities responding to climate?

Increasing community turnover



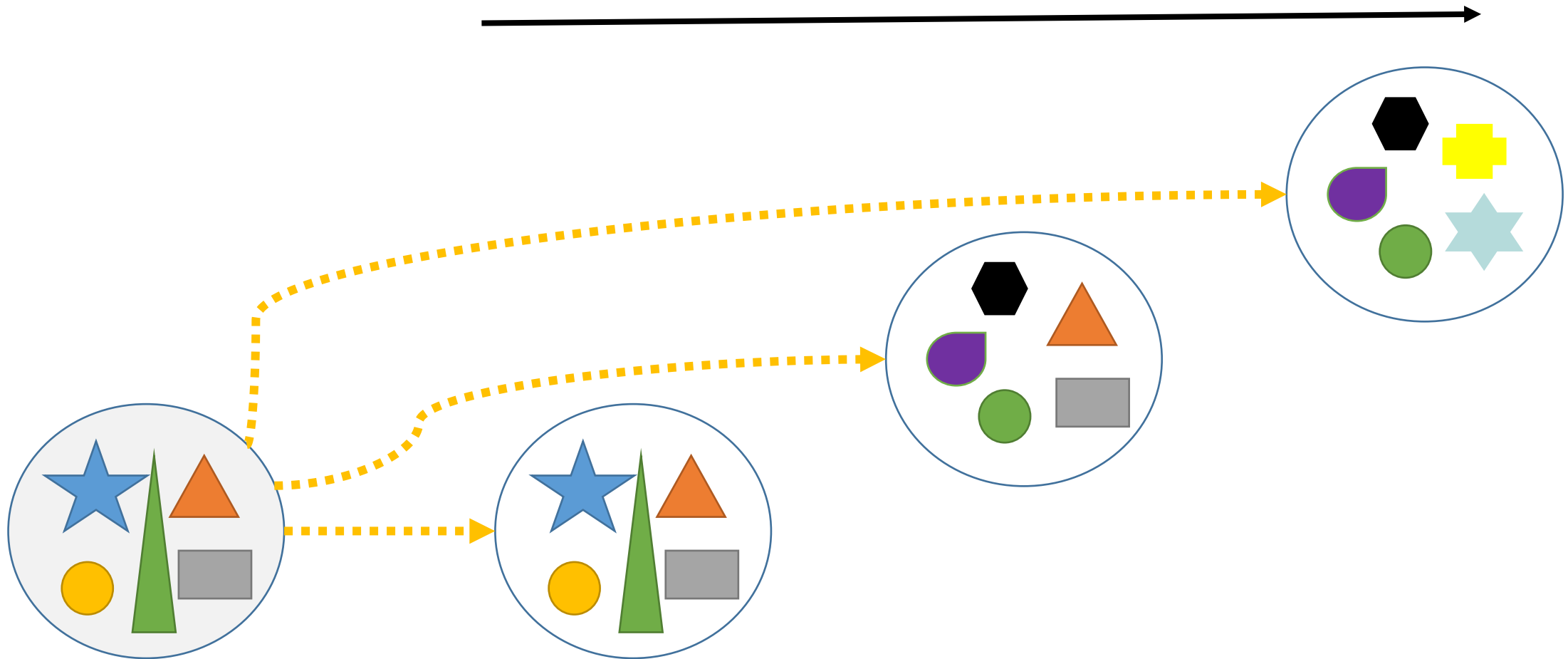
How are communities responding to climate?

Increasing community turnover



How are communities responding to climate?

Increasing community turnover



How are communities responding to climate?

Increasing community turnover



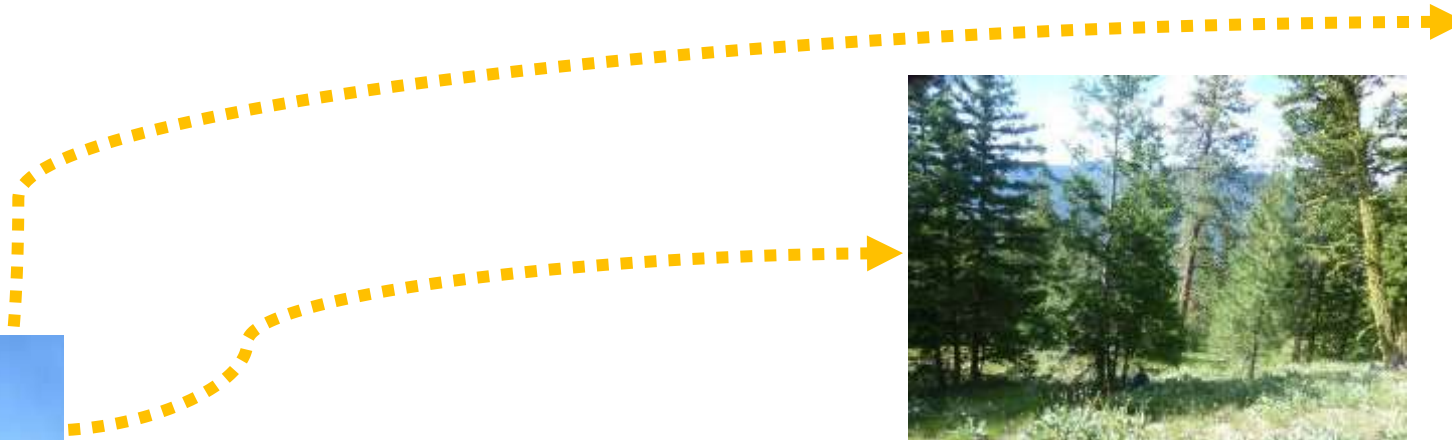
How are communities responding to climate?

Increasing community turnover

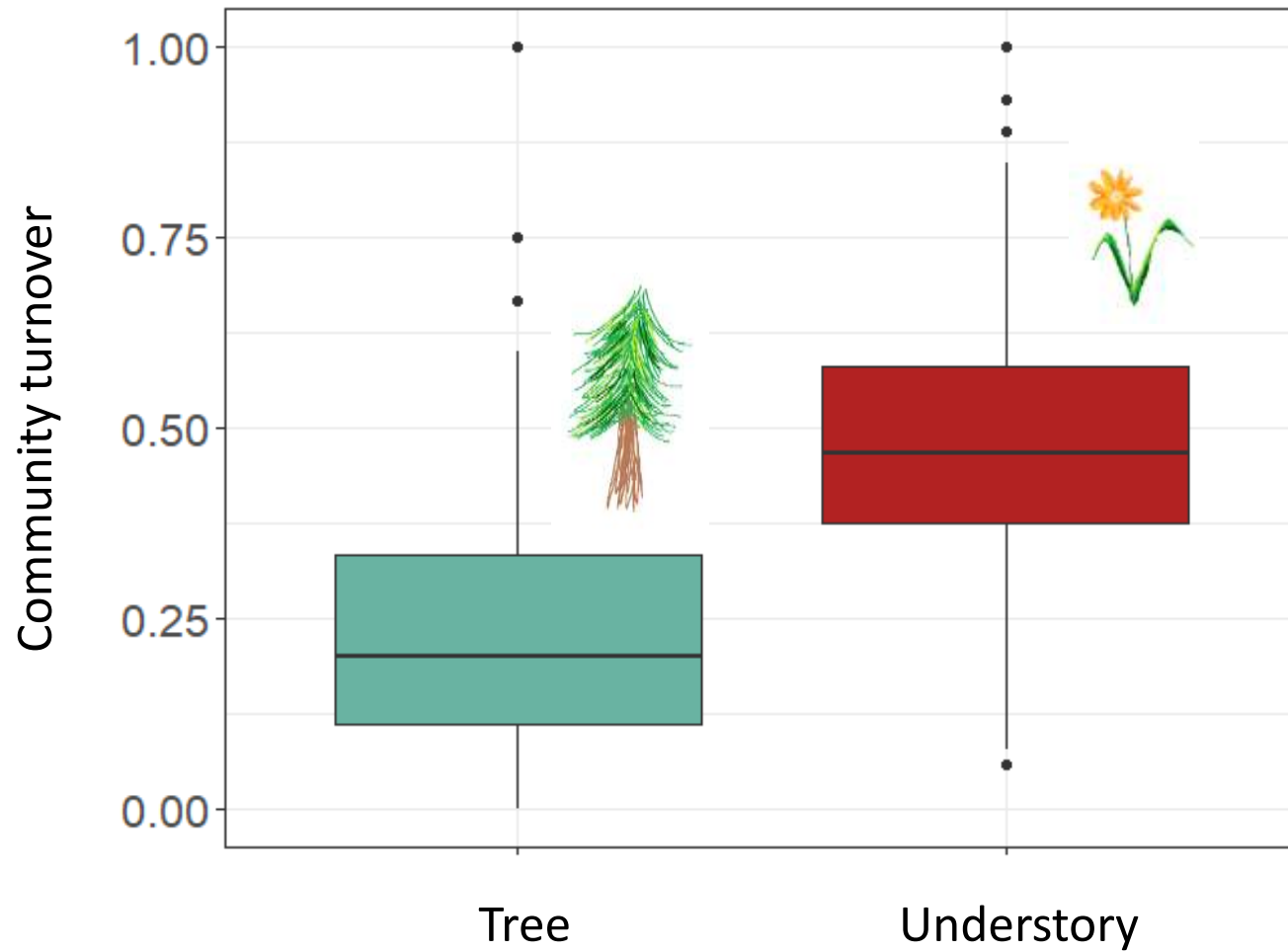


How are communities responding to climate?

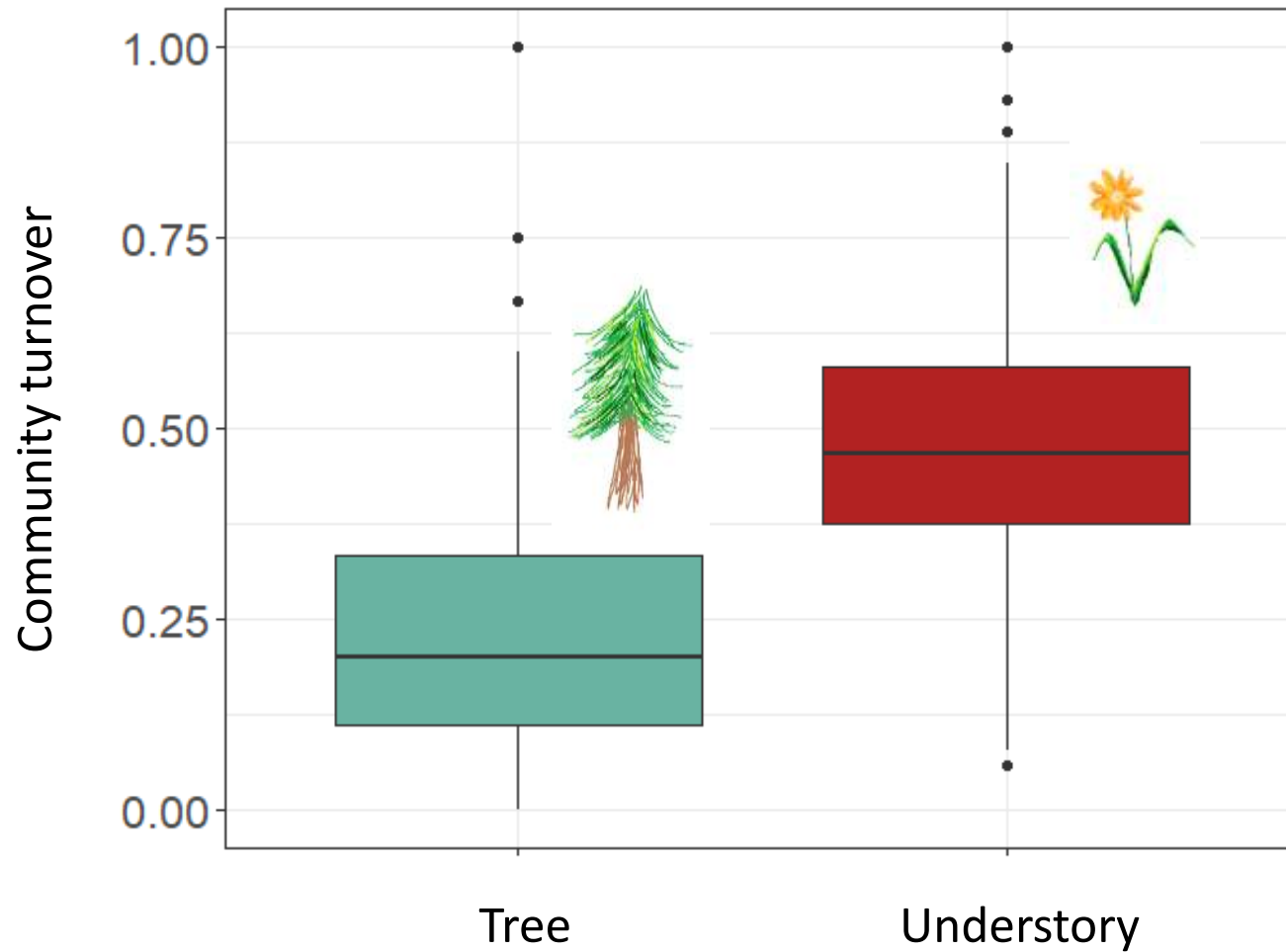
Increasing community turnover



Turnover across time

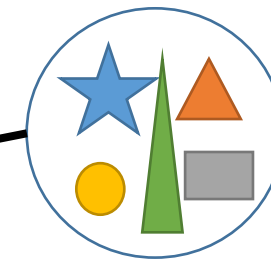
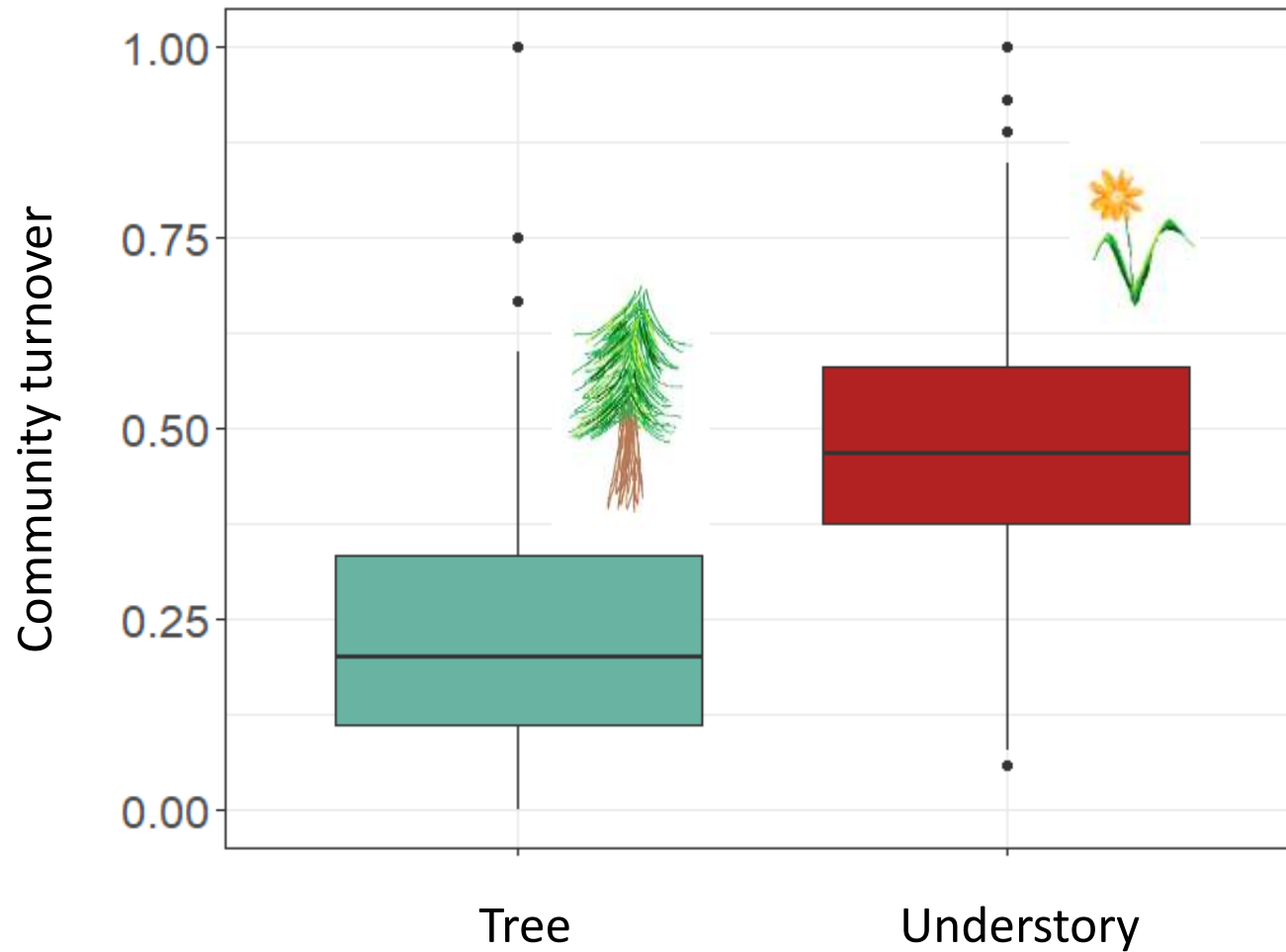


Turnover across time



Legacy
Community

Turnover across time

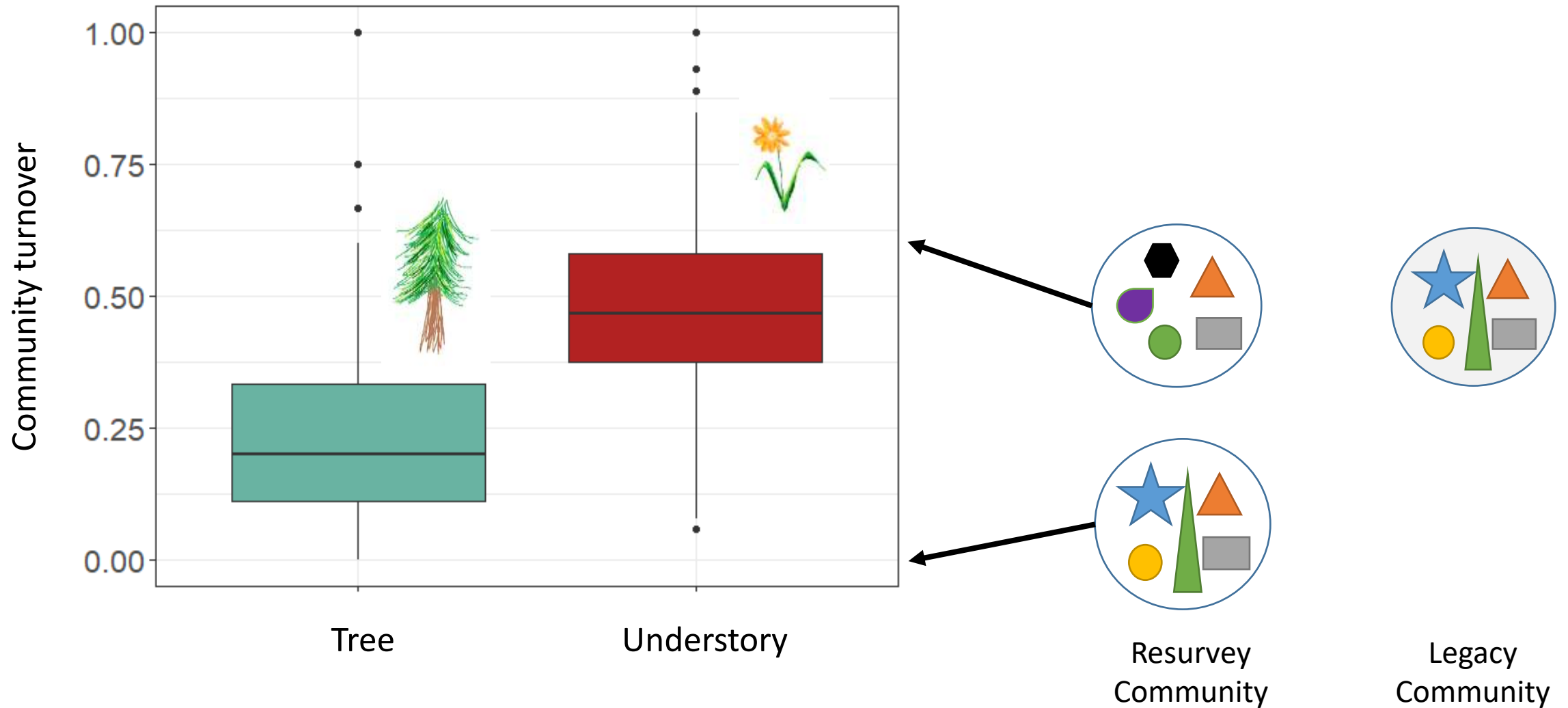


Resurvey
Community

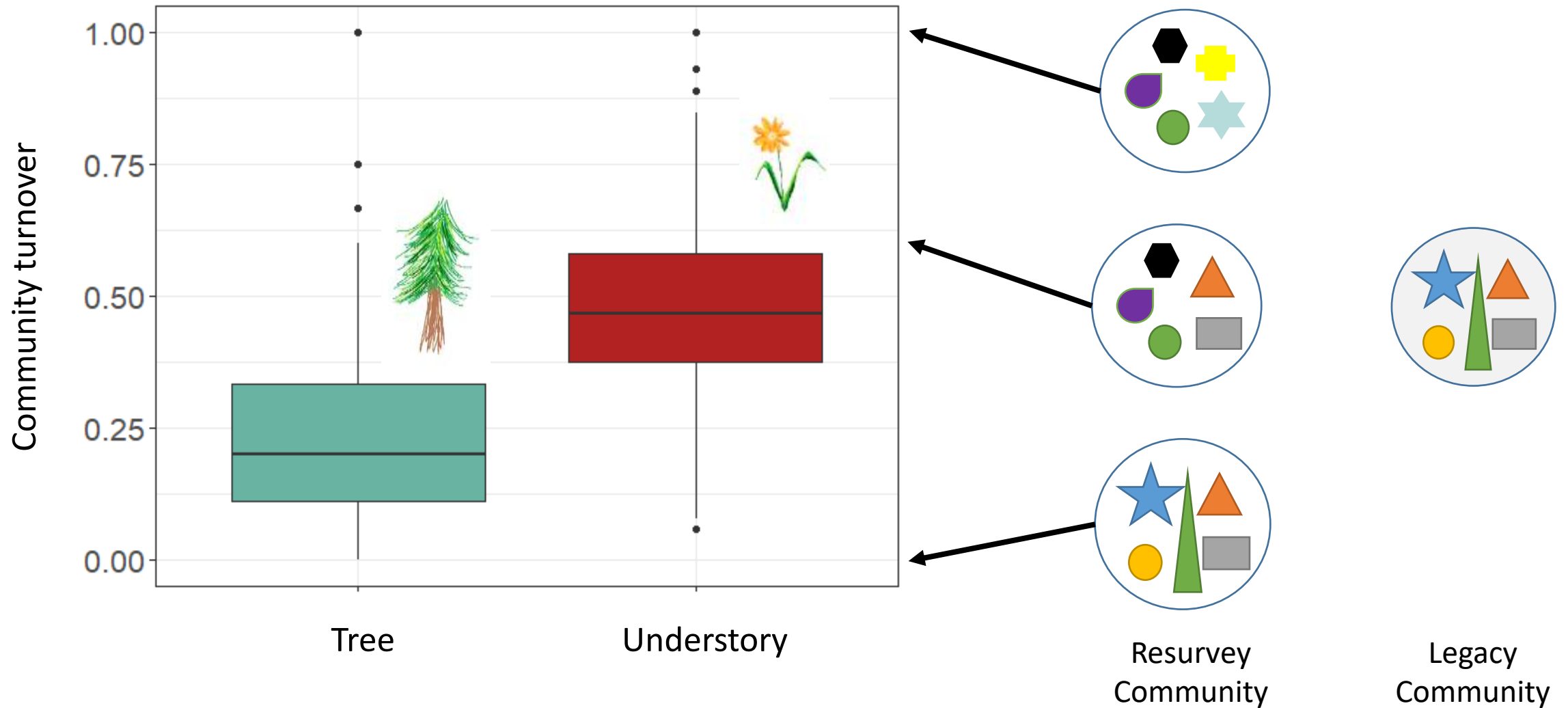


Legacy
Community

Turnover across time



Turnover across time

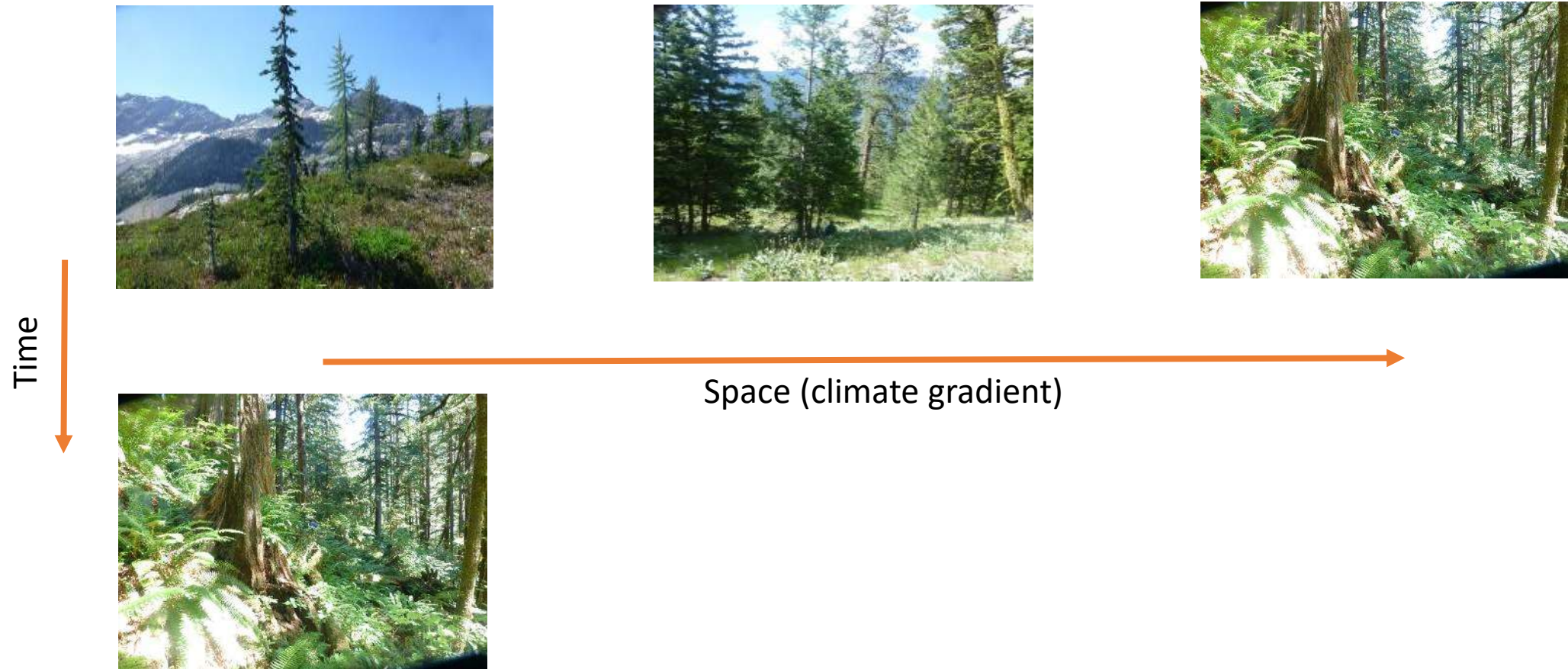


Relationships with climate across space

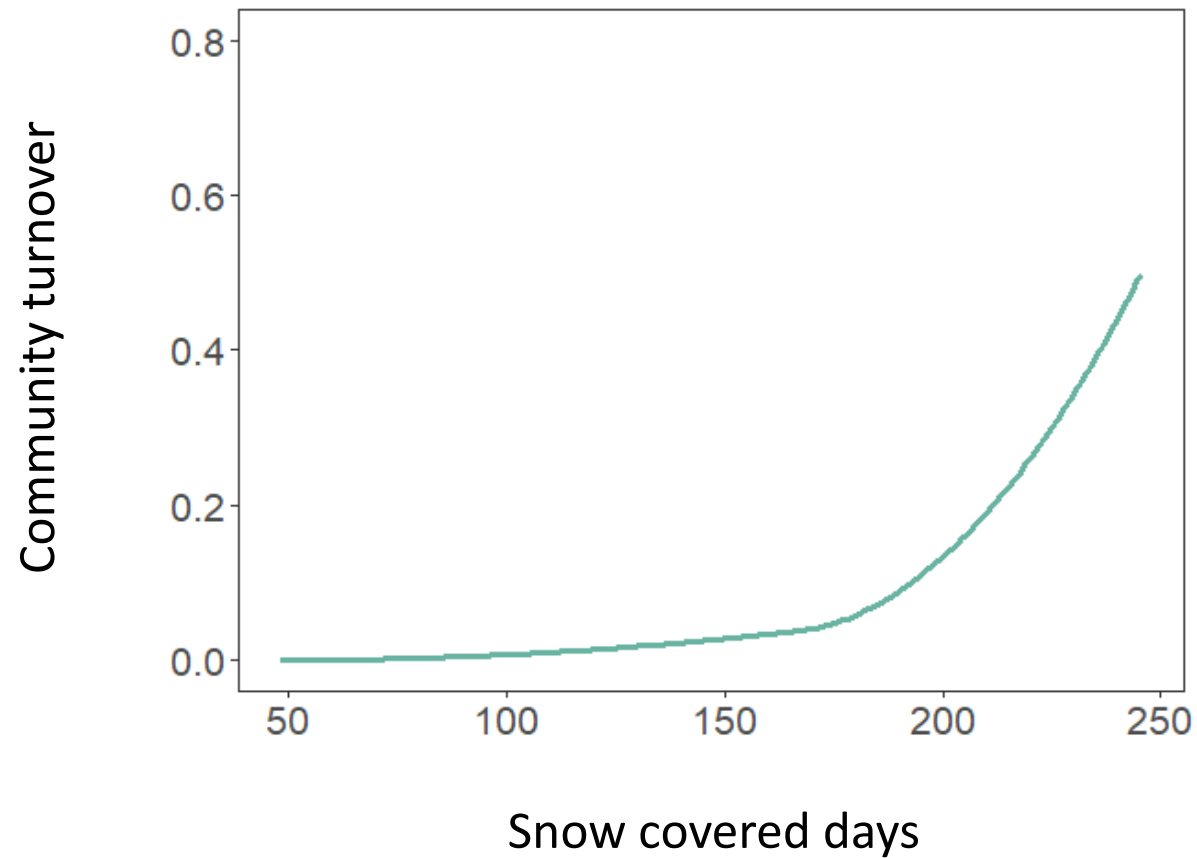
Time



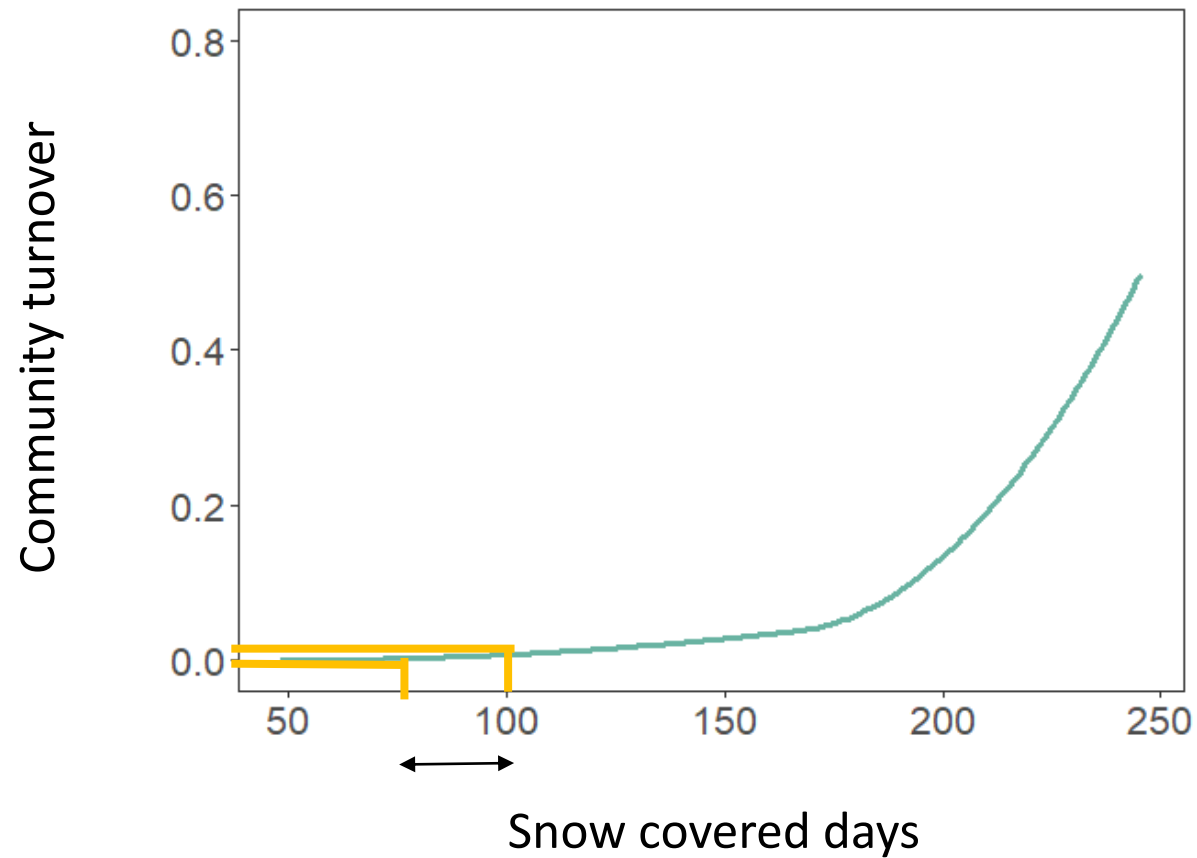
Relationships with climate across space



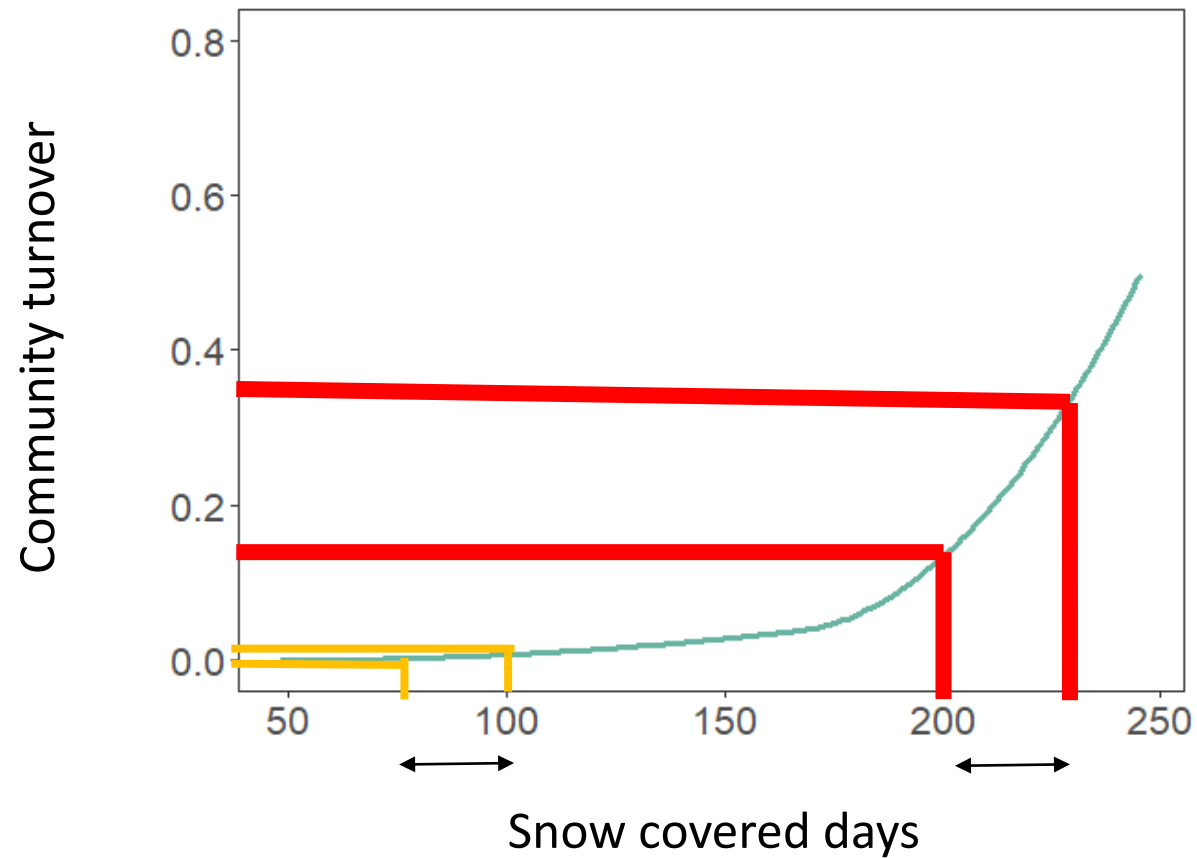
Relationships with climate across space



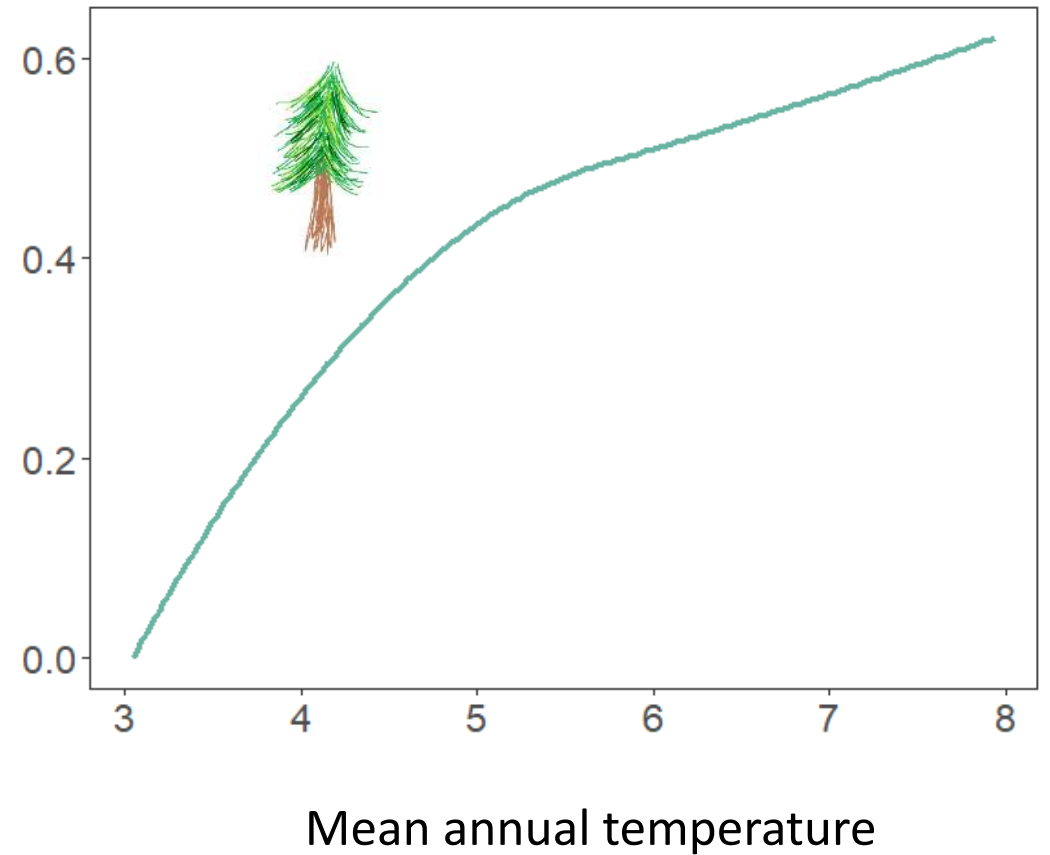
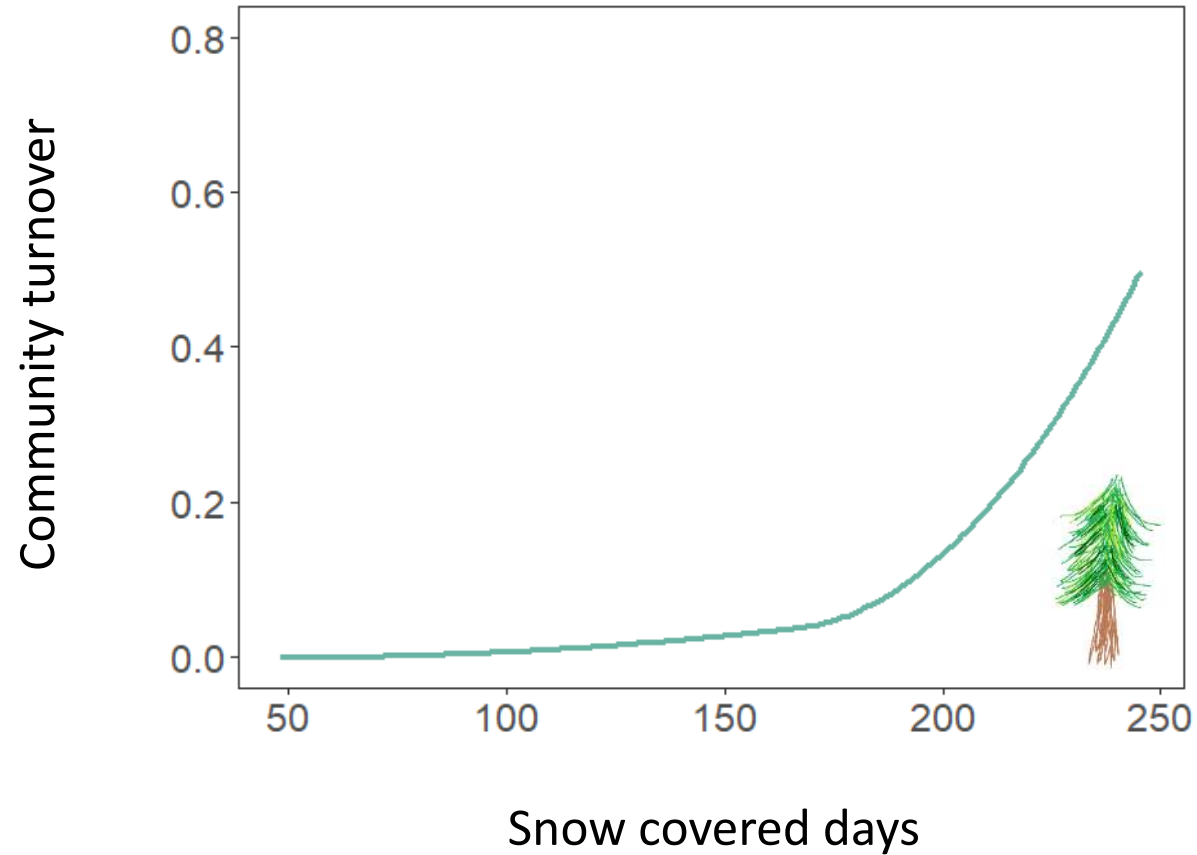
Relationships with climate across space



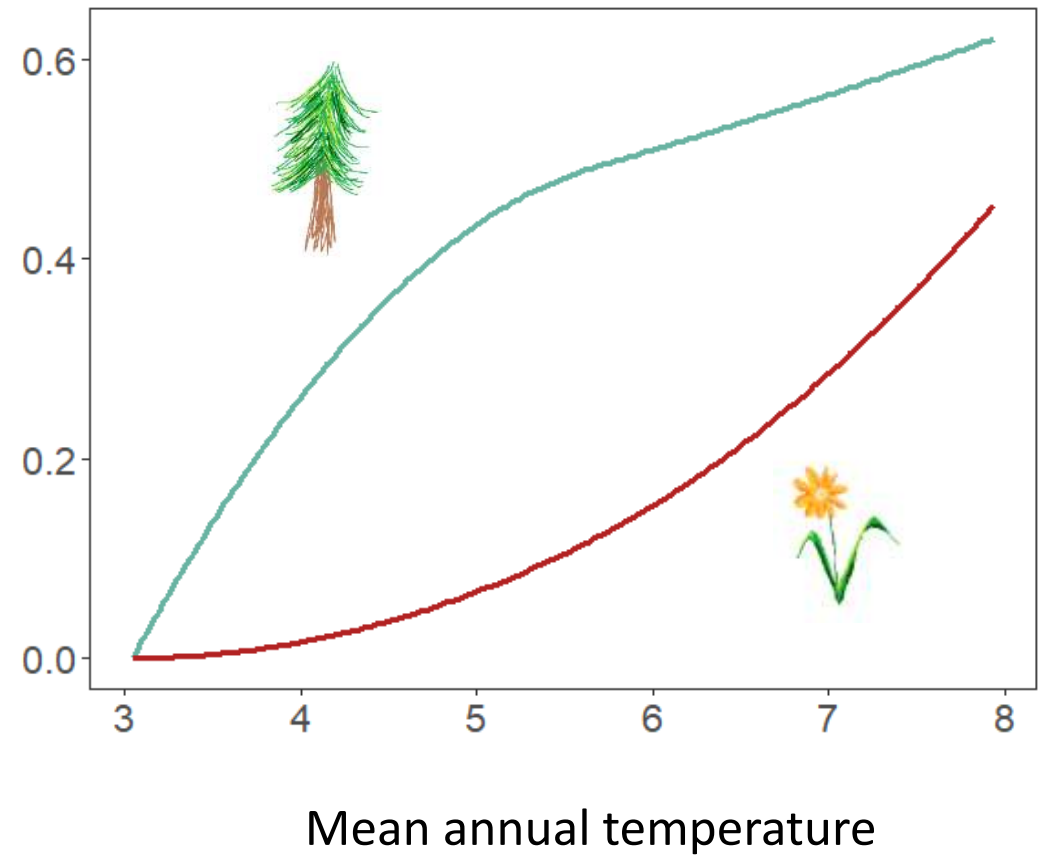
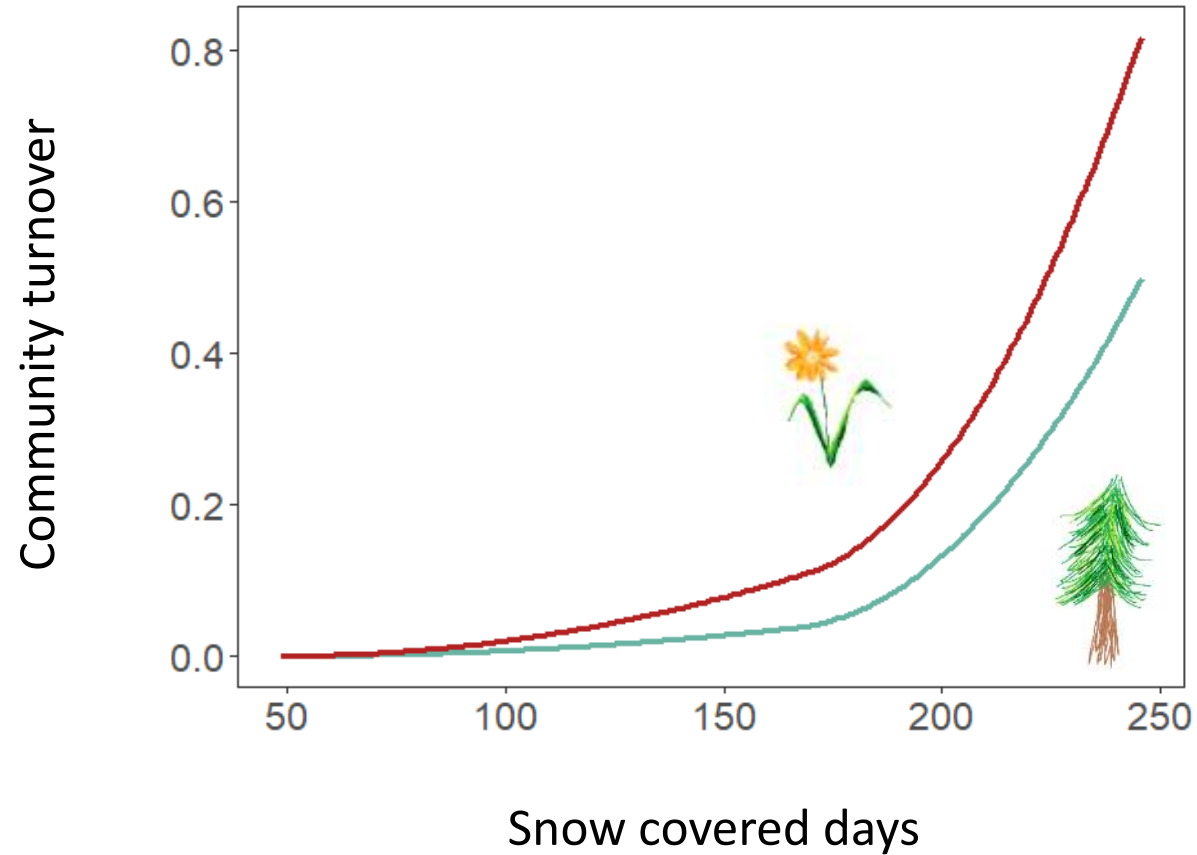
Relationships with climate across space



Relationships with climate across space

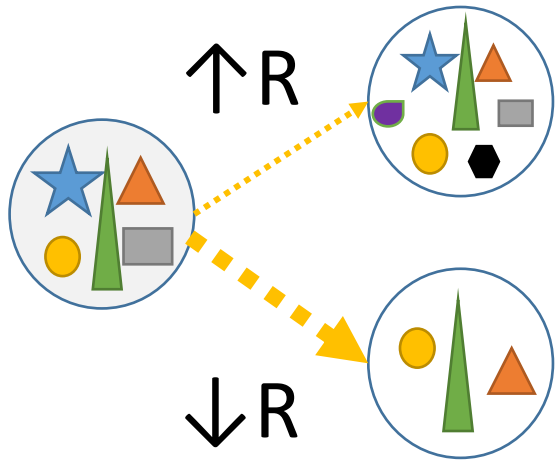


Relationships with climate across space



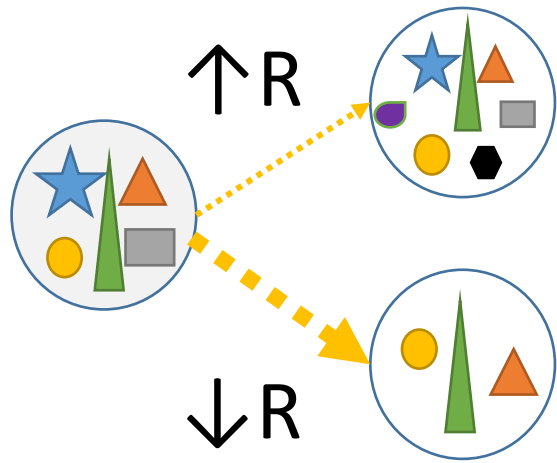
What do we now know?

Species richness

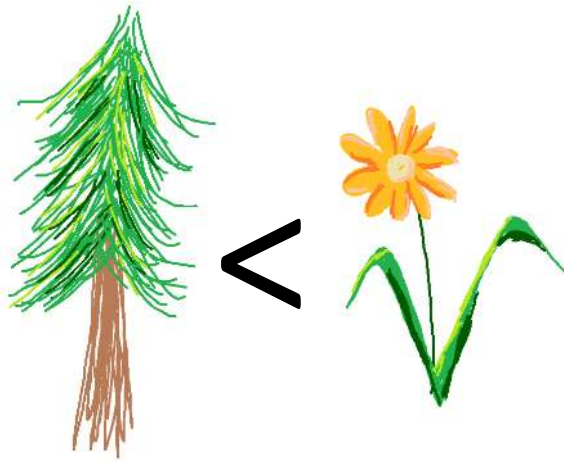


What do we now know?

Species richness

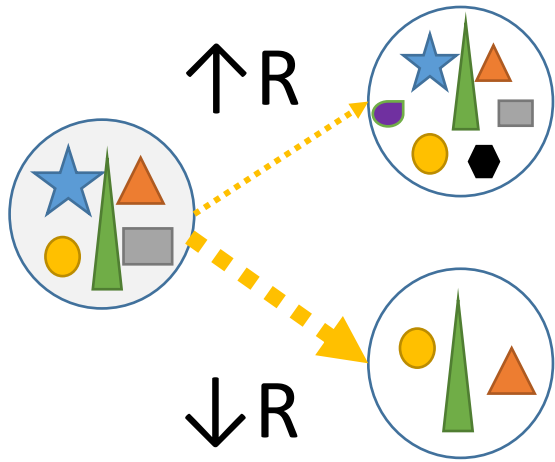


Community turnover

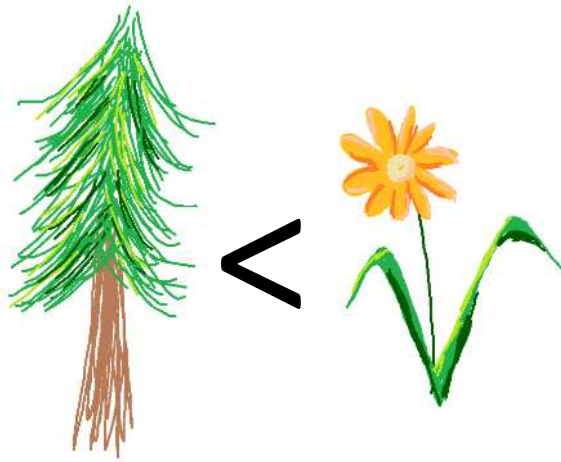


What do we now know?

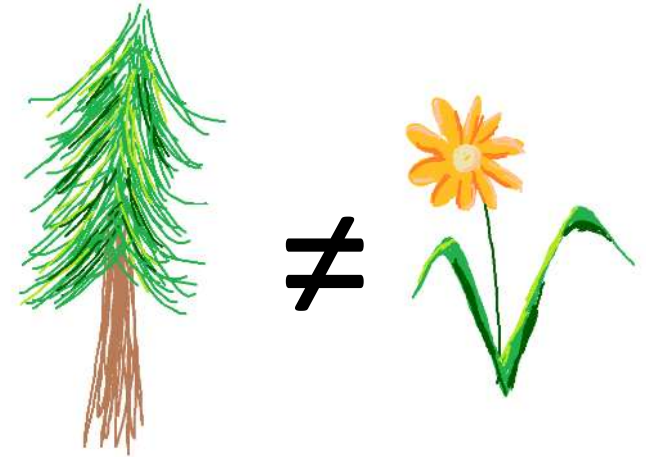
Species richness



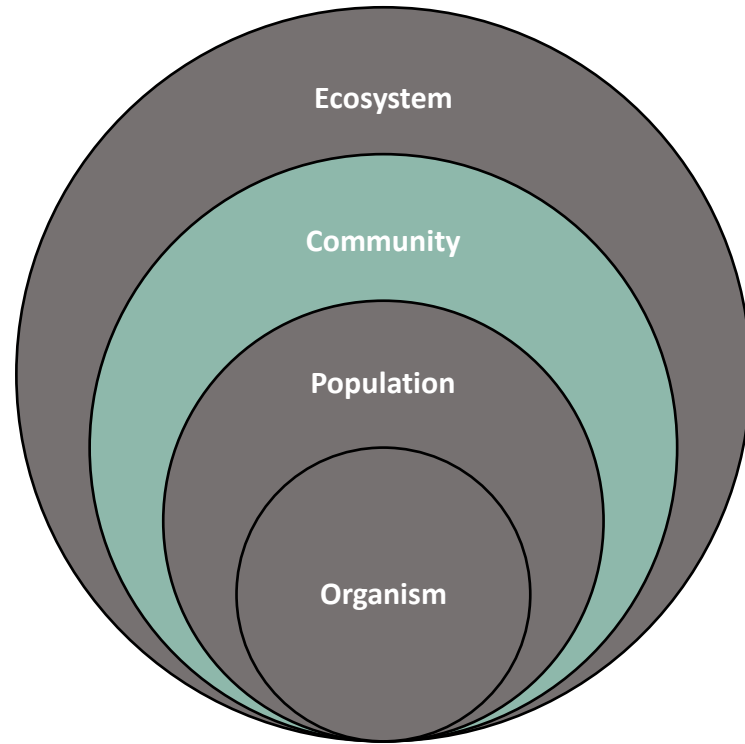
Community turnover



Community-climate relationships



What do we now know?

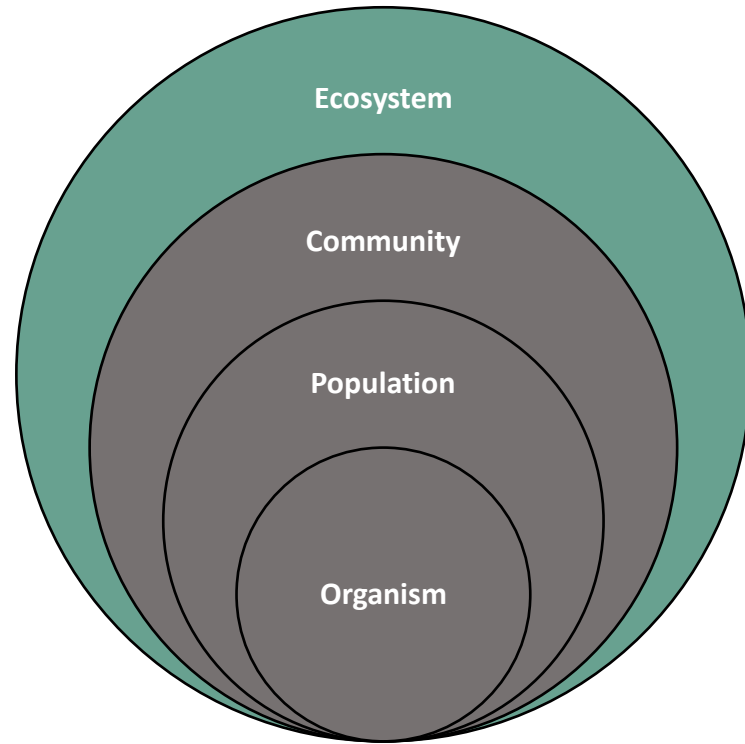


Potential for community reorganization

Future work



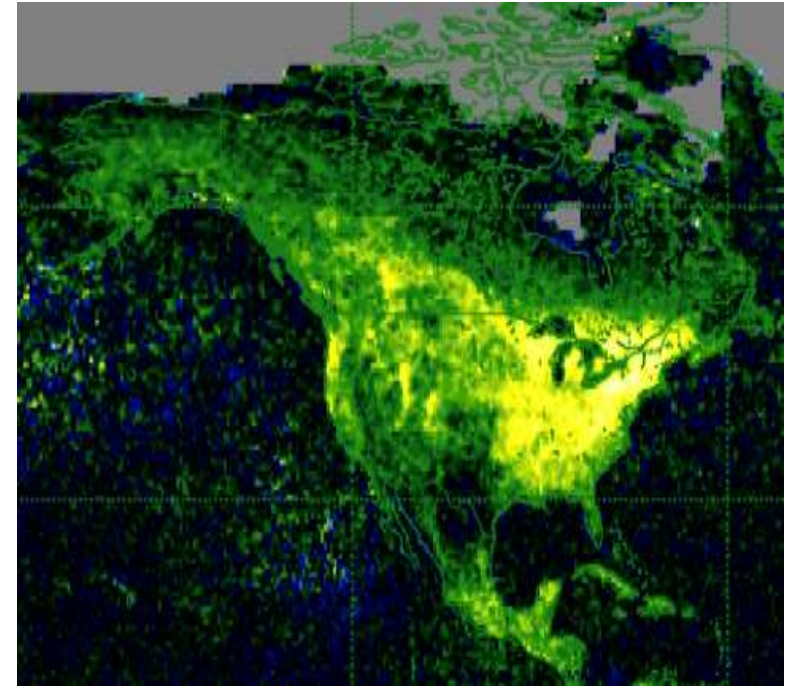
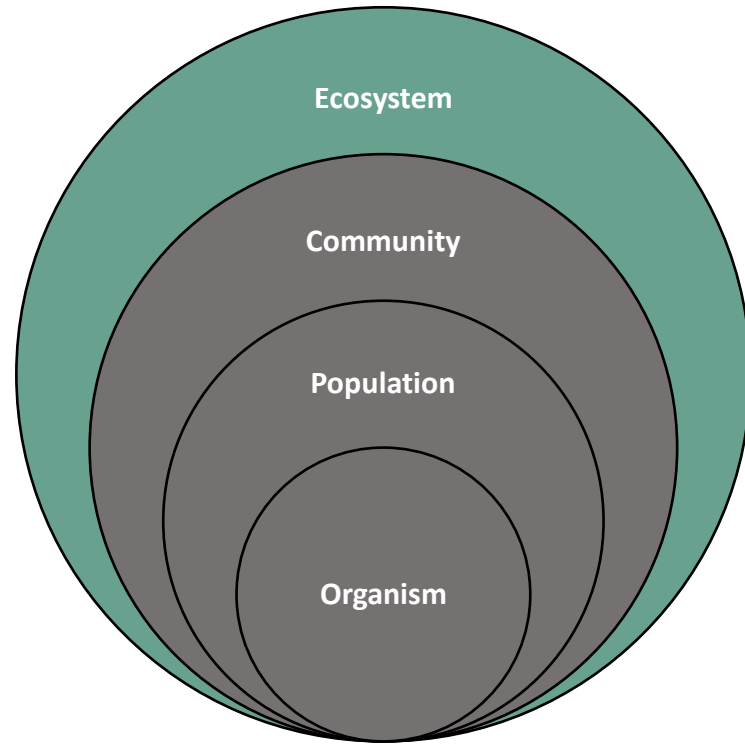
Trait data collection



Future work



Trait data collection



Satellite derived productivity

Thank you



Janneke Hille Ris Lambers



Amy Angert

Field crew members across the years

Jerry Franklin and colleagues

Catherine Copass (NPS)

Michelle Spicer

Current HRL lab members:

Ruben Manzanedo Jordana Sevigny

Meera Sethi

Samantha Brown

Stuart Graham

Chelsea Brogan

Jiajia Su

Ari Geary-Teeter

Aji John

Ammara Touch

Haleh Mawson

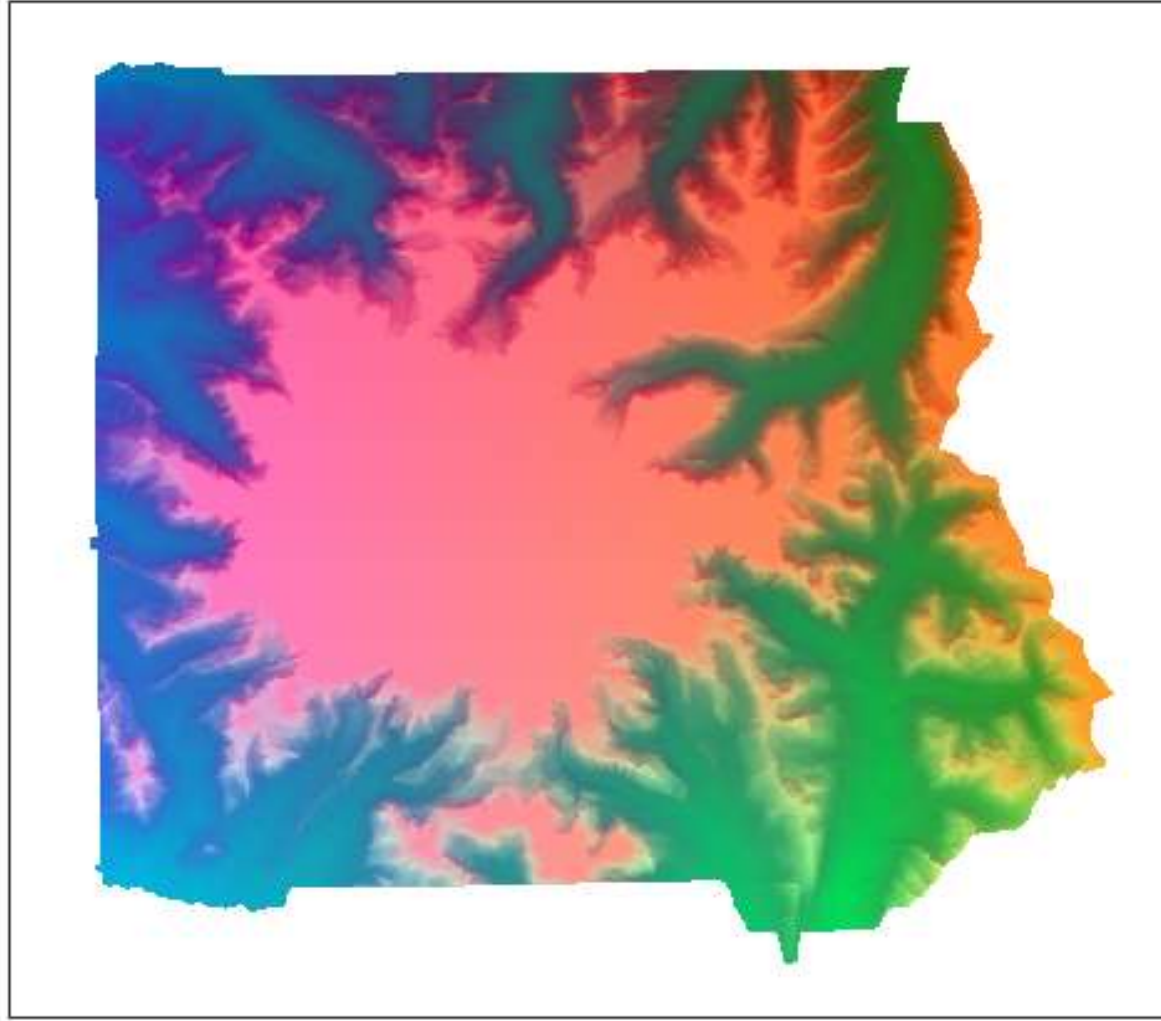




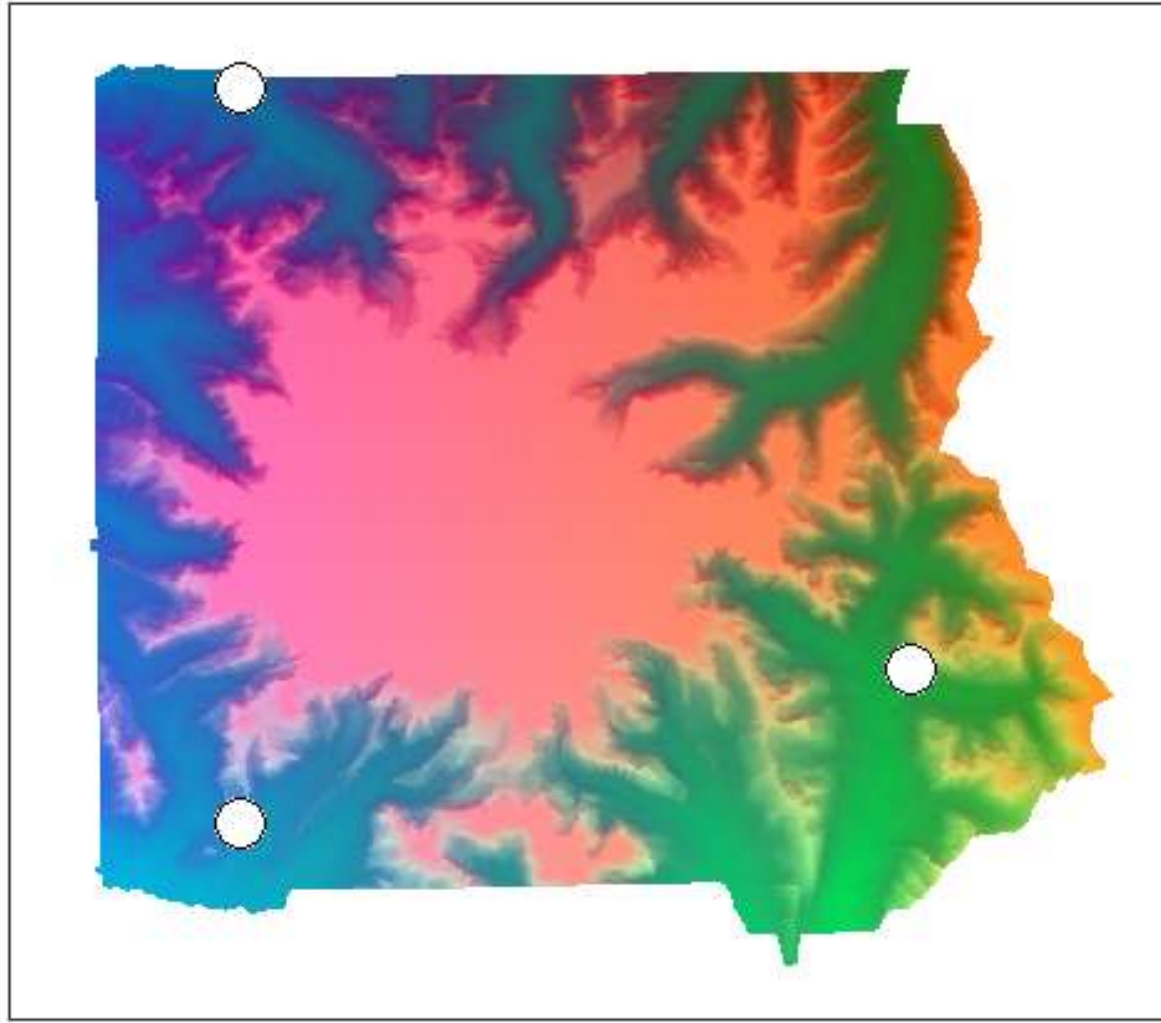
Thank you

Extra slides

Communities across space

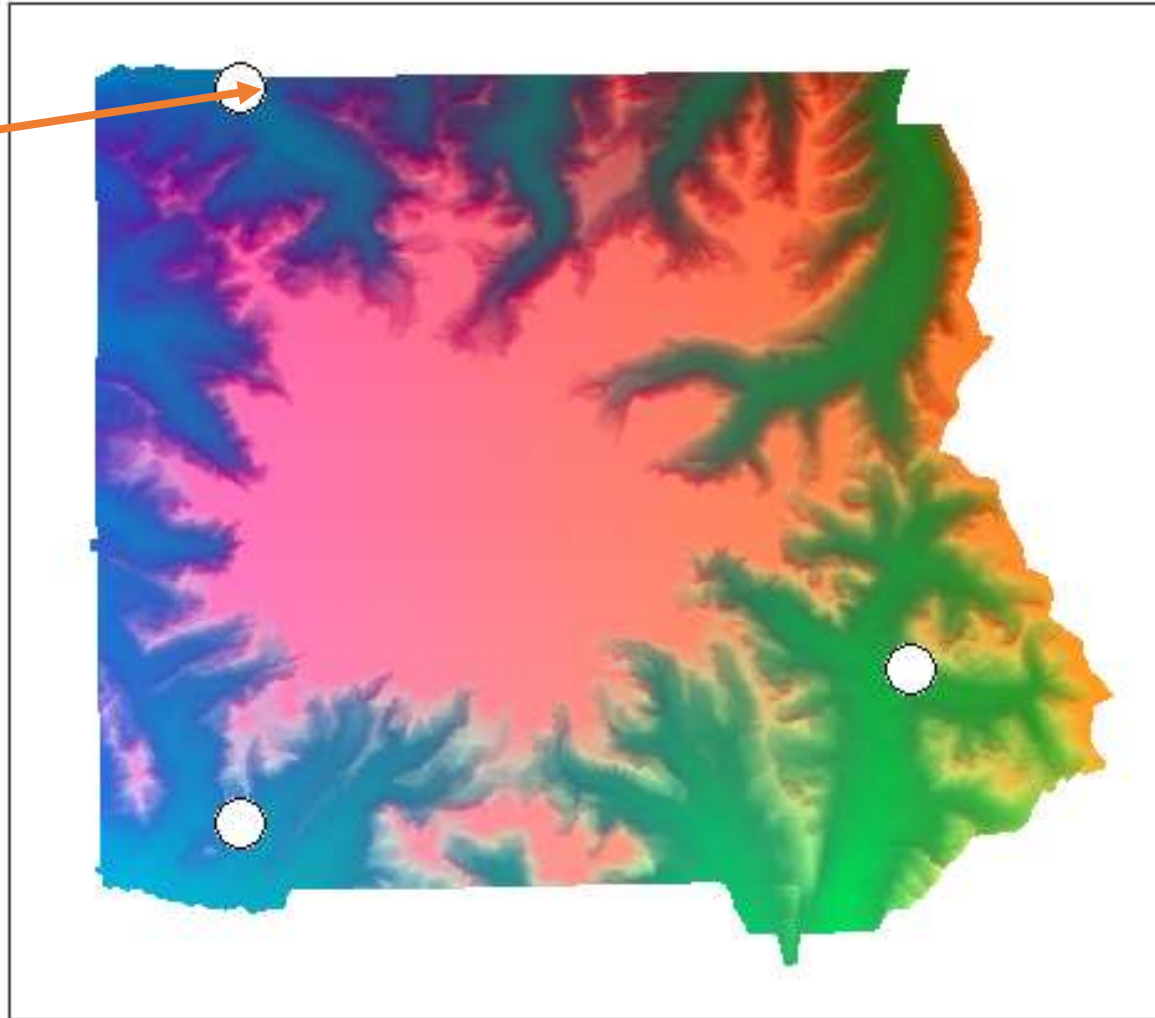


Communities across space



Communities across space

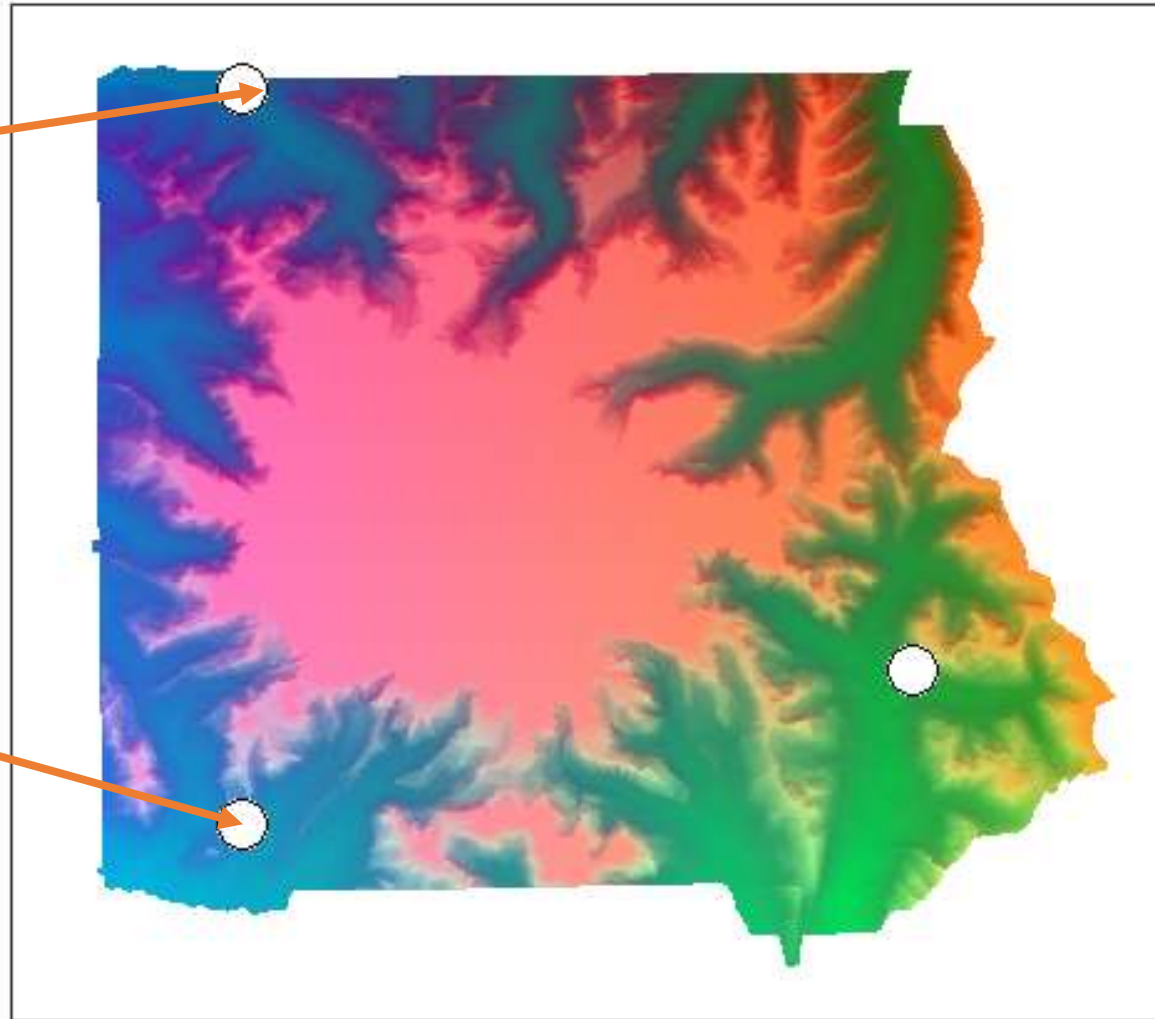
Western red cedar
Western hemlock
Pacific Yew



Communities across space

Western red cedar
Western hemlock
Pacific Yew

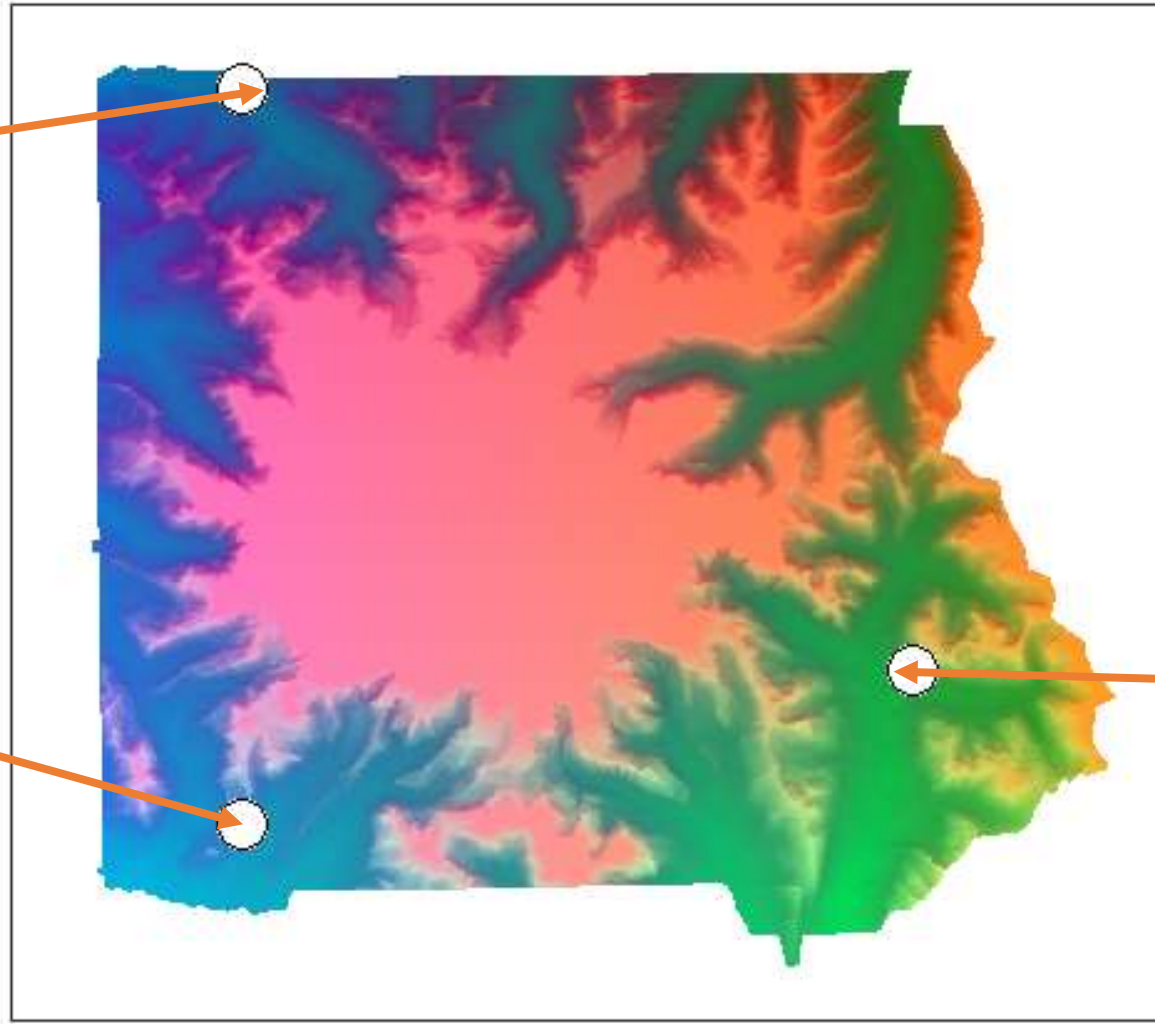
Western red cedar
Western hemlock
Douglas Fir



Communities across space

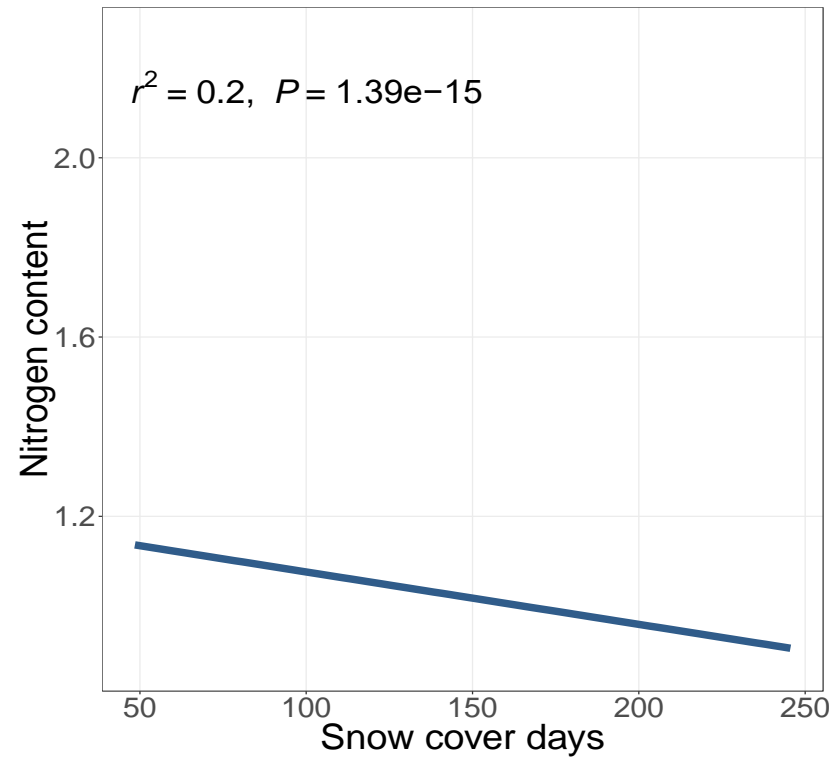
Western red cedar
Western hemlock
Pacific Yew

Western red cedar
Western hemlock
Douglas Fir



Douglas Fir
Sub Alpine Fir
Noble Fir

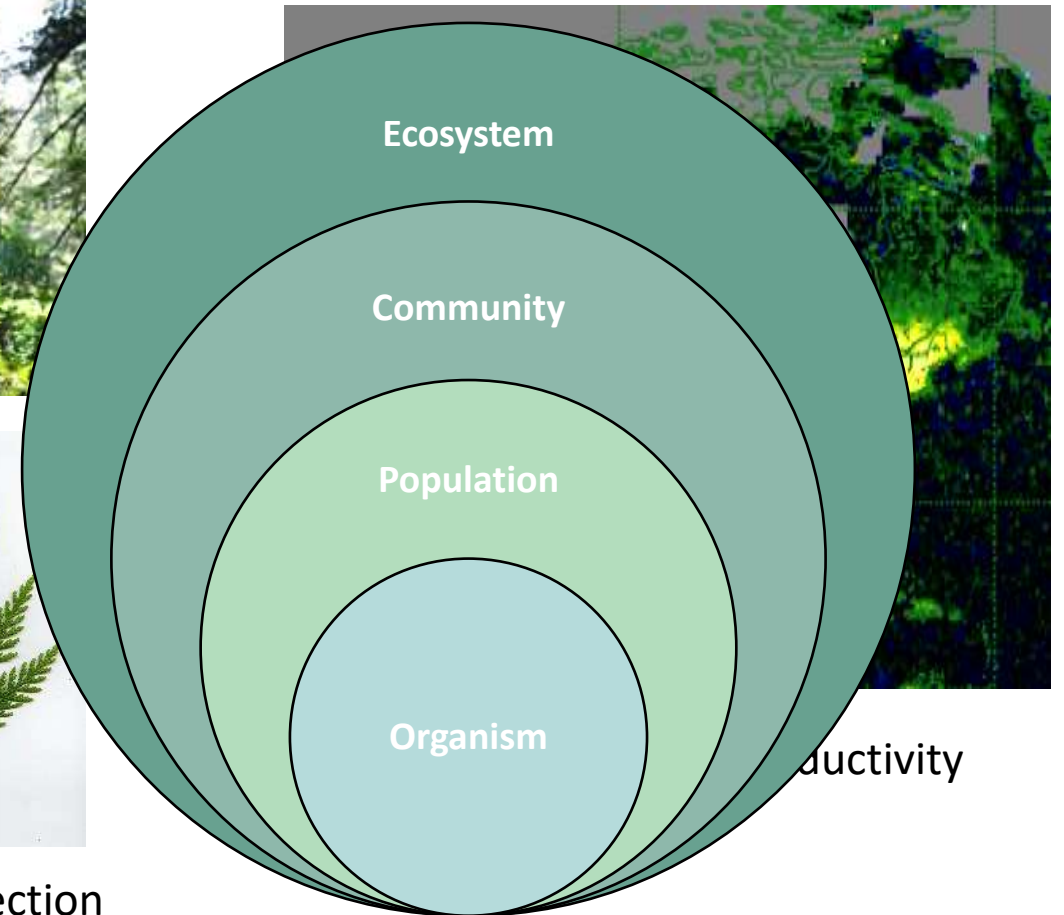
Future work



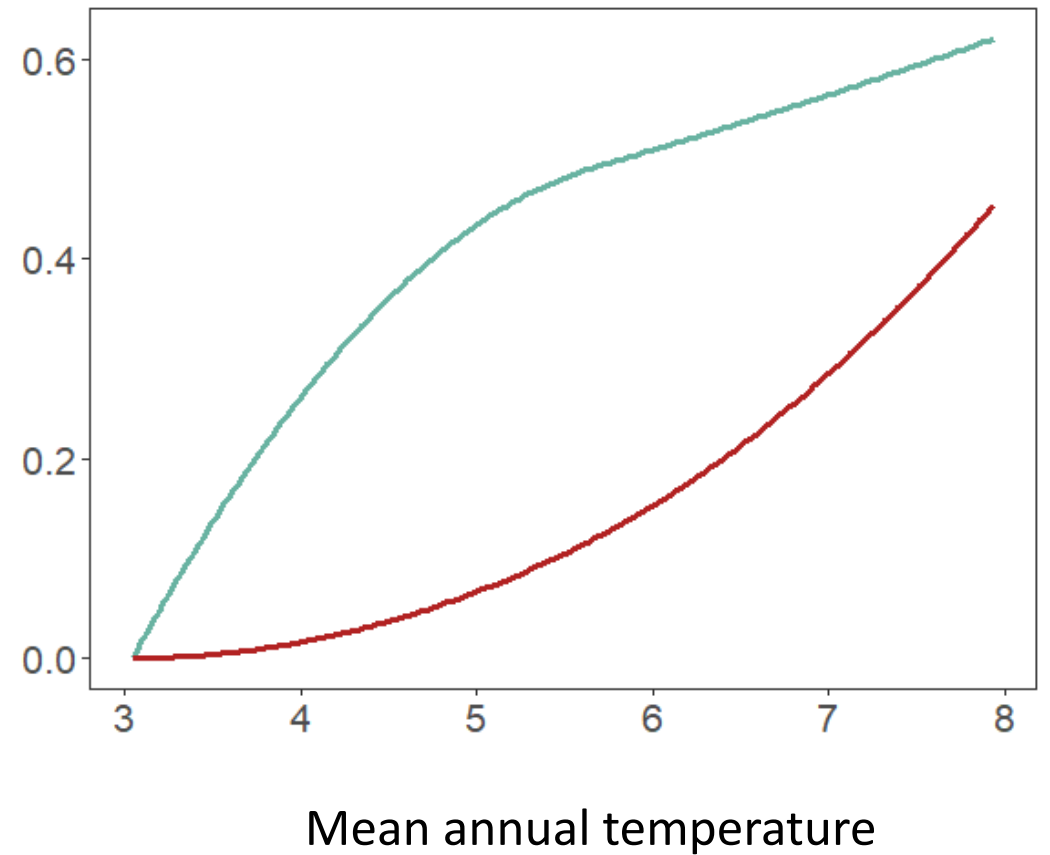
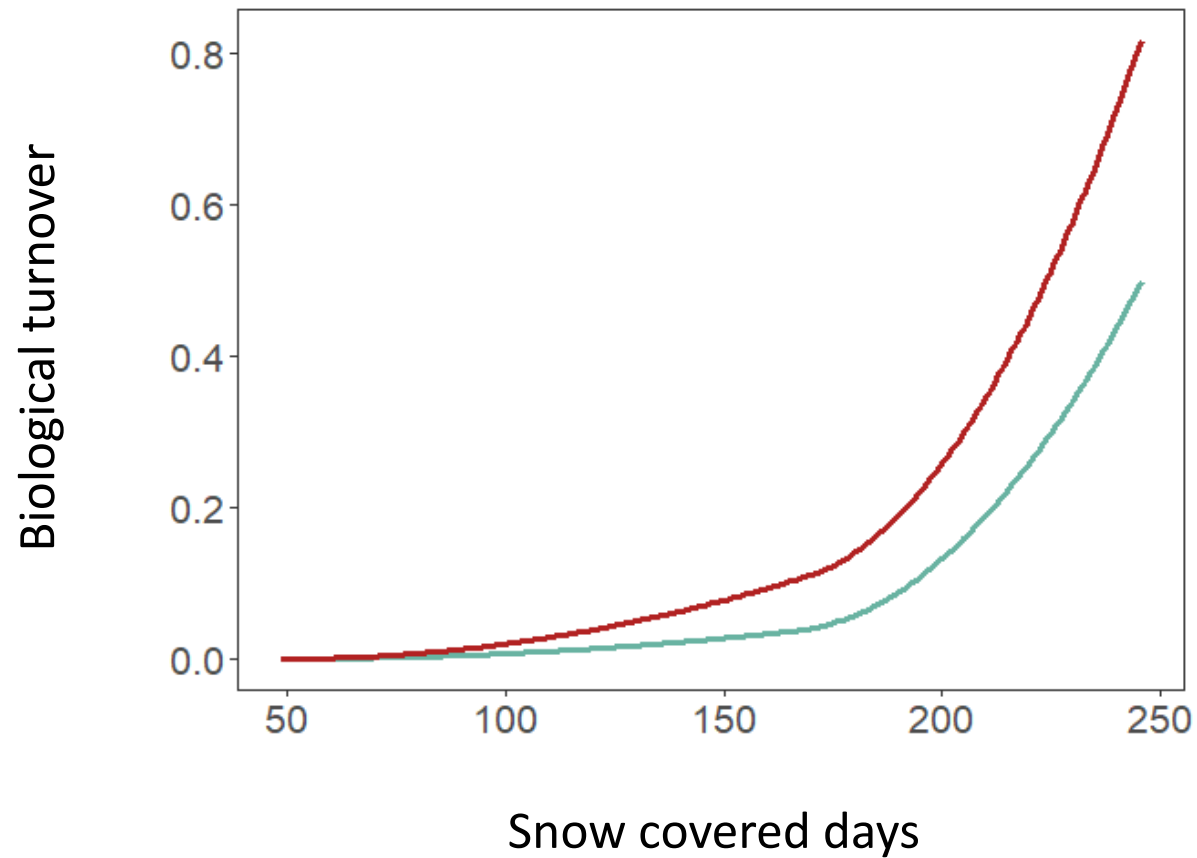
Trait environment relationships



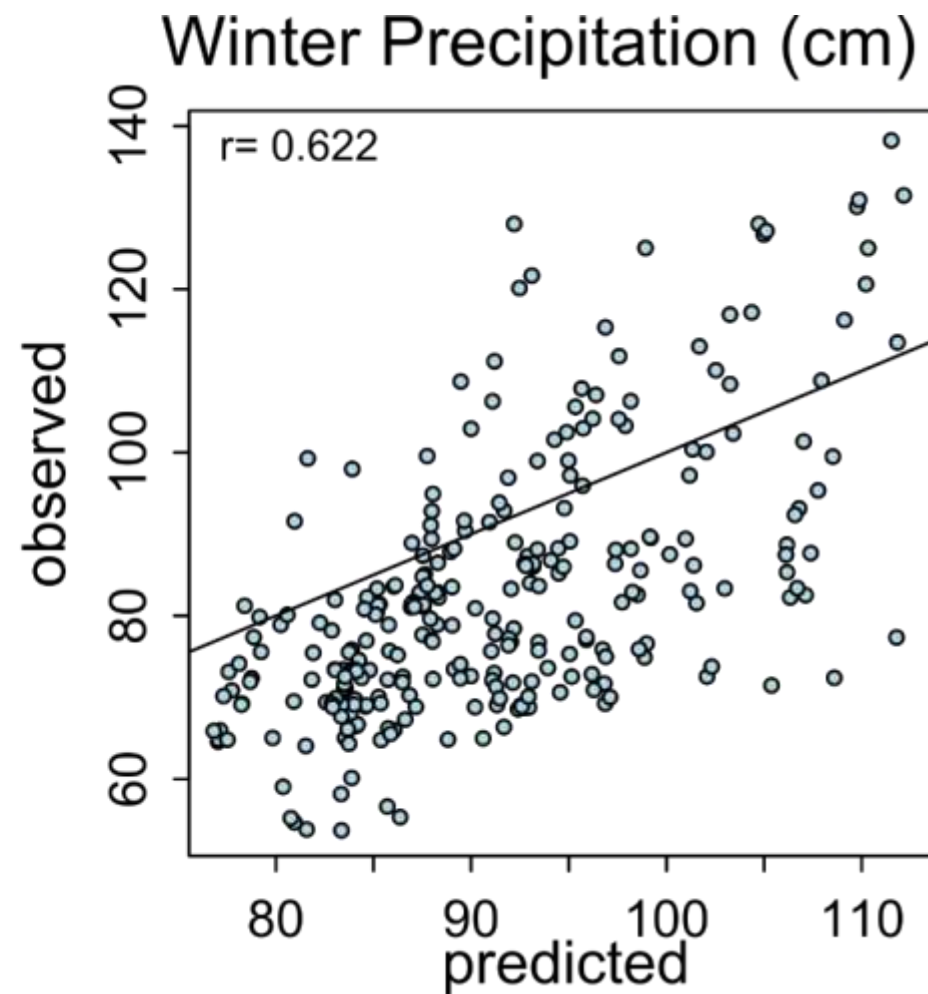
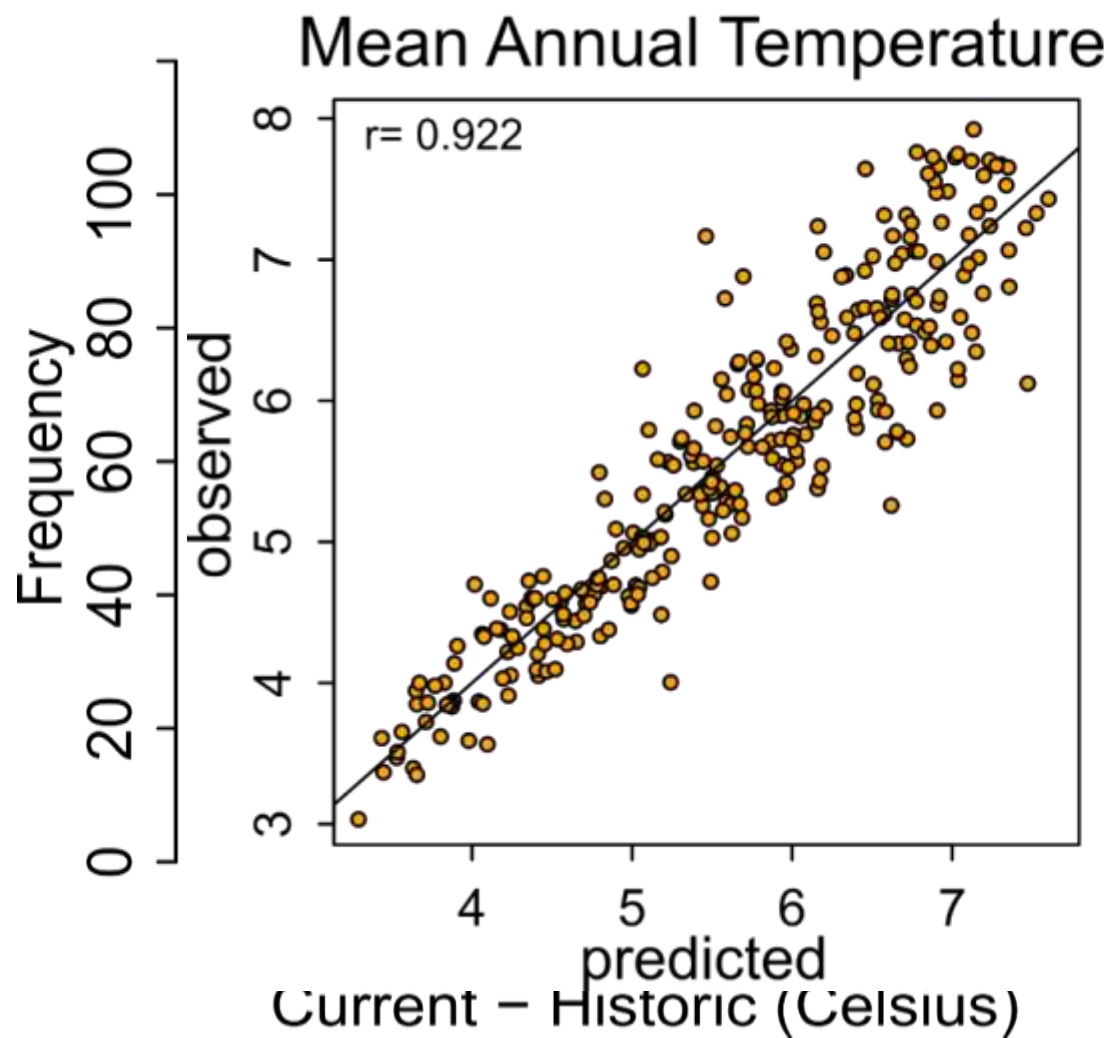
Trait data collection



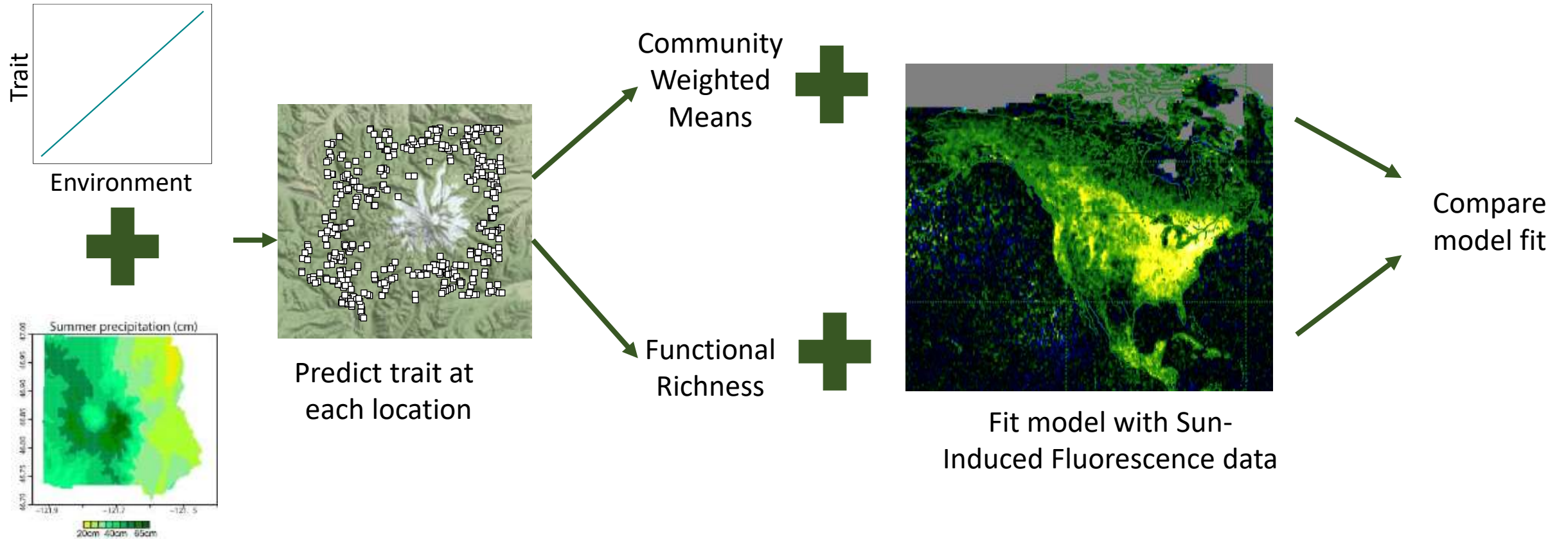
Relationships with climate



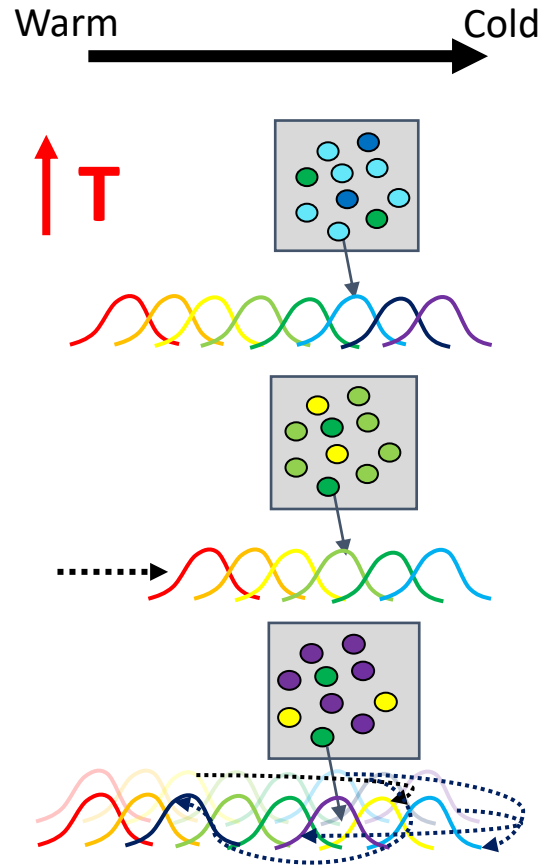
JSDM tree



Connecting community composition to productivity

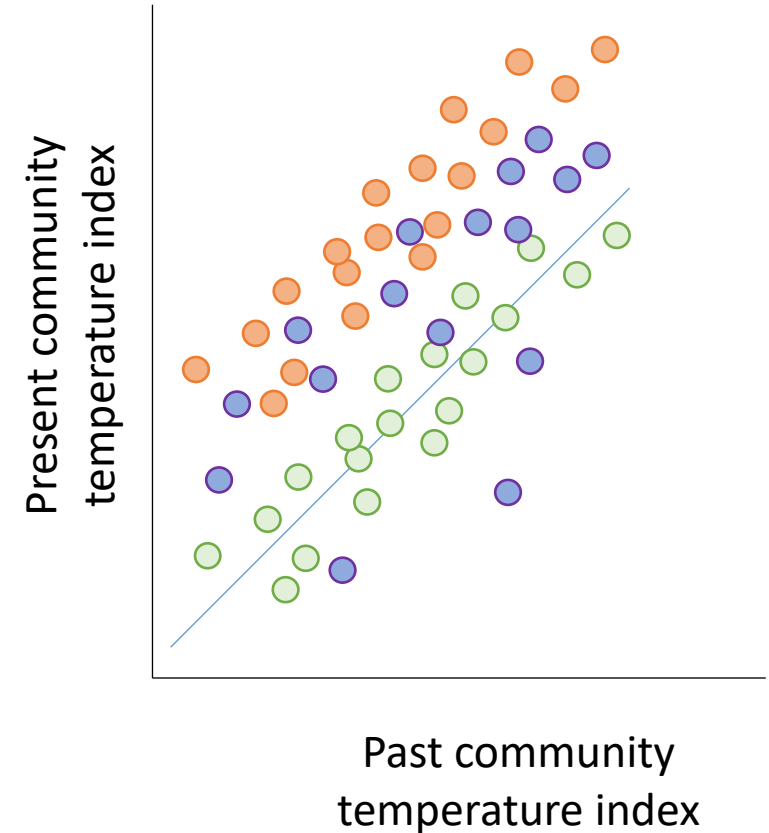


How have plant communities changed in response to recent warming?

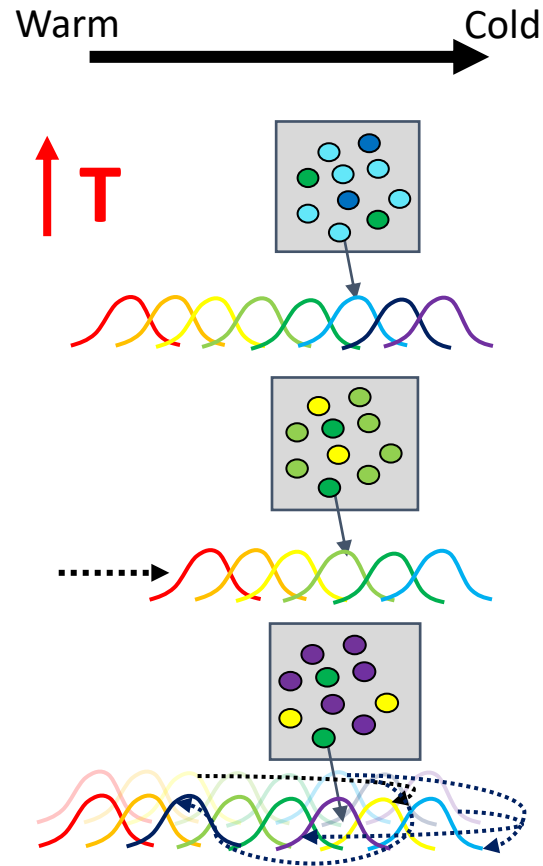


HA1: Communities have thermophilized due to similar responses of all species in a community

HA2: Communities have reorganized due to species responding individually

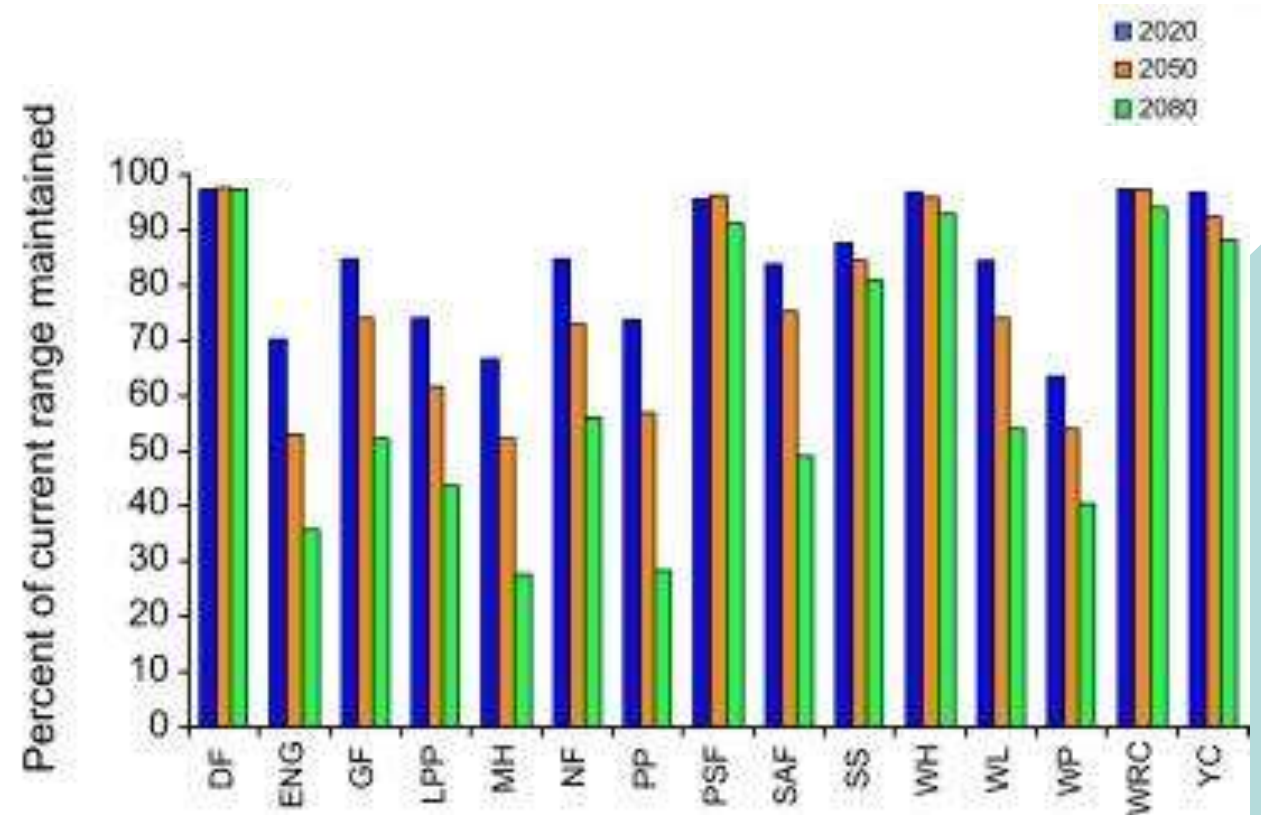


How have plant communities changed in response to recent warming?

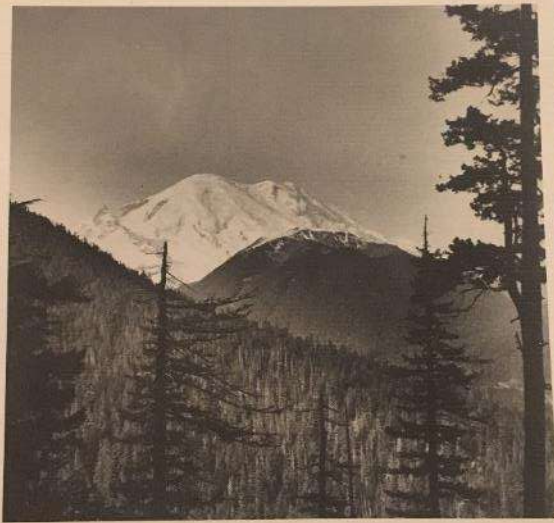


How do communities respond to climate?

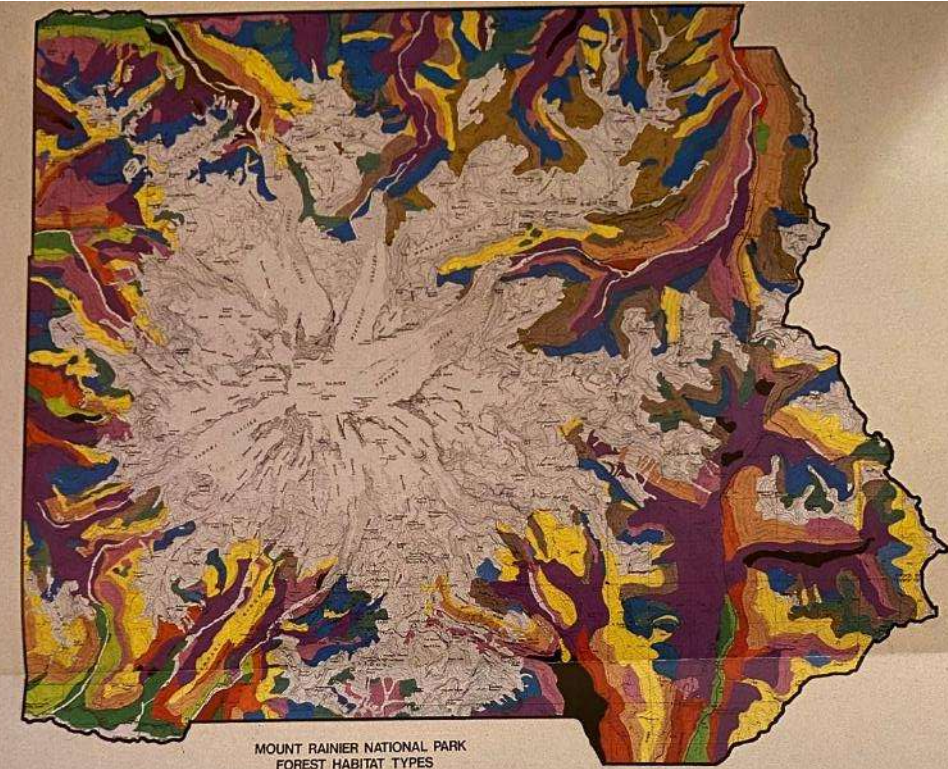
- Stay the same
- Change in a predictable manner
 - maintain community relationships with
- Communities reorganize



THE FOREST COMMUNITIES OF MOUNT RAINIER NATIONAL PARK



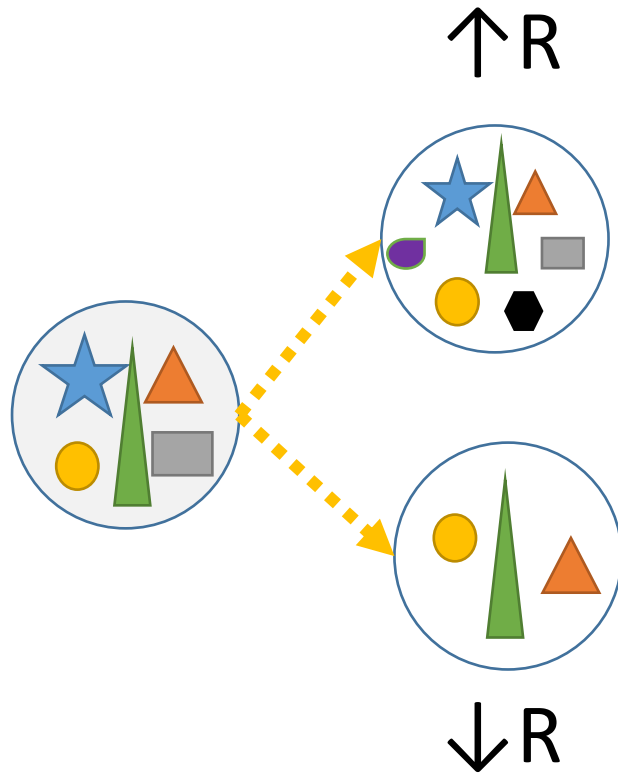
JERRY F. FRANKLIN
WILLIAM H. MOIR MILES A. HEMSTROM
SARAH E. GREENE BRADLEY G. SMITH



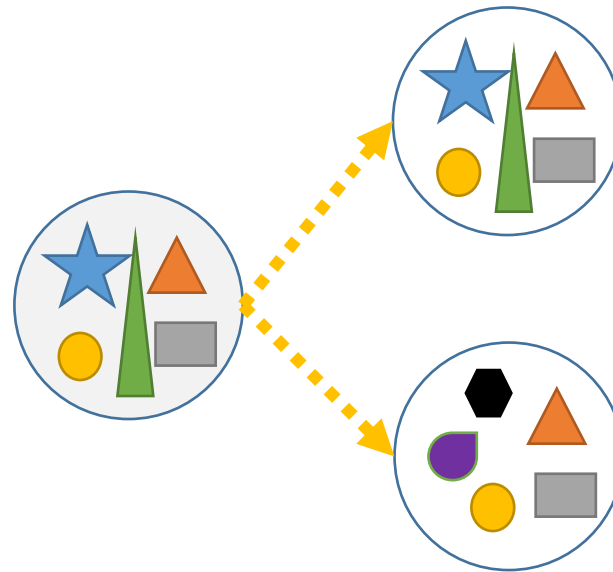
<p>TSHE/OPHO Western hemlock / Devil's club <i>Tsuga heterophylla</i> / <i>Opiopanax horridum</i></p> <p>ABAM/OPHO Silver fir / Devil's club <i>Abies amabilis</i> / <i>Opiopanax horridum</i></p> <p>TSHE/POMU Western hemlock / Swordfern <i>Tsuga heterophylla</i> / <i>Polystichum munitum</i></p> <p>TSHE/ACTR Western hemlock / Vanilla leaf <i>Tsuga heterophylla</i> / <i>Achlys triphylla</i></p> <p>ABAM/VAAL Silver fir / Alaska huckleberry <i>Abies amabilis</i> / <i>Vaccinium discolor</i></p> <p>ABAM/TIUN Silver fir / Western cowwort <i>Abies amabilis</i> / <i>Tiarella unifoliata</i></p>	<p>CHNO/VAOV Alaska cedar / Oval leaf huckleberry <i>Chamaecyparis nootkatensis</i> / <i>Vaccinium ovatum</i></p> <p>ABAM/MEFE Silver fir / Rusty leaf <i>Abies amabilis</i> / <i>Menziesia ferruginea</i></p> <p>ABAM/RHAL Silver fir / Cascades azalea <i>Abies amabilis</i> / <i>Rhododendron albiflorum</i></p> <p>ABAM/ERMO Silver fir / Avalanche fawnlily <i>Abies amabilis</i> / <i>Erythronium montanum</i></p> <p>ABAM/RULA Silver fir / Dwarf blackberry <i>Abies amabilis</i> / <i>Rubus lasiococcus</i></p> <p>ABLA/VASI Subalpine fir / Silka valerian <i>Abies lasiocarpa</i> / <i>Valeriana silchensis</i></p>	<p>PSME/ARUV Douglas fir / Kinnikinnick <i>Pseudotsuga menziesii</i> / <i>Arctostaphylos uva-ursi</i></p> <p>TSHE/GASH Western hemlock / Salal <i>Tsuga heterophylla</i> / <i>Gaultheria shallon</i></p> <p>ABAM/GASH Silver fir / Salal <i>Abies amabilis</i> / <i>Gaultheria shallon</i></p> <p>ABAM/BENE Silver fir / Oregon grape <i>Abies amabilis</i> / <i>Berberis nervosa</i></p> <p>ABAM/XETE Silver fir / Beargrass <i>Abies amabilis</i> / <i>Xerophyllum tenax</i></p>
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How are communities responding to climate?

Species richness



Community turnover



Tree vs. Understory

