



Geology and Distance Shape Alpine Plant Community Turnover in Washington's Cascade Mountains

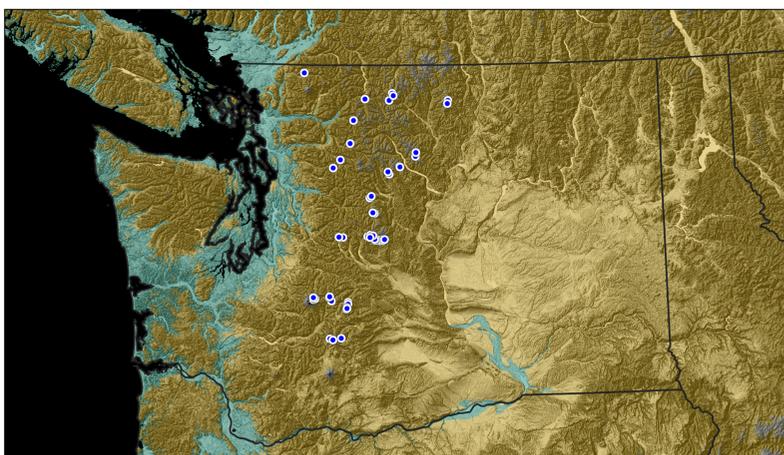
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Introduction

- The primary drivers of alpine plant community turnover are not fully understood; environmental, historical, and stochastic processes likely play a role
- Geology is suggested to be a major factor that affects plant distributions in general, but its role in shaping particular alpine plant communities is rarely quantified
- Plant communities that are closer together are also more likely to have similar geology, so geographic distance must be controlled for
- Question:** How much variation in alpine plant community composition can be explained by geology after accounting for geographic distance?

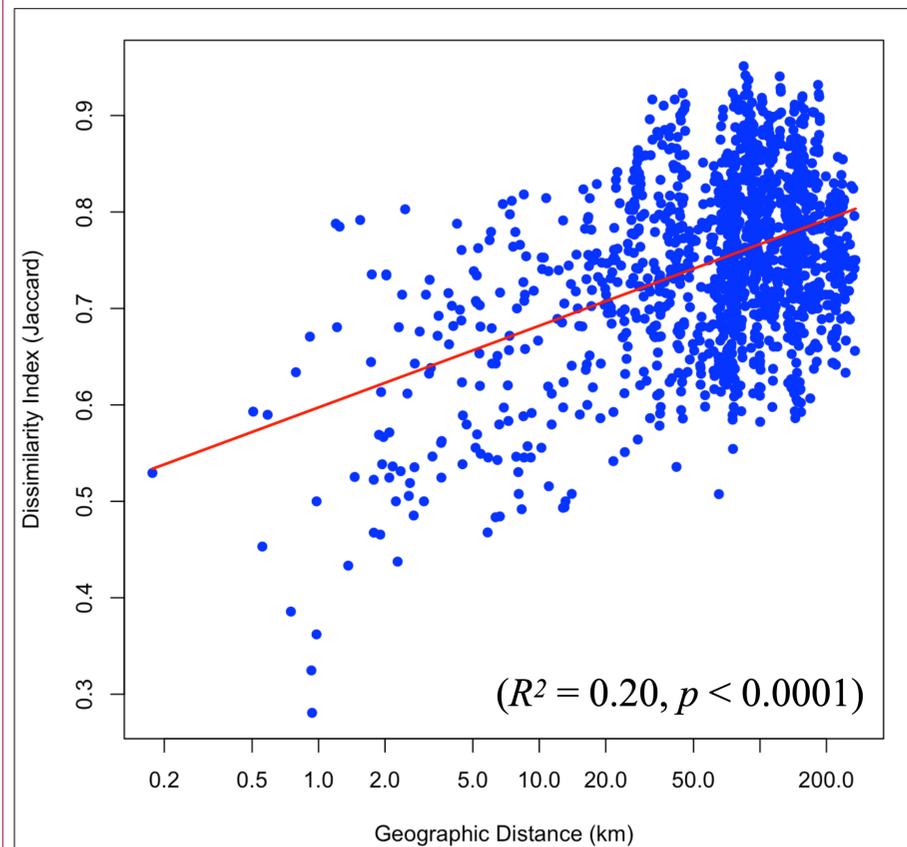


Methods

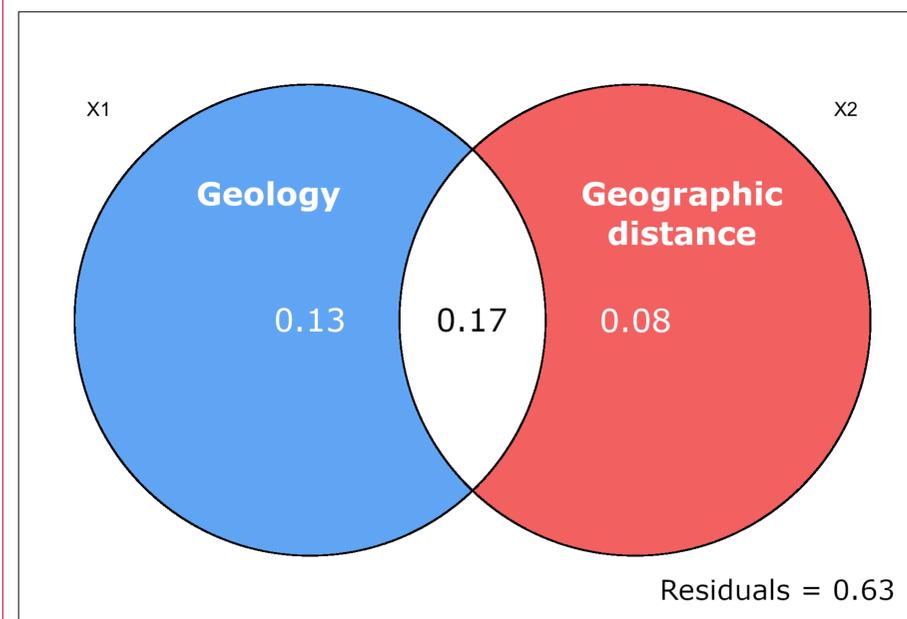
- Plant species presence/absence recorded at 55 alpine sites in Washington's Cascade mountains.
- Plant community compositional differences among sites were quantified using pairwise Jaccard dissimilarity.
- To account for geographic proximity, spatial eigenvector predictors were derived from geographic distances (PCNM/MEM) and a reduced set of spatial variables that best accounted for variation were selected.
- Distance-based redundancy analysis (dbRDA) and variation partitioning were used to estimate the unique and shared contributions of geology and spatial structure to community composition.
- Statistical significance was evaluated using permutation tests (999 permutations).

Results

Distance-decay plot showing geographic distance plotted against Jaccard dissimilarity for each pairwise combination of sites



Variation partitioning results; amount of variation in alpine plant community makeup explained by geology and geographic distance



Discussion

Distance-Decay Plot:

- Plot clearing shows correlation between distance and Jaccard dissimilarity, with a wide spread around line of best fit
- Linear regression shows distance accounts for about 20% of variation in plant community composition

Variation Partitioning:

- Geology and geographic distance together account for 37% of variation in alpine plant community composition:
 - 17% shared between geology and geographic distance
 - 8% unique to geographic distance
 - 13% unique to geology
- 63% of variation unaccounted for

Conclusion: Geology is a modest but significant factor in alpine plant community turnover, and additional environmental and historical factors likely play major roles.

Future Questions:

- What are the other drivers of alpine plant community turnover? (e.g. climatic, phylogenetic, historical)
- How might this pattern look in other mountain ranges with different histories?

Acknowledgements

Thank you to Brielle Canares, Matthew Inthone Chao, Iris Dimpsey, Payton Danosky, Erik Ertsgaard, Nicholas Gjording, Ava Jeanne Gutheil, Winston Hackett, Ava Kloss-Schmidt, Samantha Lieberman, Leo Linder, Sophia Ronan, Phoebe Smurthwaite for previous field work; Liz Bell and Peter Dunwiddie, Tony Cavalieri and Ellen Look, Jim Duemmel, Jennie Goldberg and Peter Stekel, Nole Knoke, Wendy McClure, Carol Nygren, Ann and Don Schaechtel, Donovan and Linda Tracy, Ann and Fred Weinmann for financial support of the project; Dan Post and Crystal Shin for databasing support.

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