

# Community assemblage and functional diversity across elevational gradients from the tropics to the arctic

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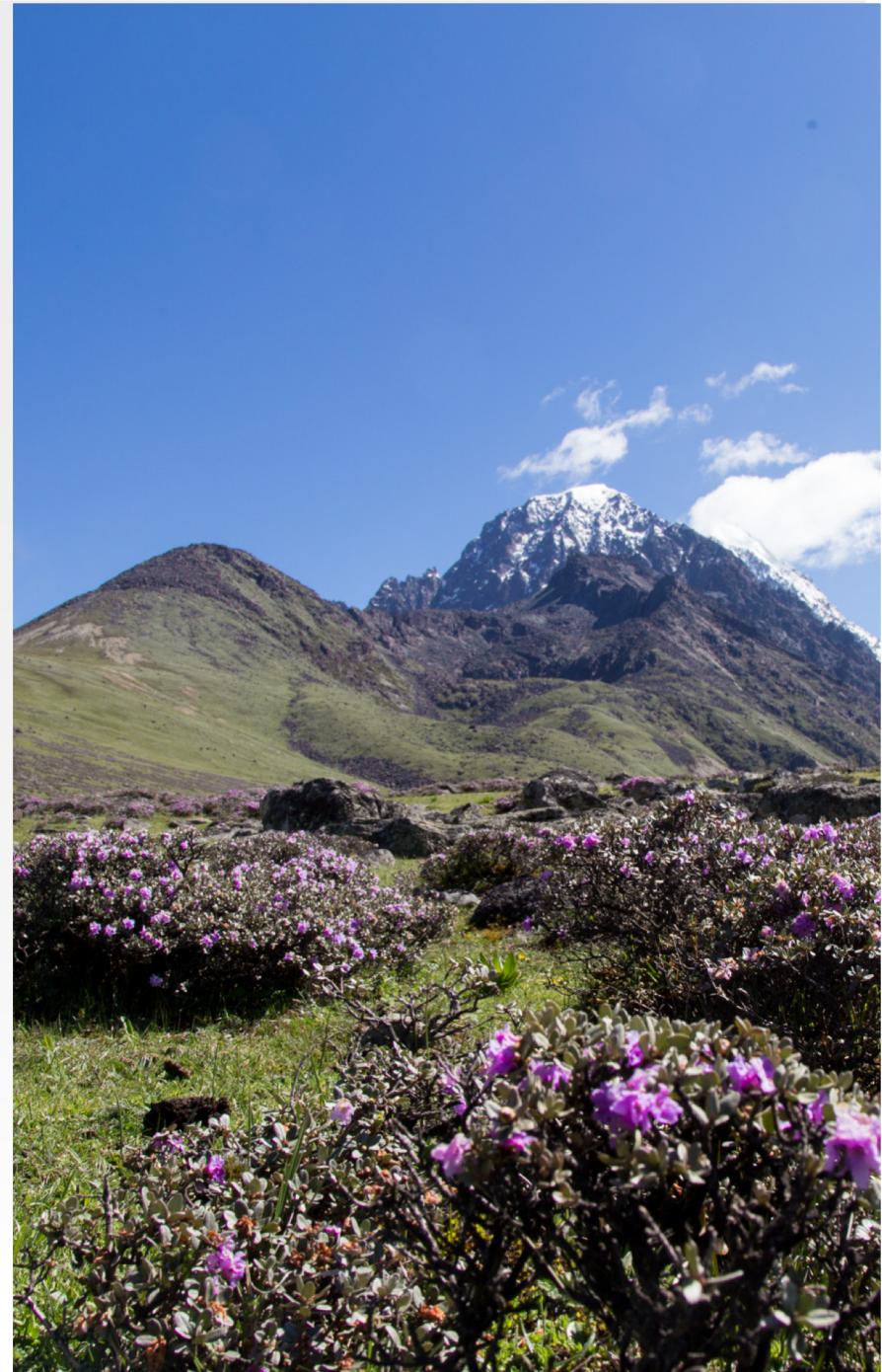
# Alpine grasslands

25% of Earth land area

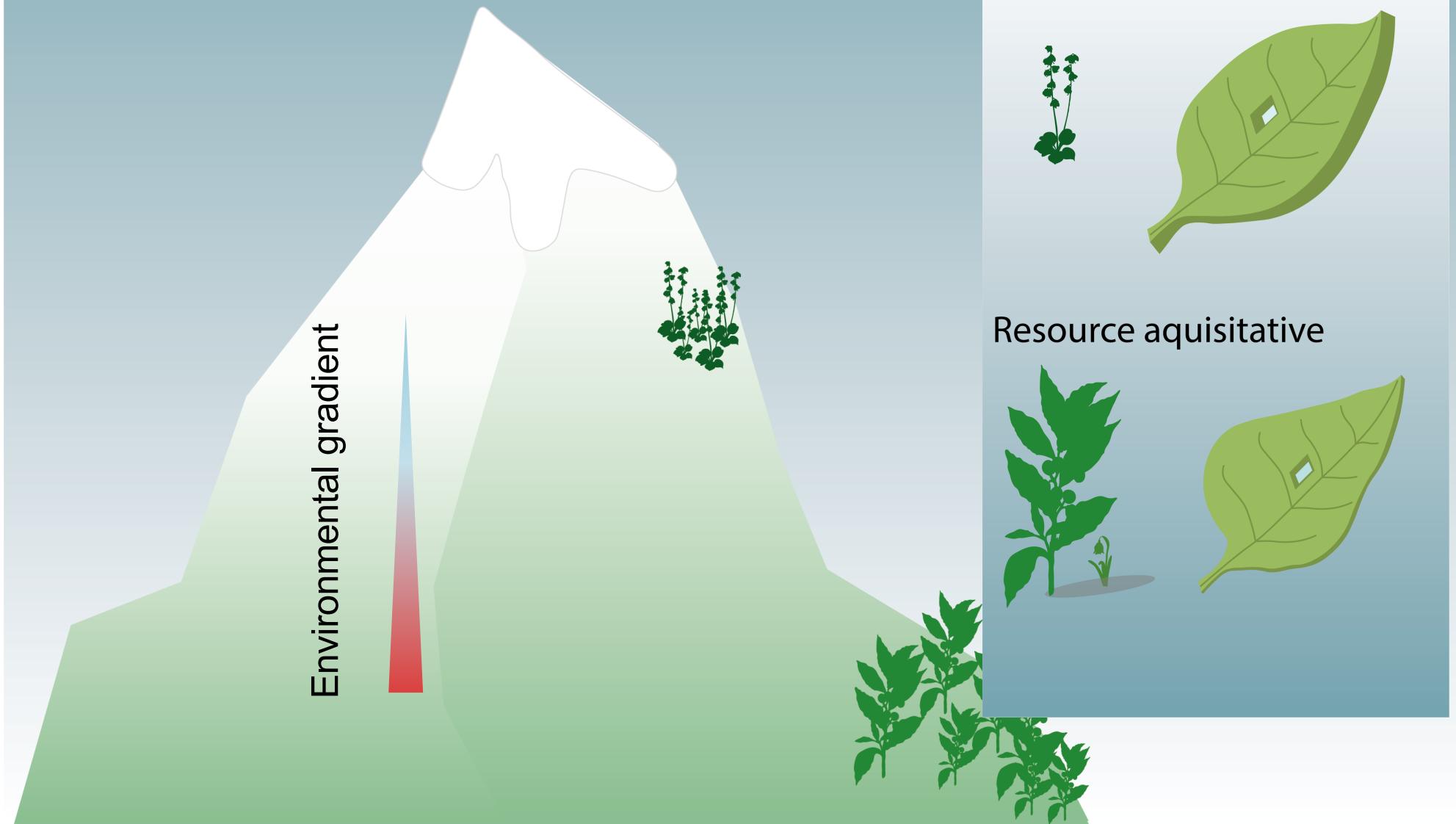
Provide ecosystem function and services:

- clean water
- grazing areas
- Biodiversity
- carbon sequestration and storage

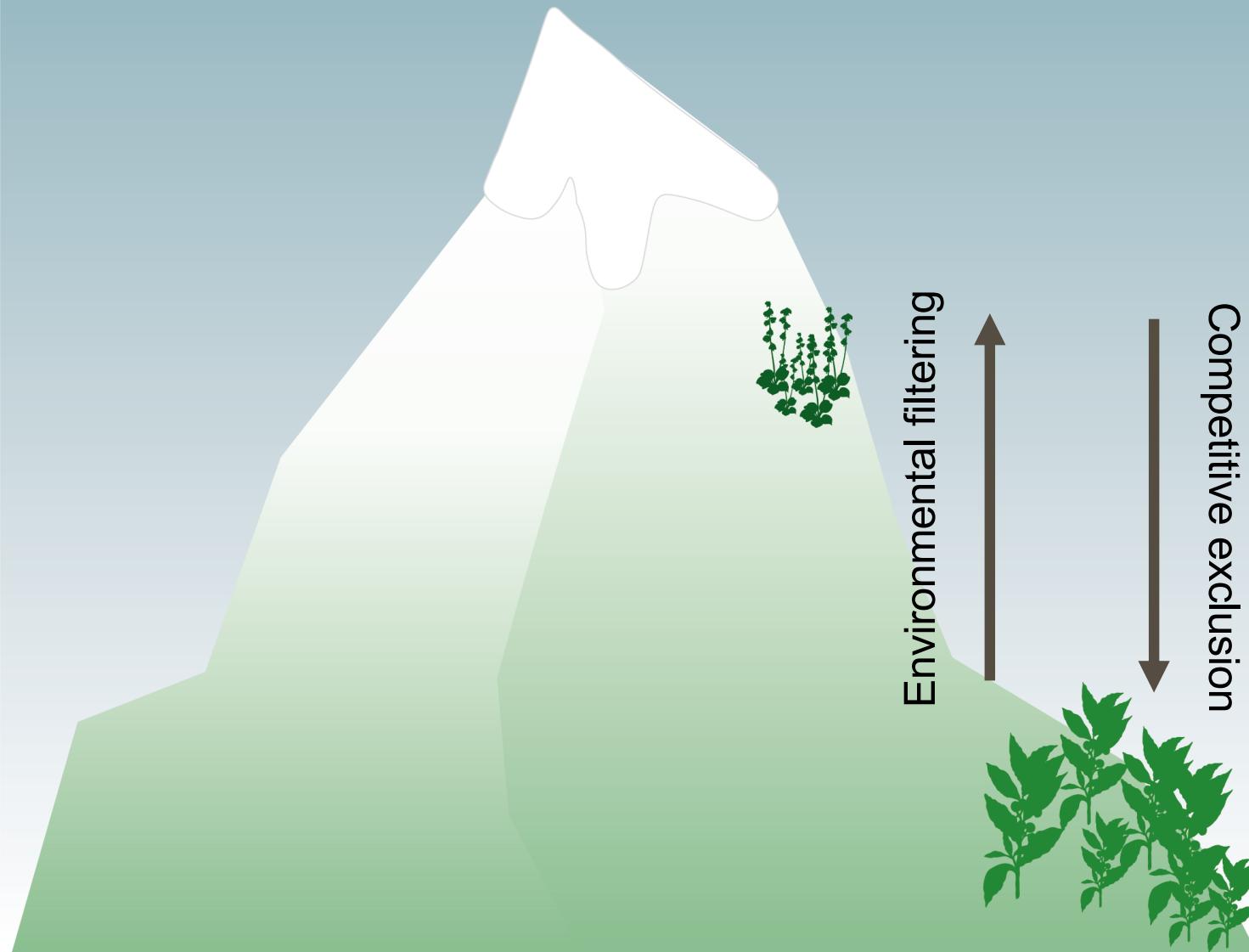
Understand processes that shape communities to predict changes in ecosystem functioning.



# Elevational gradient



# Elevational gradient

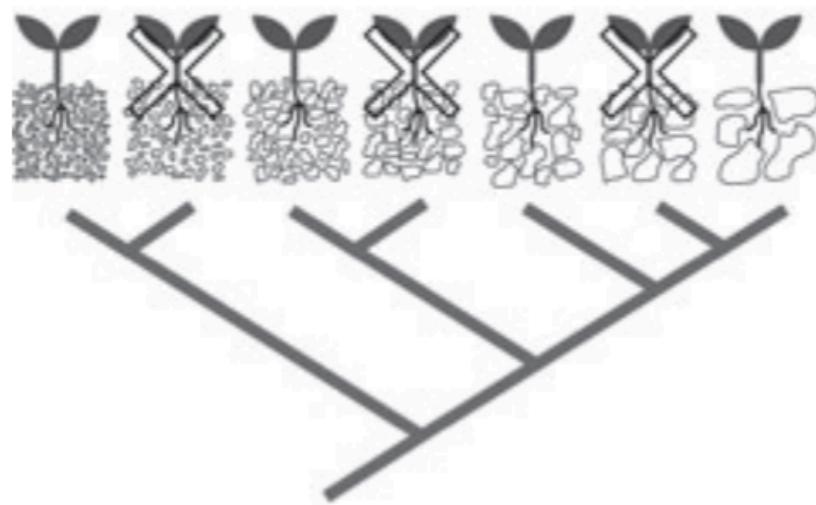




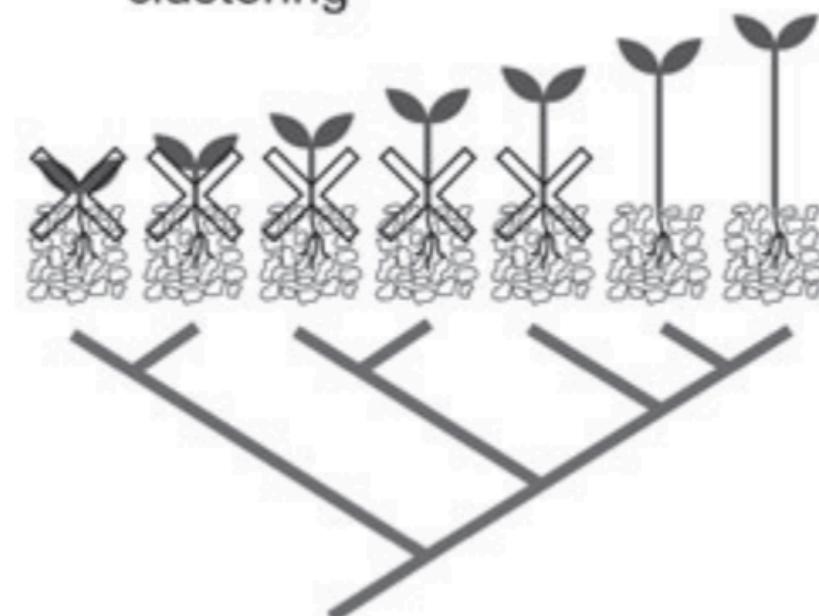
### Population structure

(a) Competition drives over-dispersion

Fitness



(b) Competition drives clustering



Trait values

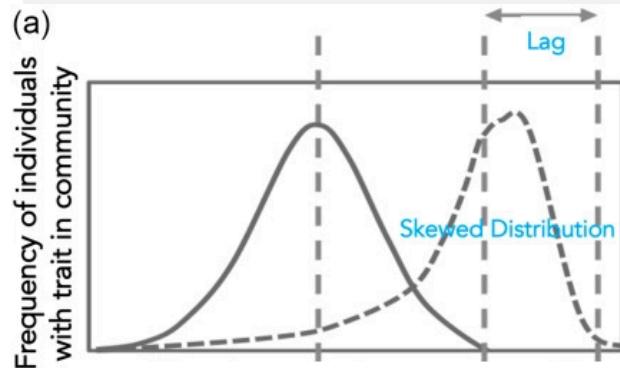




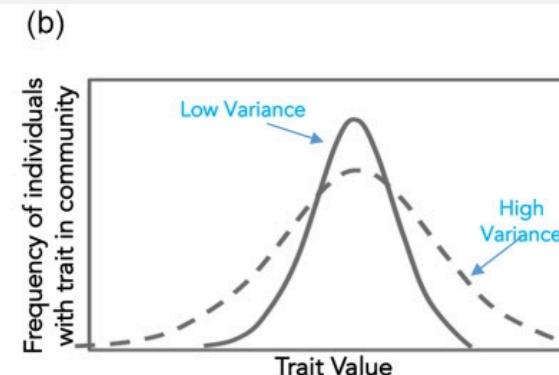
# Trait Driver Theory

Trait-based scaling theory can link plant functioning (traits) and ecosystem processes.

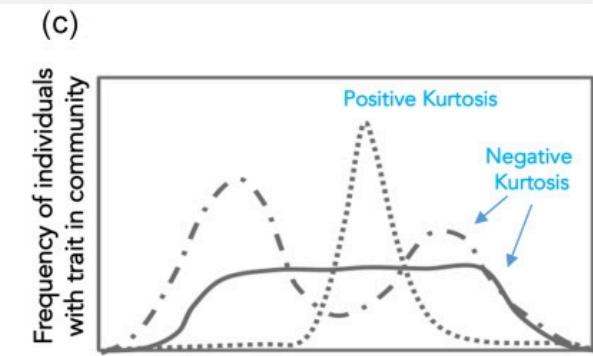
Skewness  
asymmetry



Variance  
richness

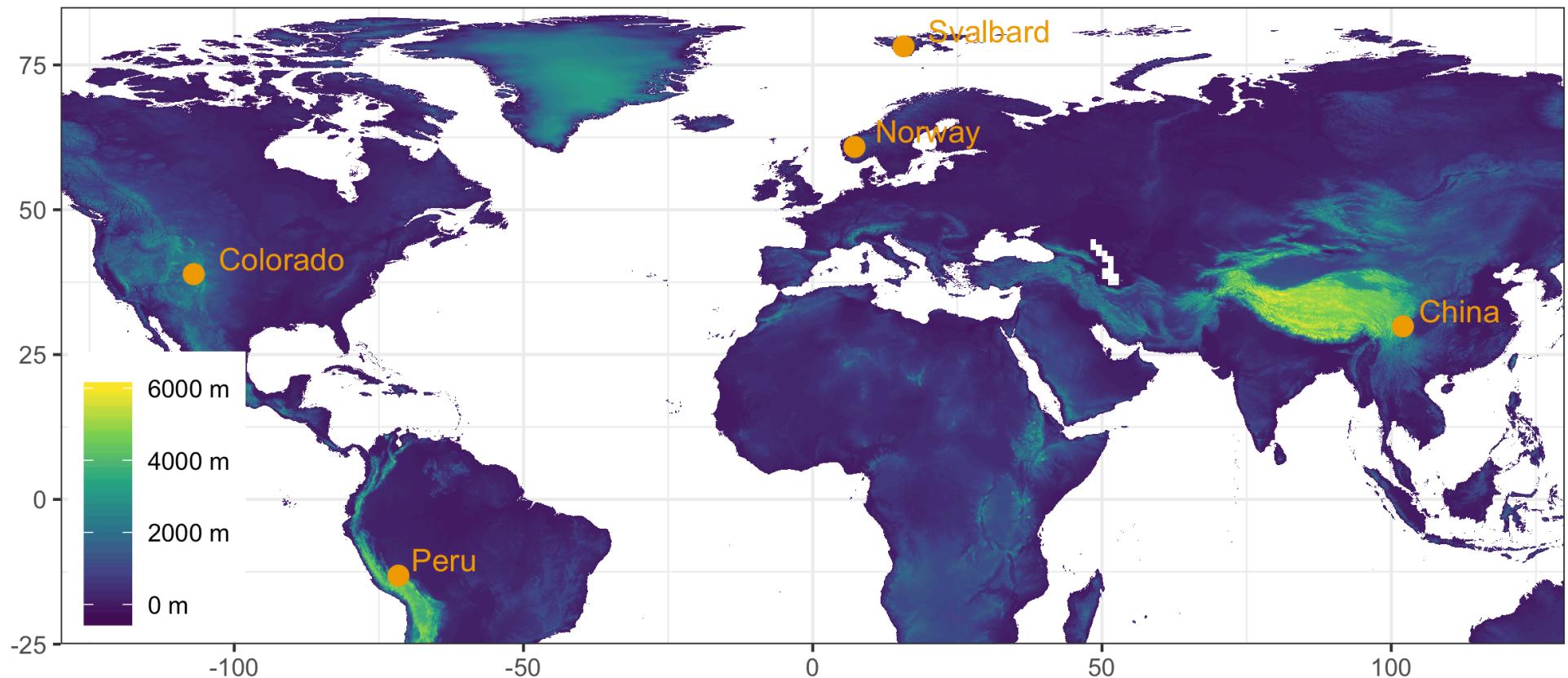


Kurtosis  
evenness





# How do grassland communities respond to drivers along elevational gradients in terms of functional diversity?



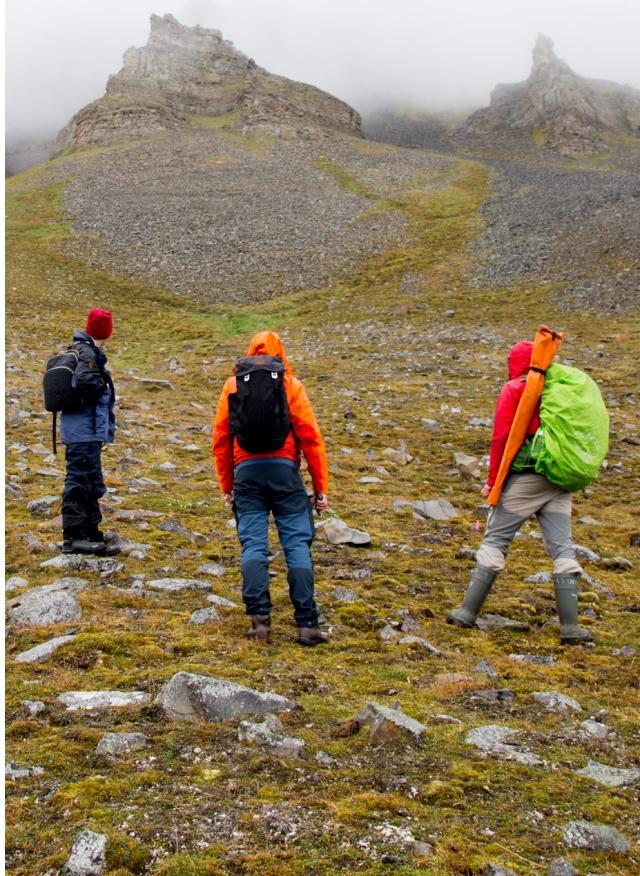


## Arctic

▲ 0 – 250 m a.s.l.

🌡 -6.2 °C

💧 321 mm



## Temperate

▲ 500 – 4000 m a.s.l.

🌡 2-3 °C

💧 400 - 1200 mm

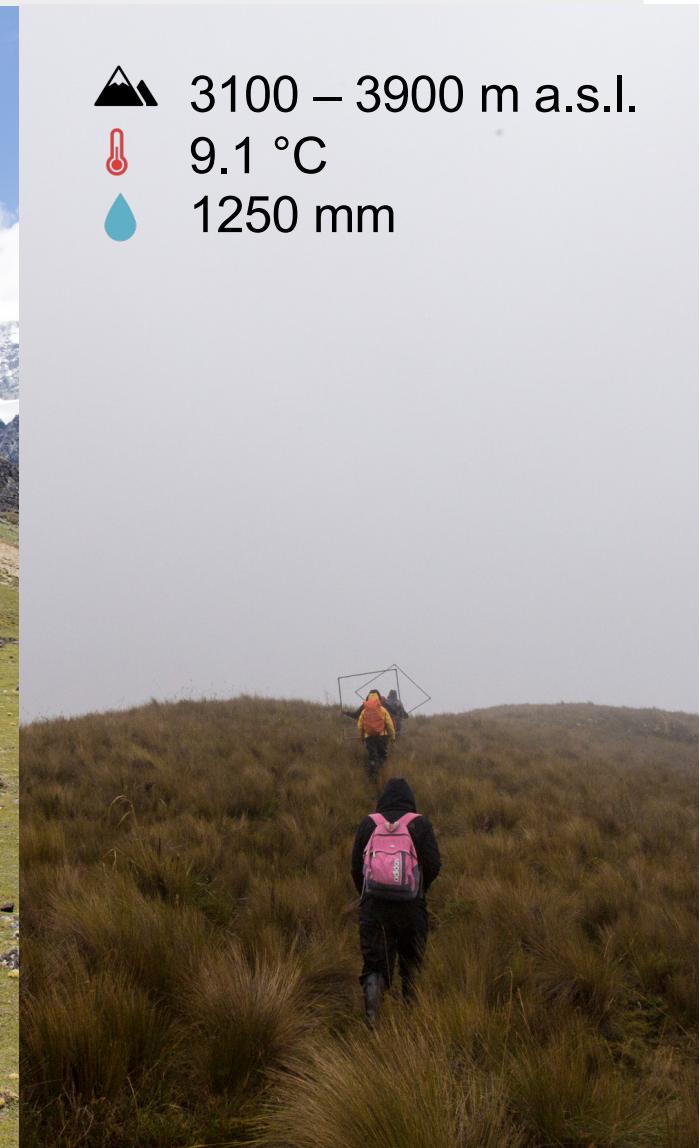


## Tropics

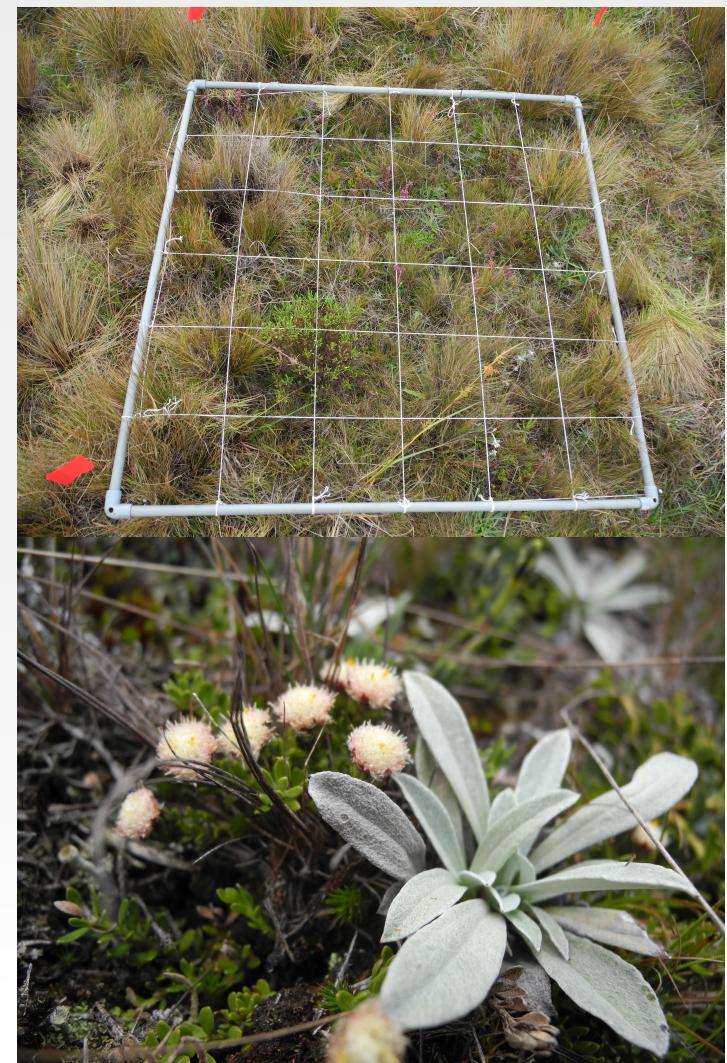
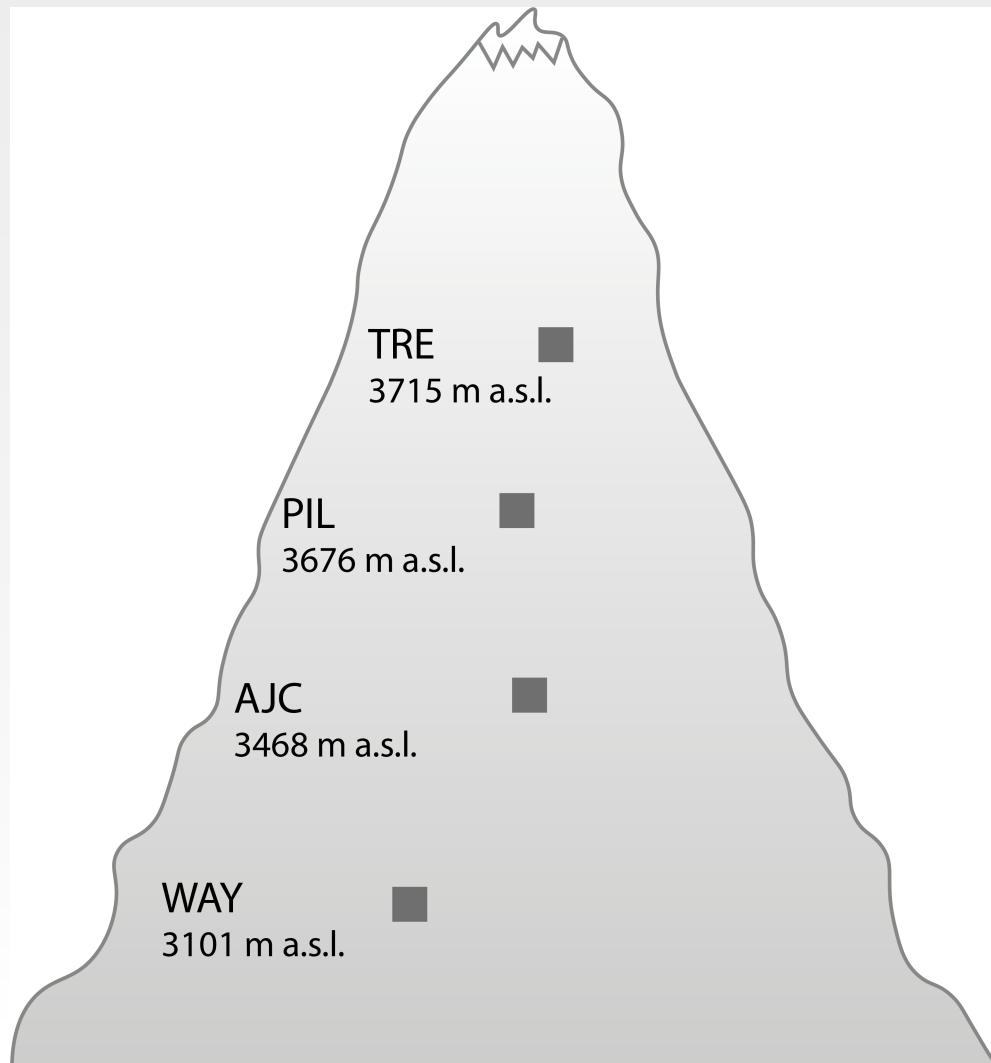
▲ 3100 – 3900 m a.s.l.

🌡 9.1 °C

💧 1250 mm



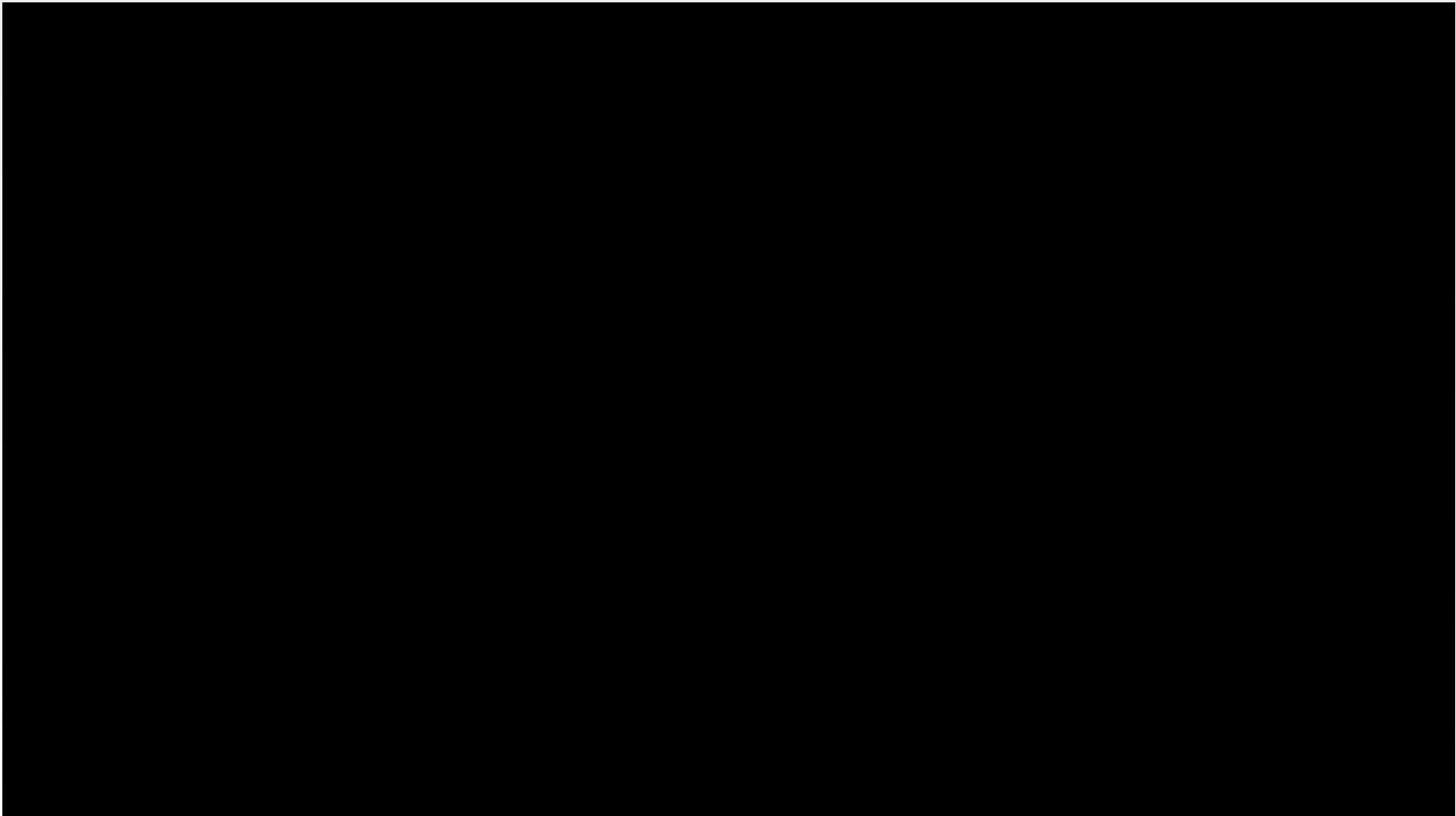
# Gradient and data collection

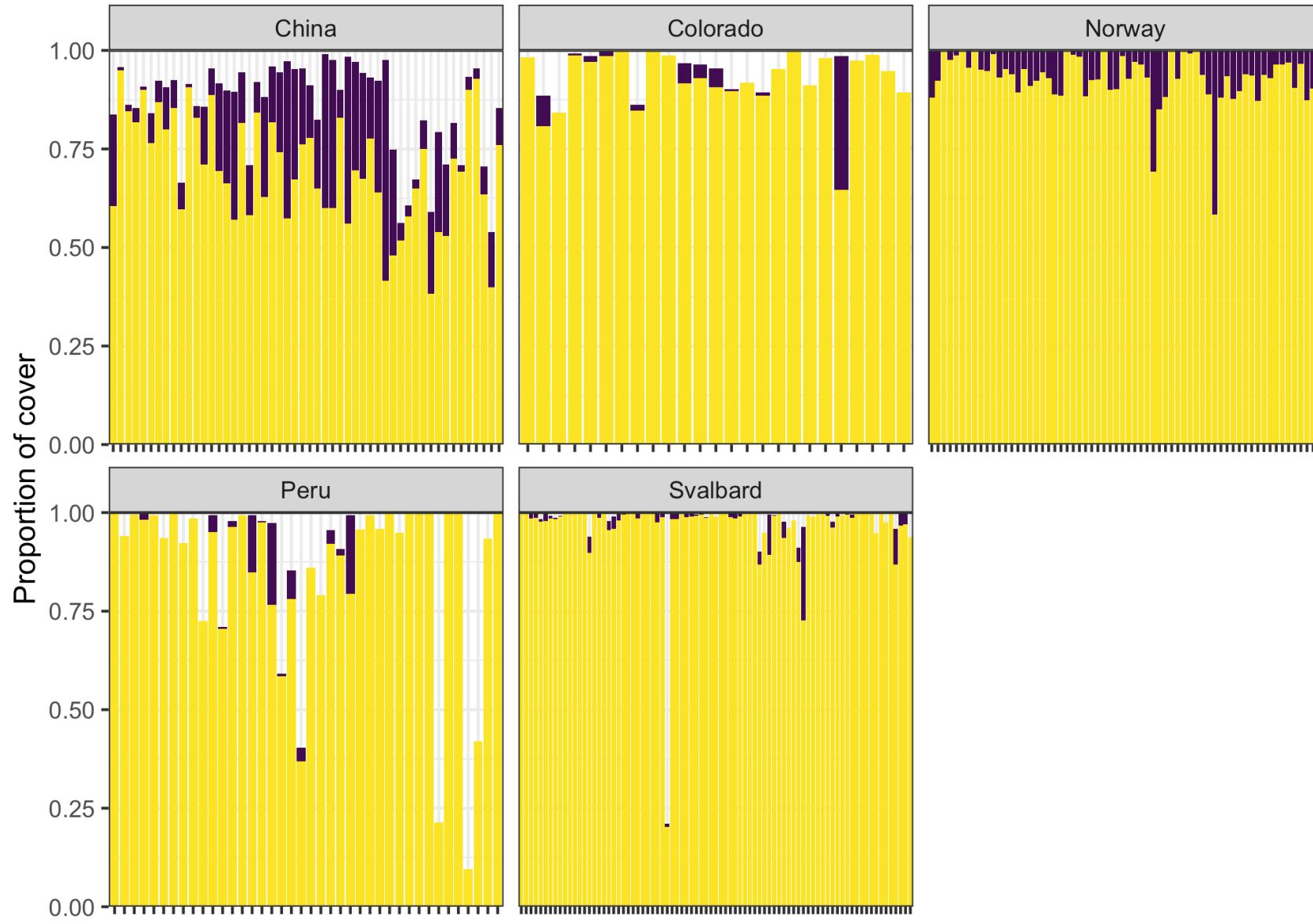


# Measure leaf functional traits



## Trait wheel™

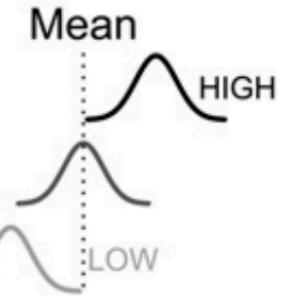




```
devtools::install_github("richardjtelford/traitstrap")
```

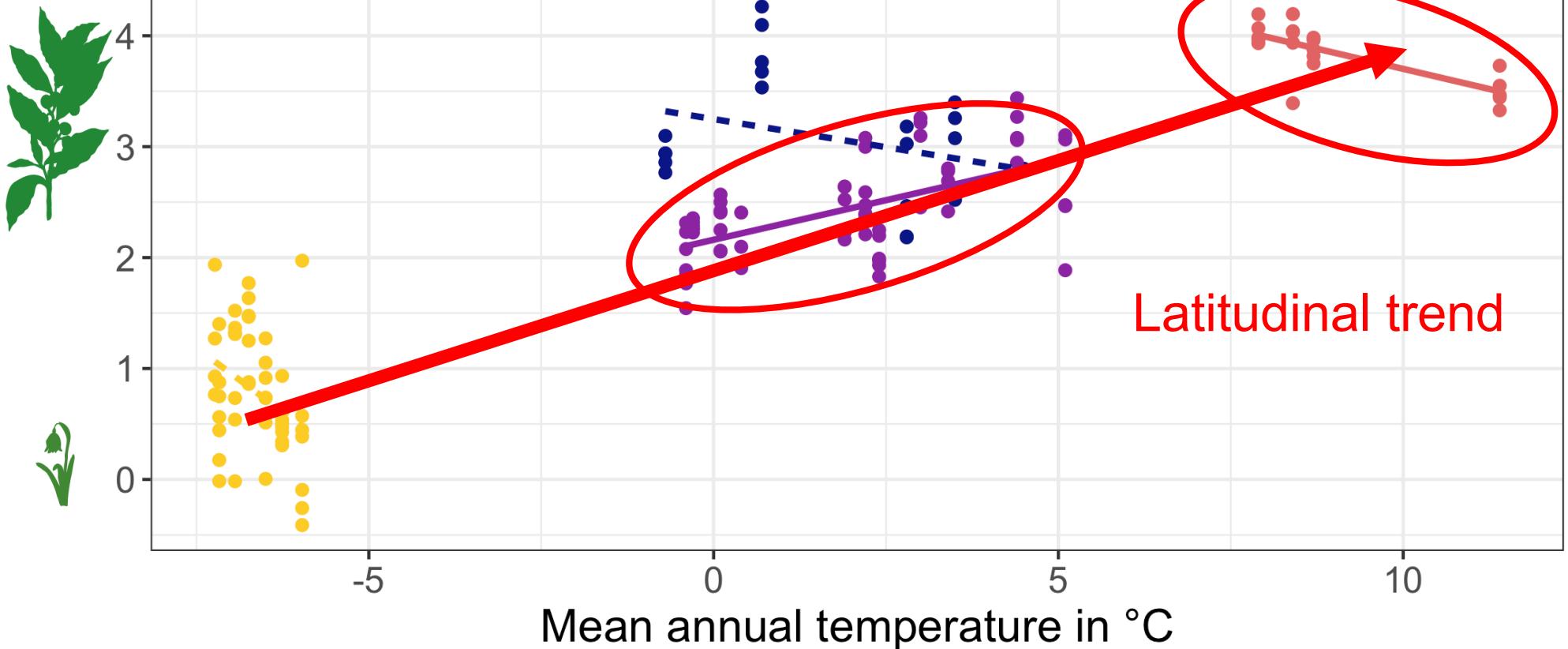


# Mean plant height

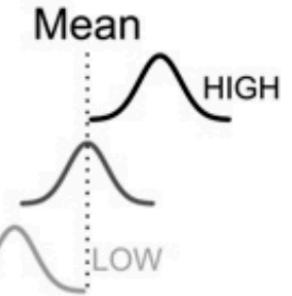


log(Plant height in cm)

Colorado Norway Peru Svalbard

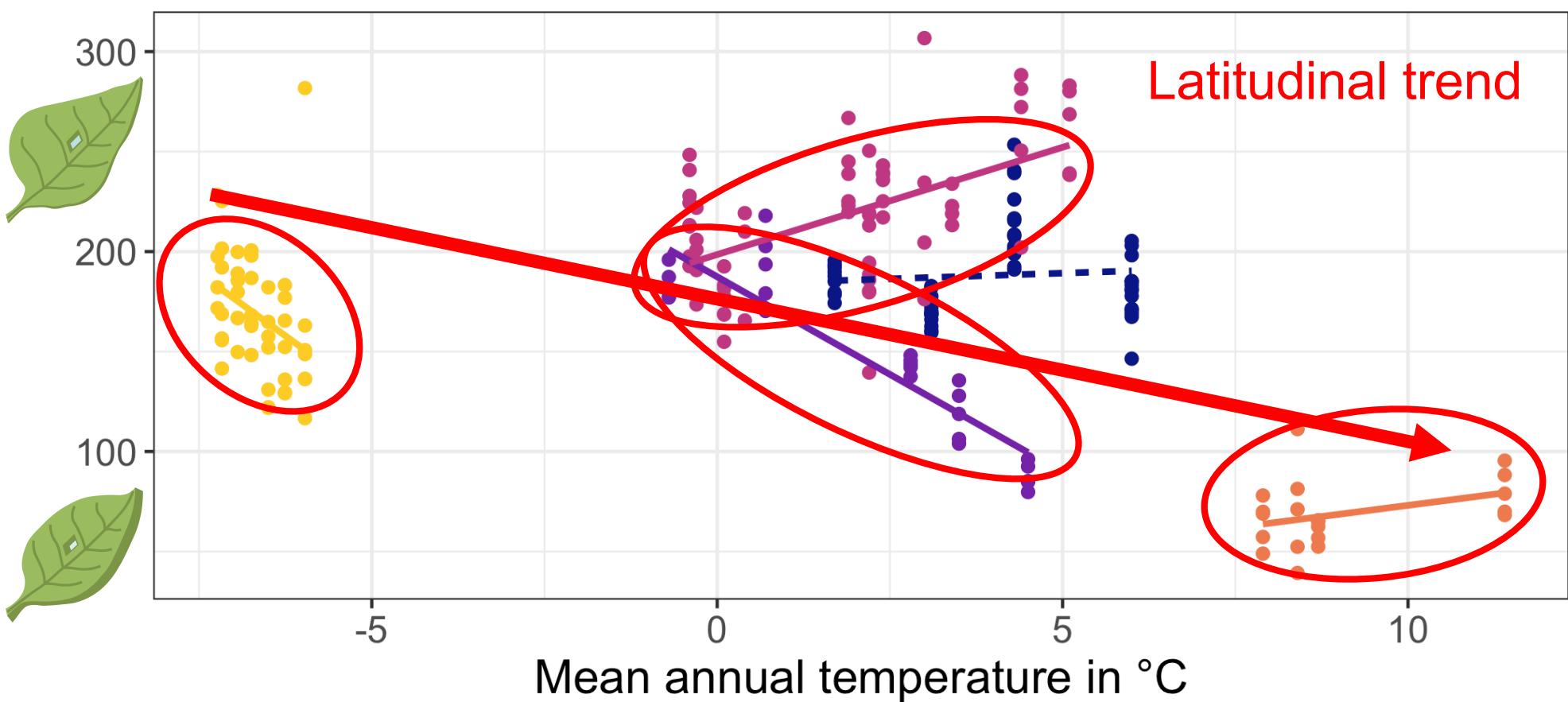


# Mean SLA

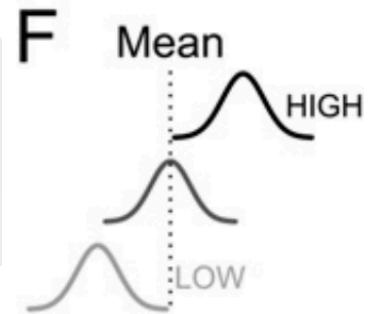


SLA in cm<sup>2</sup> g

—●— China   —●— Colorado   —●— Norway   —●— Peru   —●— Svalbard

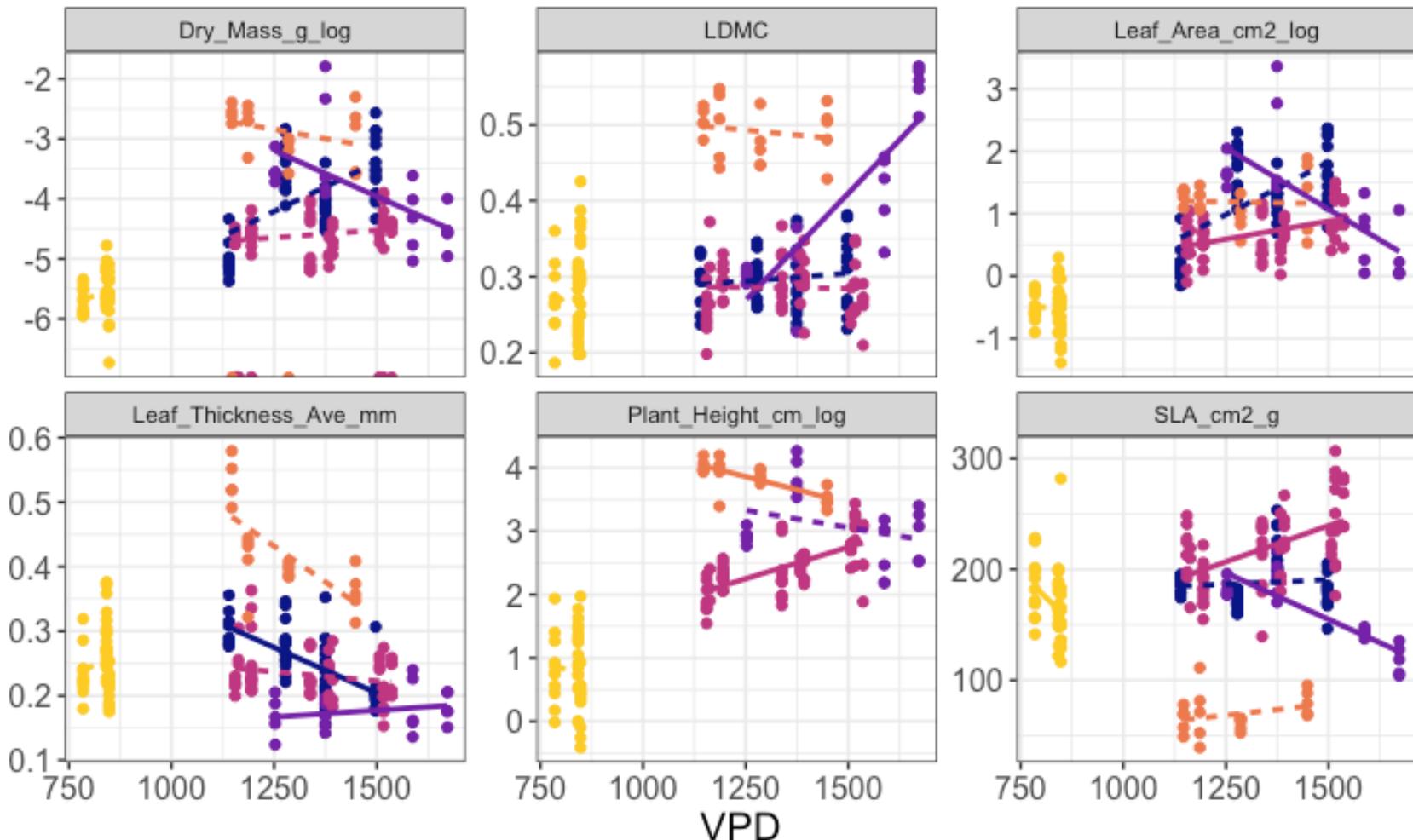


# Vapour pressure deficit



Mean trait value

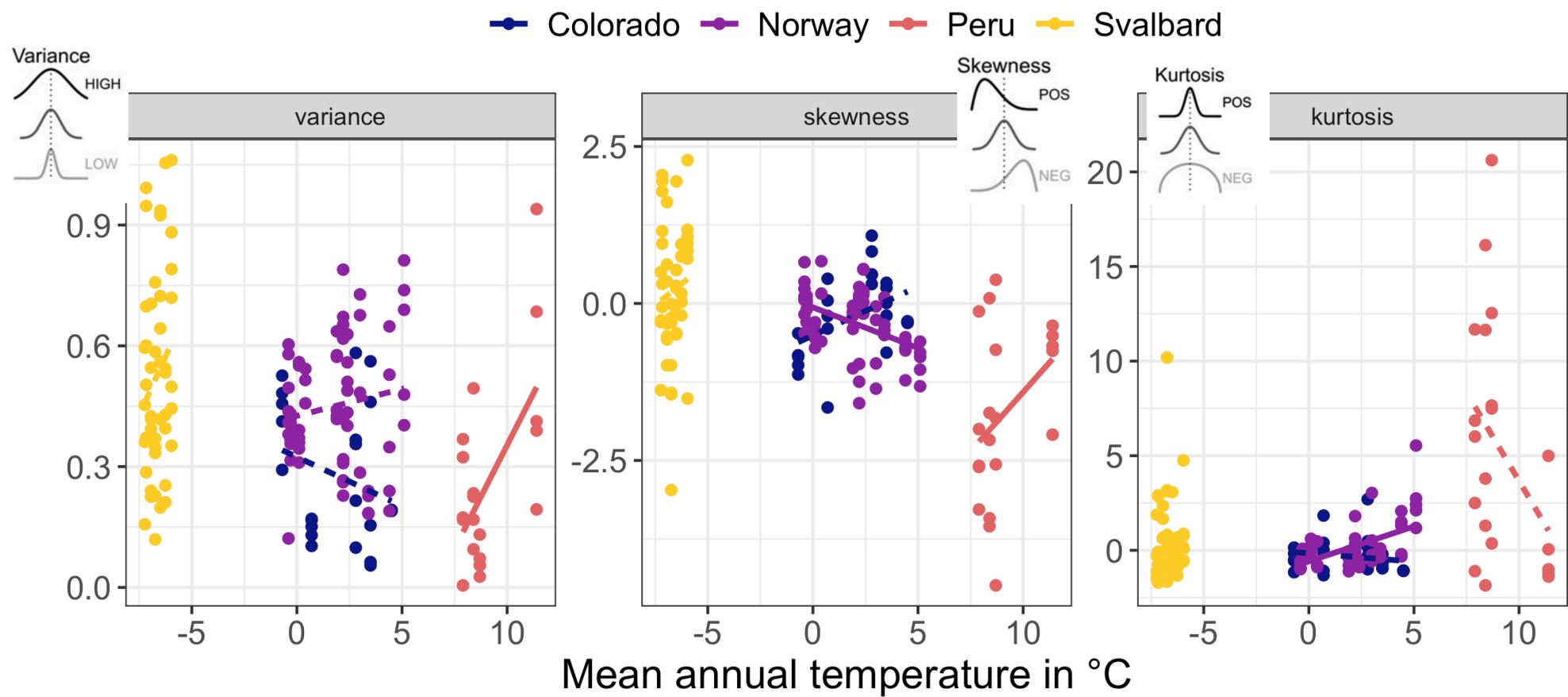
— China — Colorado — Norway — Peru — Svalbard



# Higher trait moments

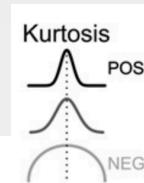
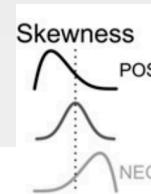
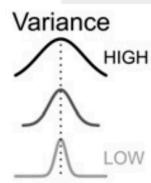


log(Plant height in cm)

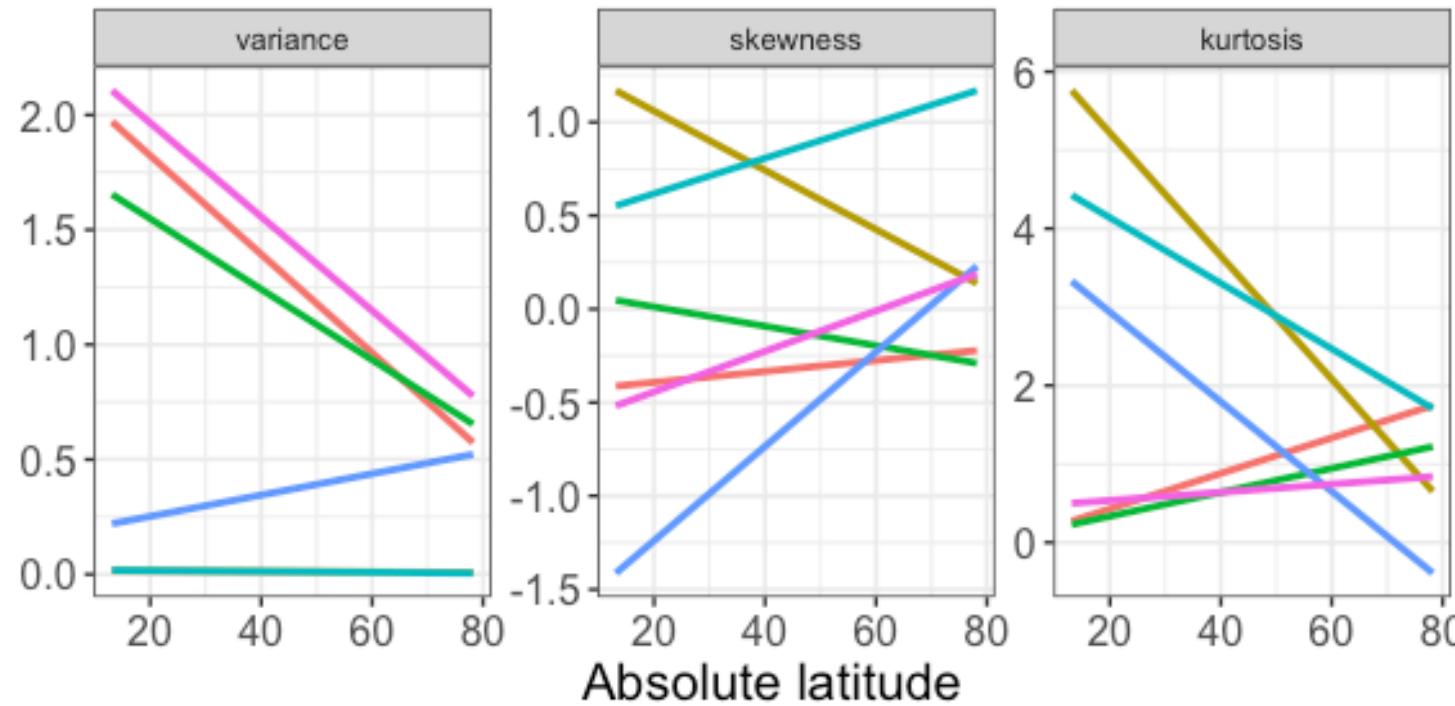




# How consistent are these patterns across latitude?



Shift in trait moments along latitude



- Dry mass
- LDMC
- Leaf area
- Leaf thickness
- Plant height
- Wet mass





**Regional context dependencies**

**Stronger global patterns for trait means**

**Higher trait moments show stronger global trends**