Alpine plant community-climate relationships across elevation gradients in the White Mountains, CA

CNPS Conference 2018

GLORIA Great Basin

Meagan Oldfather, Brian Smithers, Michael Koontz, Jan Nachlinger, Catie Bishop, Jim Bishop & Connie Millar

Photo by Mike Koontz

Communities Across Elevation

- Representative of broad-scale climate associations
- Upper elevational shifts with a warmer, drier climate

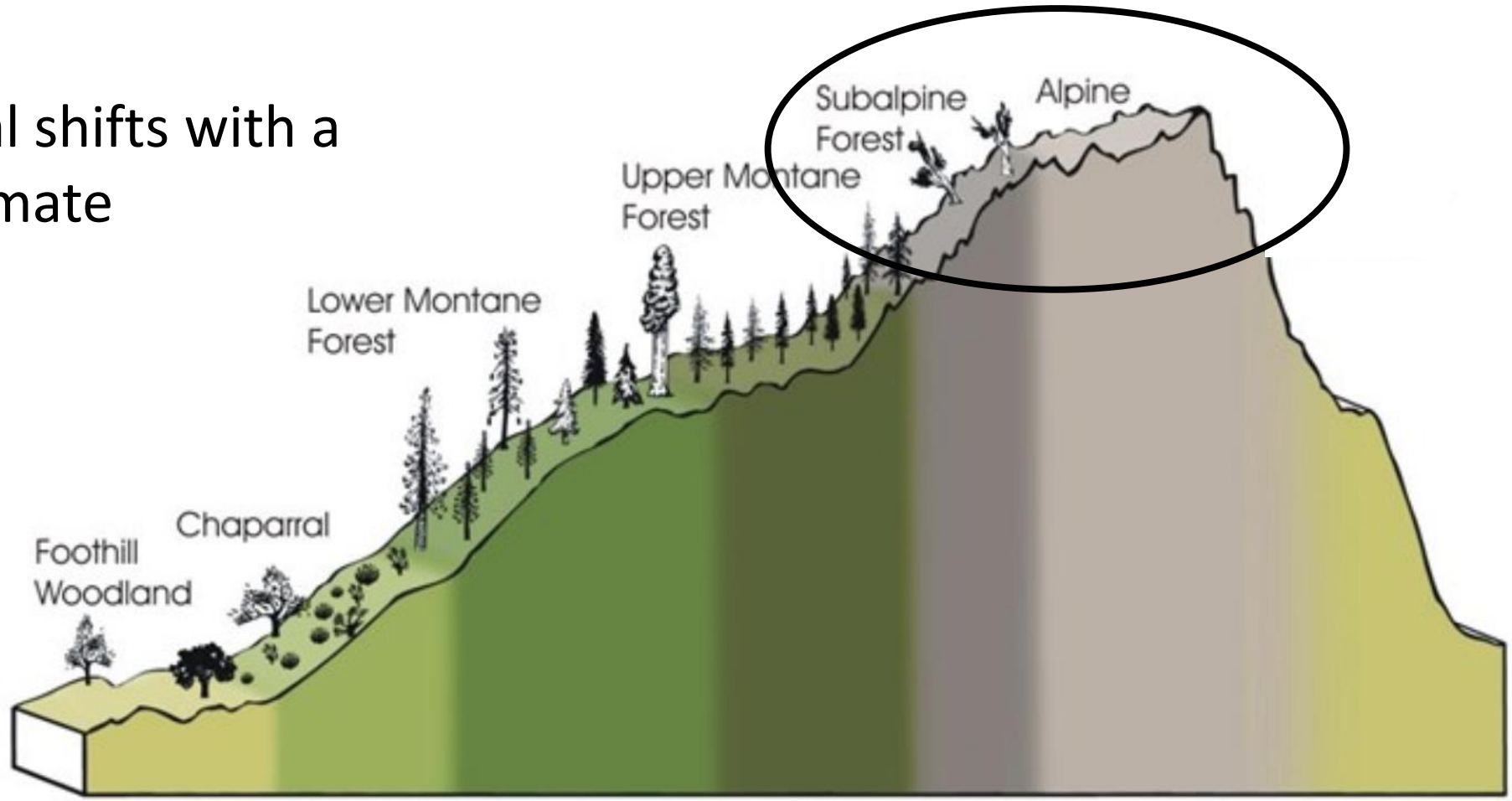
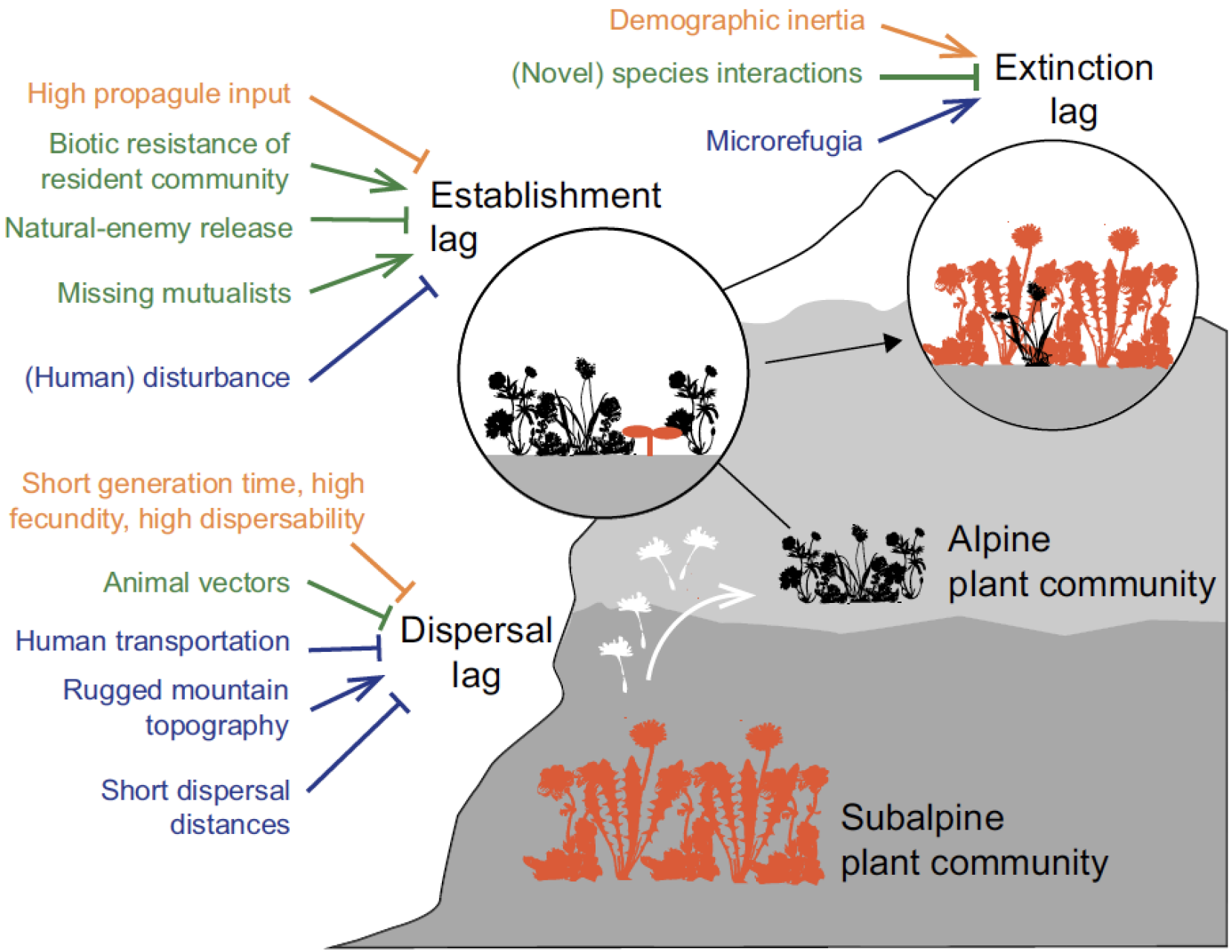


Illustration by Justin Hofman and Meryl Goldin Rose

Alpine Plant Communities

- Harbingers of biotic impacts of a changing climate
- Sensitive to climatic conditions & limited disturbance
- Western North America alpine shaped by patterns of temperature, precipitation and snow-pack

Community Turnover with a Changing Climate



Alexander et. al. 2017

Main Questions

1. Does the community climate niche change predictably across elevation gradients?

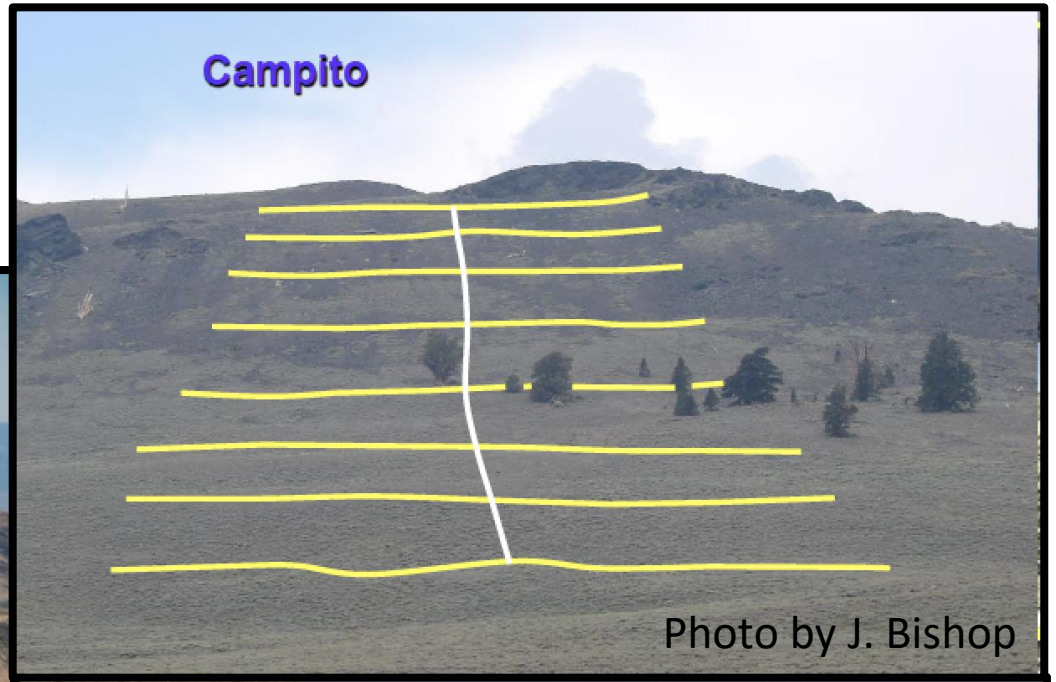
2. Does this relationship hold across different spatial scales?

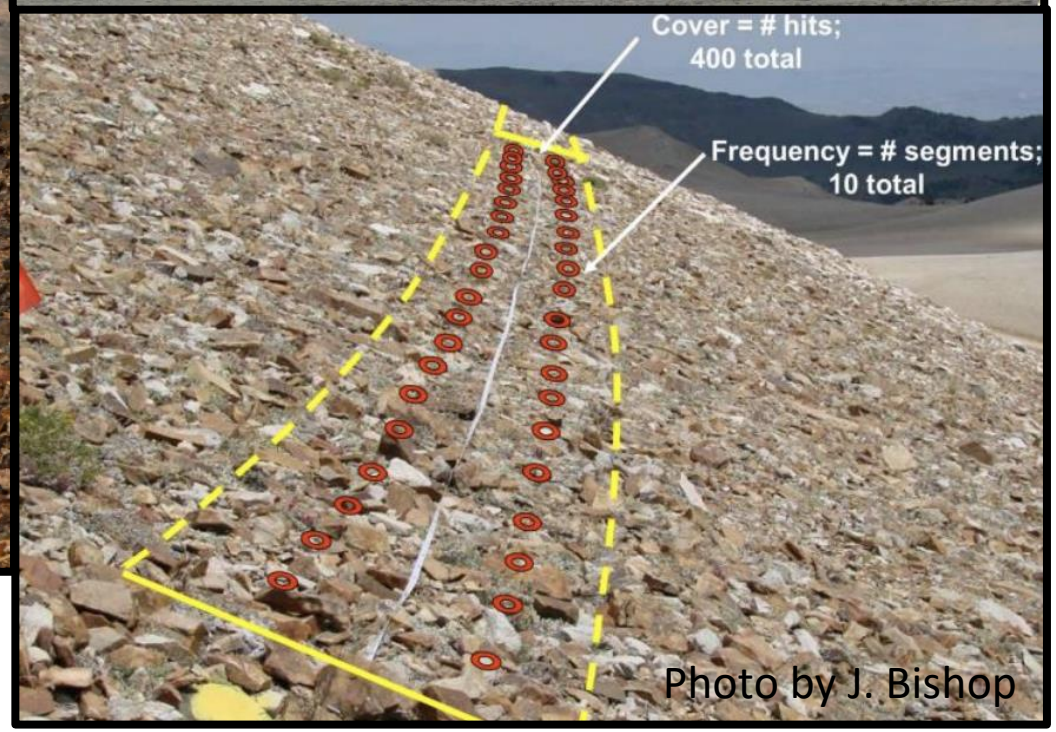



Global Observation Research Initiative in Alpine Environments (GLORIA) Great Basin

White Mountains, CA

Downslope Surveys



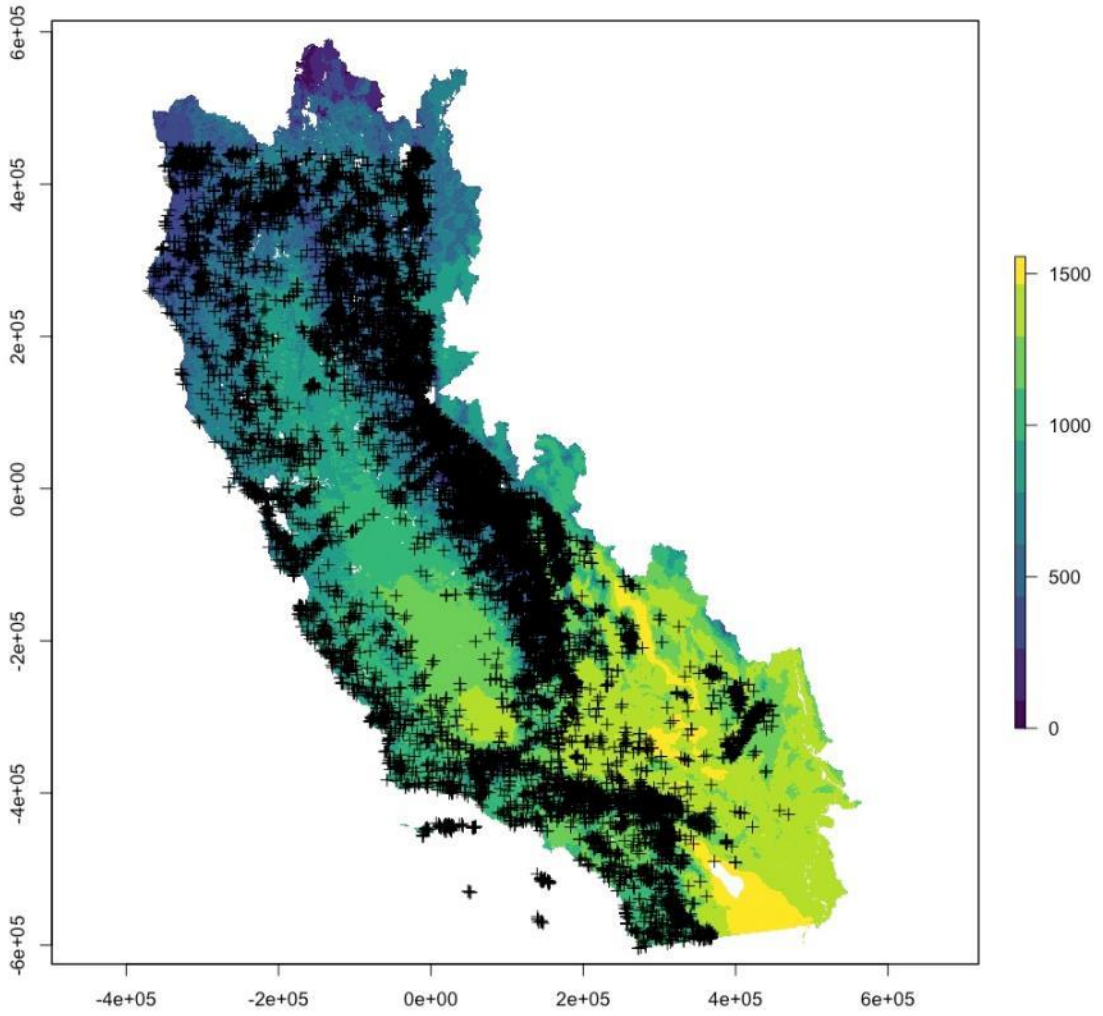


Calculating Community Niche Means (CNM)

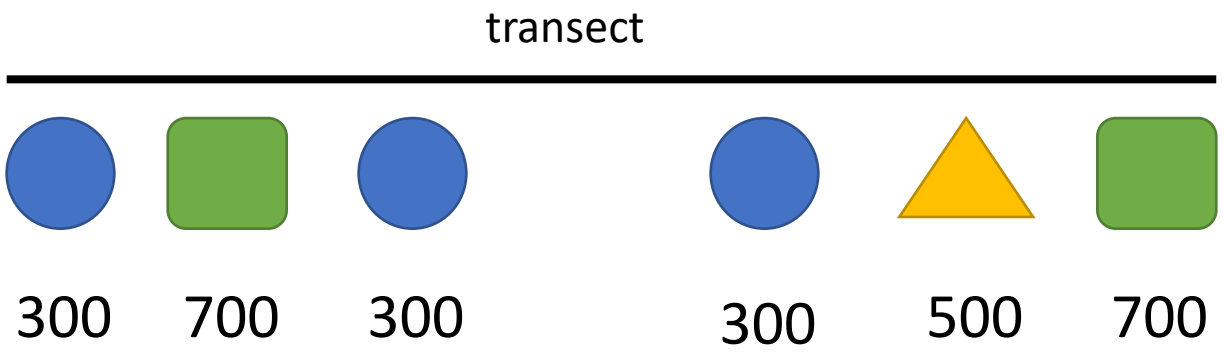
- CNM = abundance-weighted mean of each constituent species' average climatic niche in a single community

- Climatic niche based on CCH data of each species (Baldwin *et al.* 2017)

- Climatic Water Deficit, an integrative measure of when energy availability exceeds water supply (Flint & Flint 2013)



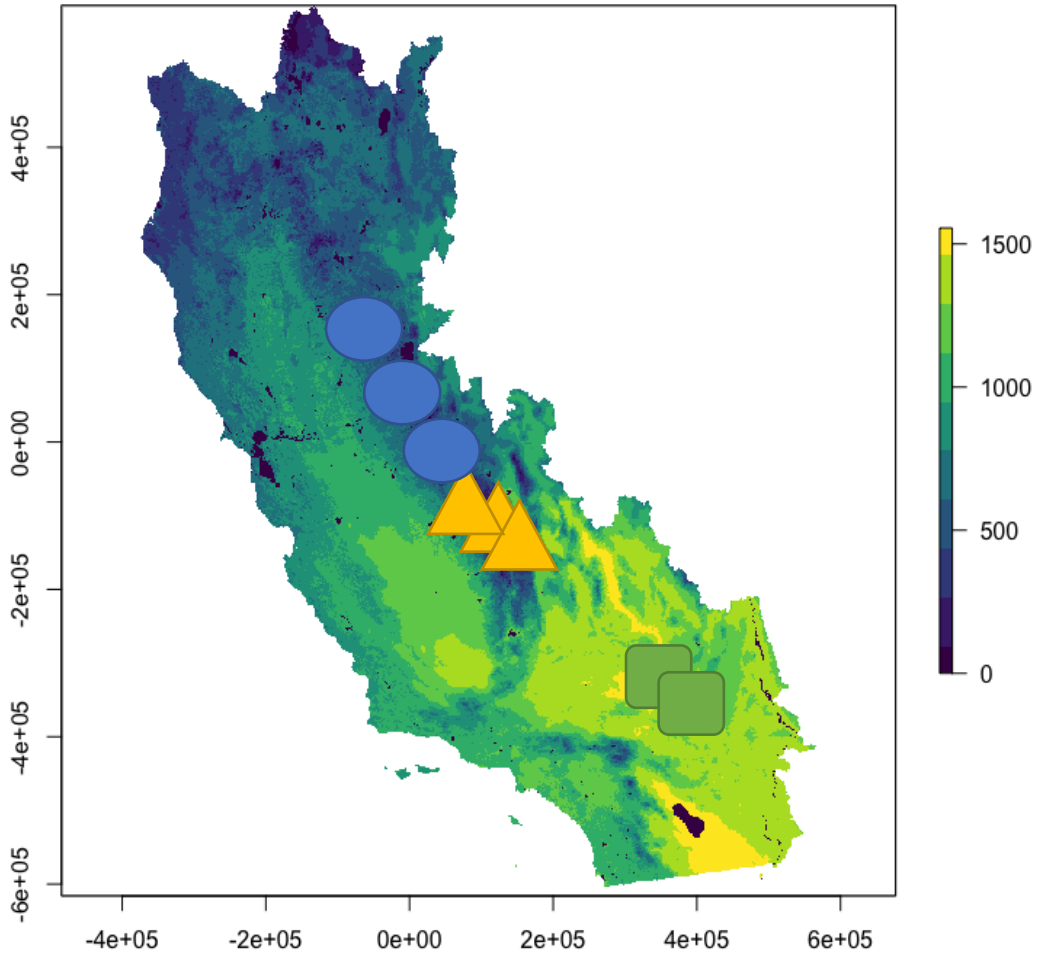
Calculating Community Niche Means (CNM)



300 * 3 + 700 * 2 + 500 * 1 = 2800

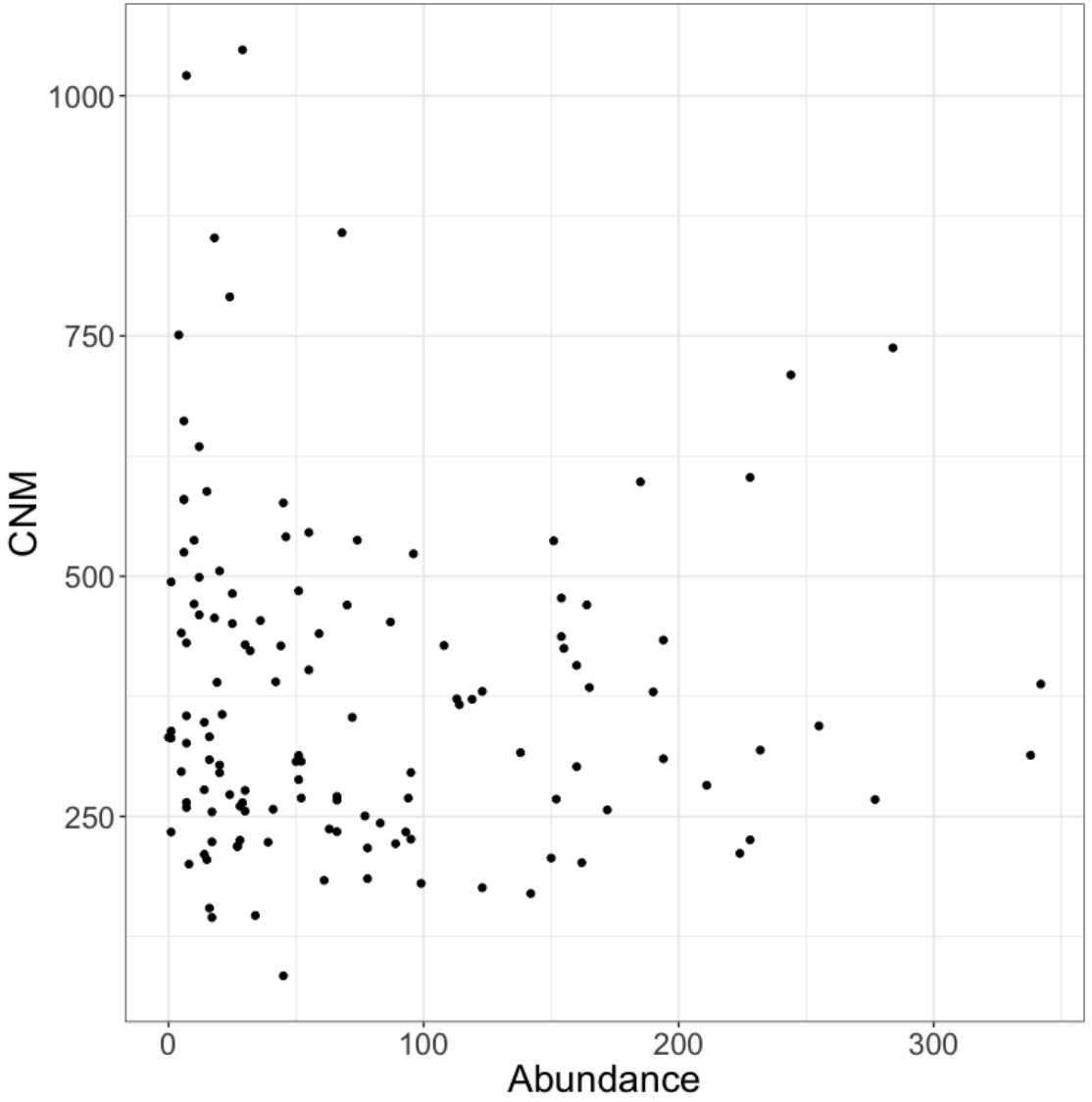
2800 / 6 = 467

CNM = 467

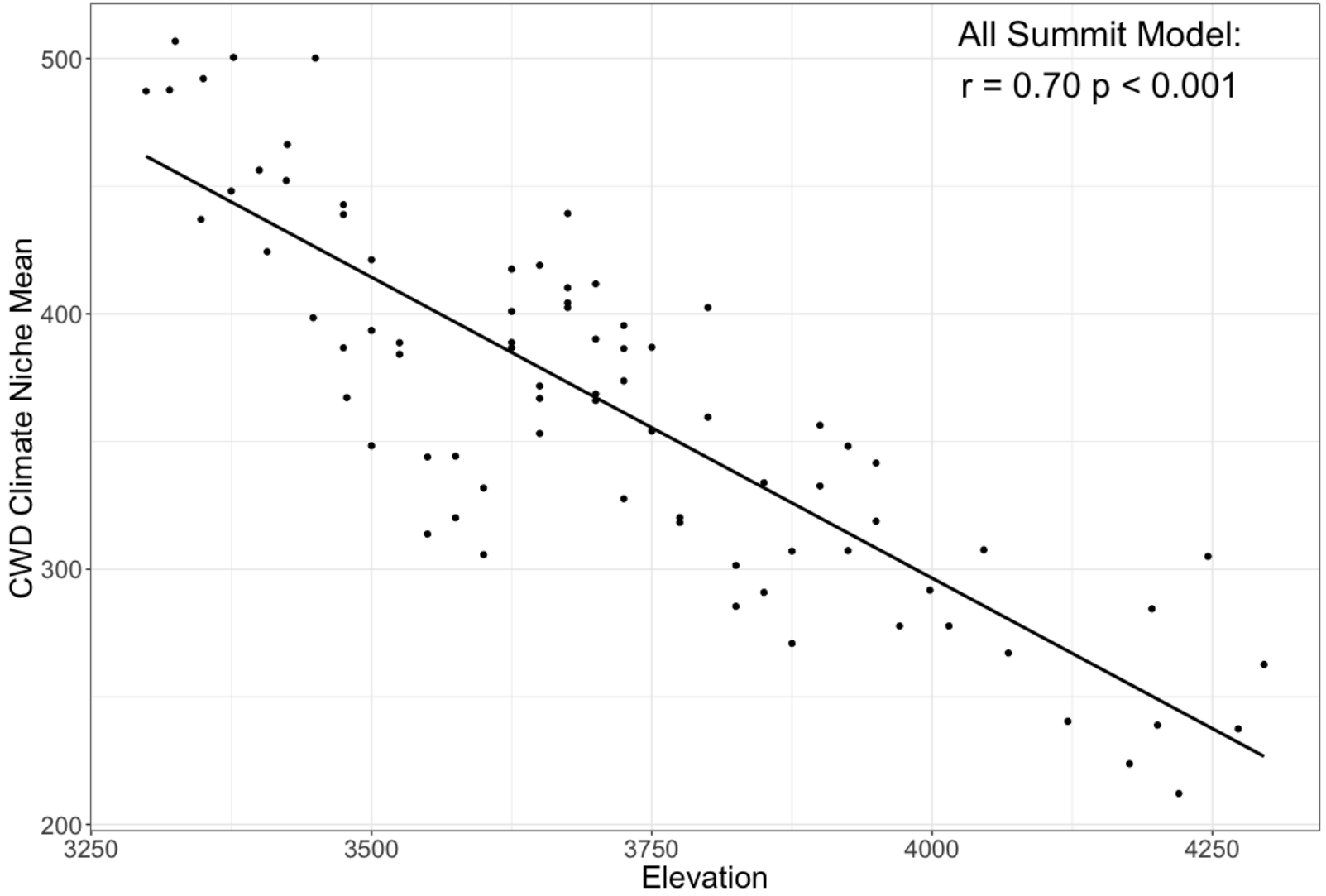


Community Characteristics

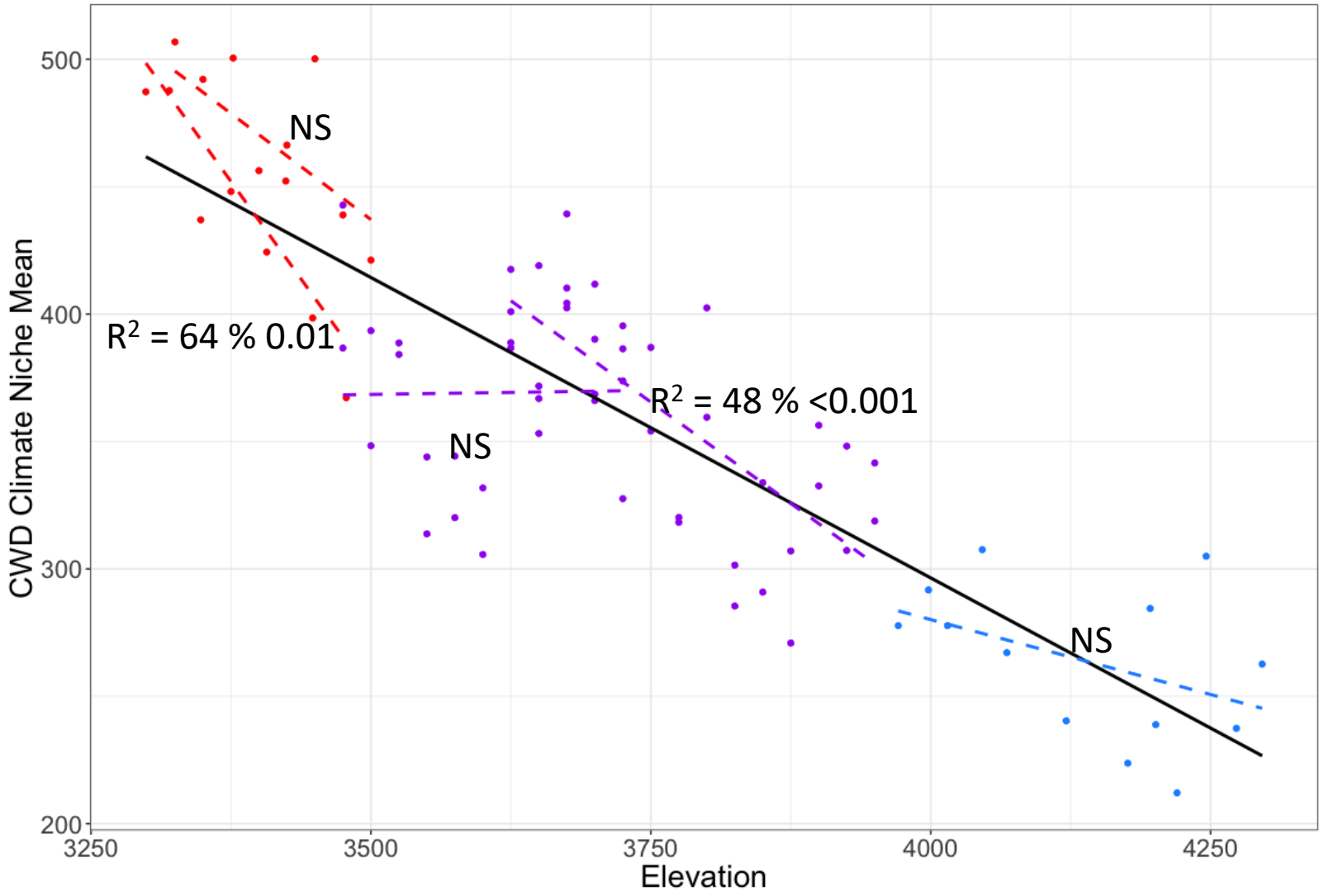
Species	CNM
Elymus elymoides var. californicus	388
Phlox condensata	314
Poa secunda subsp. secunda	738
Erigeron pygmaeus	268
Eremogone kingii var. glabrescens	344
Koeleria macrantha	710
Pyrrocoma apargioides	319
Linanthus pungens	603
Poa glauca subsp. rupicola	226
Draba oligosperma	212



Range-wide Relationship



Summit Relationships



Conclusions

- Species with cooler/wetter ranges were more commonly found at higher elevation
- Environmental sorting of species' local distributions at the scale of a mountain range
- For a single summit, weak or absent sorting potentially due to smaller-scale topographic effects shaping environmental conditions
- Community-climate relationships are scale-dependent & alpine plant range shifts predictions should consider fine-scale climatic conditions

Acknowledgements

White Mountain Research Center

Bristlecone Chapter

Photo by Mark Hoshovsky

Join Us!


Photo by Mark Hoshovsky

2018 Survey Dates

Death Valley National Park:
6/25 – 6/30

White Mountain downslope:
7/10 – 7/13

Great Basin National Park:
7/19 – 7/24

Contact:
gloriagreatbasin@gmail.com
meagan_oldfather@berkeley.edu