A functional trait perspective on alpine plant community responses to rapid climate change in a xeric mountain range

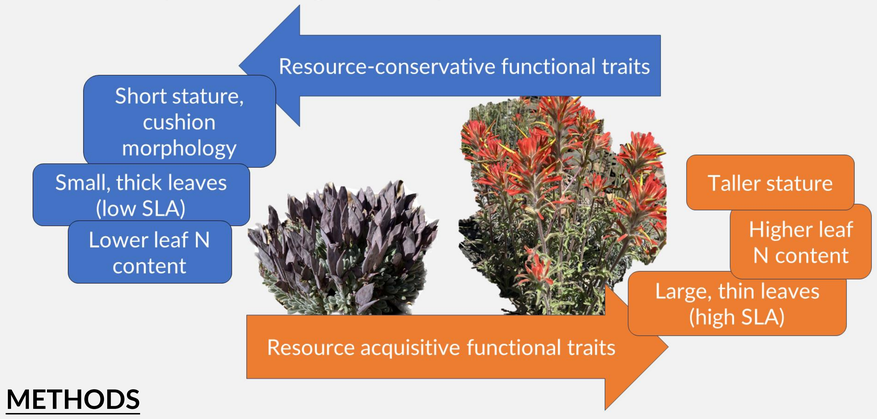
PRESENTER
Kaleb A. Goff
kagoff@ncsu.edu

AUTHORS
Kaleb A. Goff[1,2], Meagan F. Oldfather[1,3], Jan Nachlinger[1], Brian V. Smithers[1,4], Michael J. Koontz[1,5], Catie Bishop[1], Jim Bishop[1], Seema N. Sheth[1,2]

[1]GLORIA Great Basin, Oroville, CA, USA
[2]Department of Plant and Microbial Biology, North Carolina State University, Raleigh, NC
[3]North Central Climate Adaptation Science Center US Geological Survey, Boulder, CO
[4]Department of Ecology, Montana State University, Bozeman, MT
[5]Earth Lab, University of Colorado, Boulder, CO

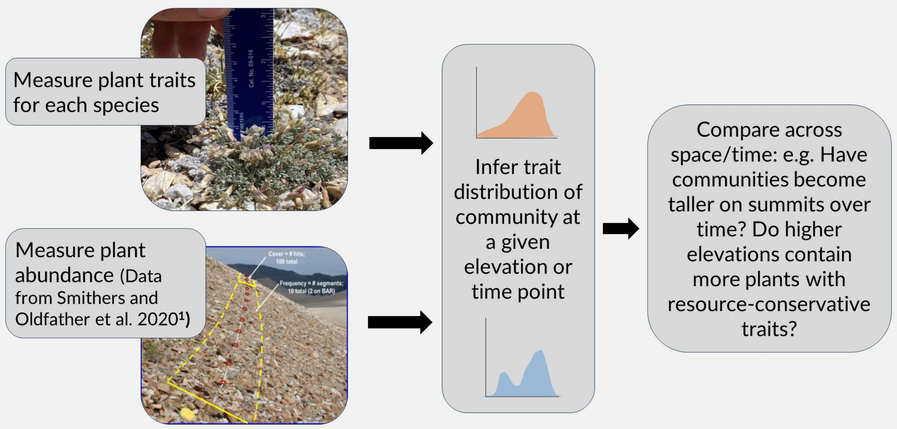
BACKGROUND

- Understanding which species are the most threatened by climate change is a key challenge in global change biology.
- Species adapted to cold conditions with long lifespans and limited ability to move to track favorable climate conditions may be some of the most likely to be highly sensitive to rapid climate change. Plants growing on mountain summits are one such example.
- Traits are directly related to ecosystem processes such as carbon cycling and may provide more generalizable information about community-level changes than species identities.

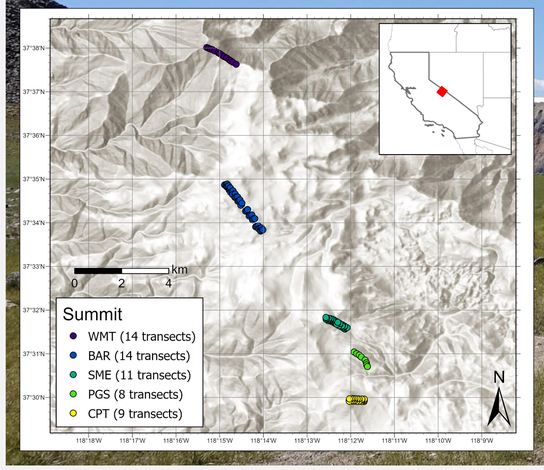


METHODS

- Collect data for each species across five plant functional traits: plant vegetative and generative height, leaf area, specific leaf area, and leaf dry matter content. Measure plant abundance along elevation gradients and at multiple time points using segmented belt transects.
- Estimate trait distributions using community-weighted averages, calculated as the sum of species-level trait values multiplied by their proportional abundance in each transect.



Plant traits can be used to understand climate change impacts in high elevation ecosystems



PRELIMINARY RESULTS

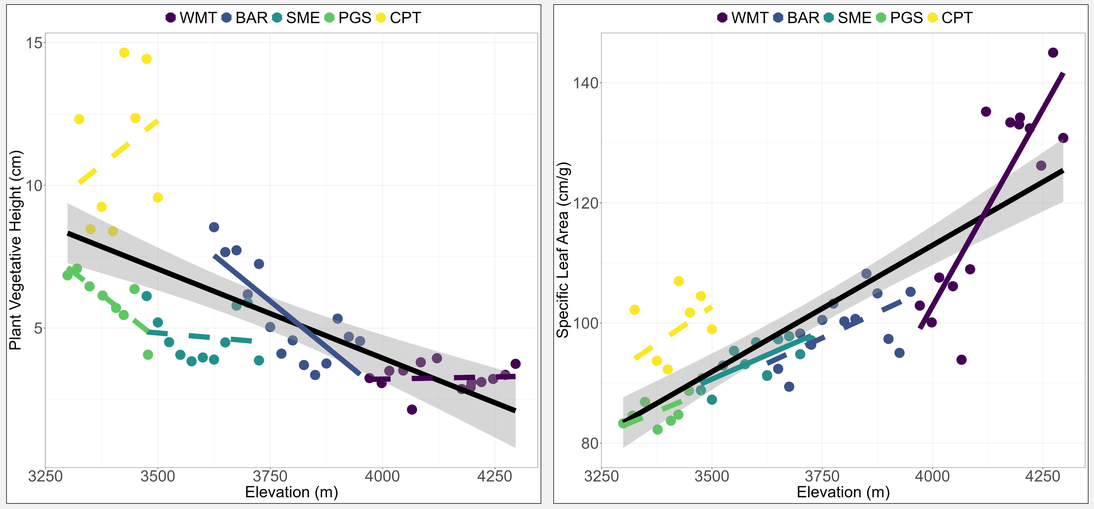


Figure 1: Community-weighted mean traits along an elevation gradient. Each point represents a community (belt transect segment), colored by peak, and lines show the relationship between elevation and two plant functional traits: vegetative height and specific leaf area. Dashed lines show slopes that are not significantly different from zero using a Bonferroni-corrected significance threshold of P = 0.01.

PRELIMINARY CONCLUSIONS

- Across the elevation gradients on individual peaks (colored lines), relationships between traits and elevation are relatively weak, and communities become enriched with a mix of resource acquisitive and conservative traits as elevation increases.
- Across the elevation gradient of the entire mountain range (black line), there are strong relationships between elevation and traits. Plant height decreased and SLA increased with elevation, consistent with shifts to resource acquisition and resource conservation, respectively.

LITERATURE CITED:
1. Smithers, B. V., Oldfather, M. F., Koontz, M. J., Bishop, J., Bishop, C., Nachlinger, J., & Sheth, S. N. (2020). Community turnover by composition and climatic affinity across scales in an alpine system. *American Journal of Botany*, 107(2), 239-249.

ACKNOWLEDGEMENTS
We gratefully acknowledge the hard work of functional trait field technicians Malia Reiss and Sylvie Amstutz. Thanks to NCSU undergraduates Sophie Meng, Emma Wilson and Mataeus Funderburk for lab assistance with functional trait data. Abundance data was collected thanks to the hard work of hundreds of volunteers. Sarah Hecocks contributed the inset study area map, with inspiration from Smithers and Oldfather et al. 2020.