# Plant communities across topographic gradients:

# Post-fire vegetative diversity along ridgelines in southwestern Oregon


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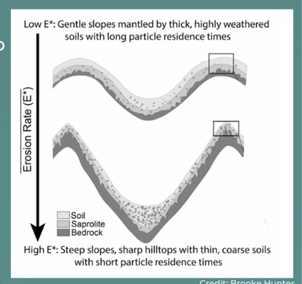
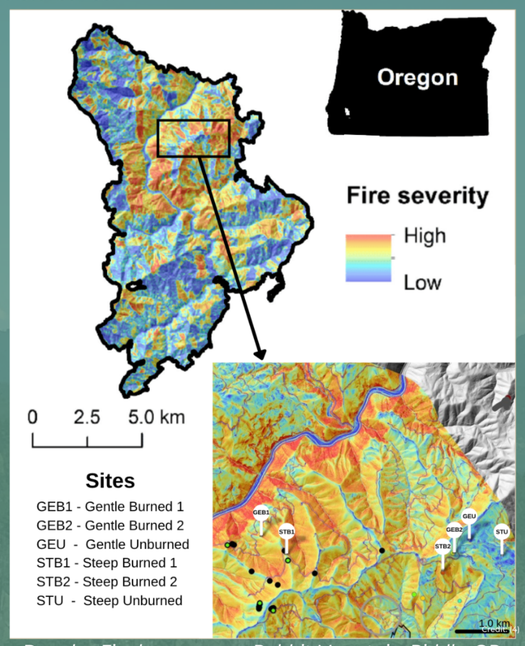
## Background

- The Klamath Mountains tie together a multitude of geomorphological processes and ecosystems and are well known as a unique landscape of diverse topography and exceedingly diverse flora. (1,2,3)
- This diverse topography is characterized by both steep ridgelines, which have shallower, rocky soils and gentle ridgelines, which have thicker, more highly weathered soils
- Previous studies found the complex geology of this region to be related to the structure, composition, and productivity of vegetation (1,2)




Credit: Brooke Hunter

- In 2013, the Douglas Fire complex burned nearly 20,000 hectares of southwestern Oregon forests in the Klamath Mountains near Riddle, OR. (4)
- Vegetation is not randomly assembled across space -- one of the major endeavors of ecology is understanding how spatial patterns relate to species diversity and distribution (3,5,8)
- The Intermediate Disturbance Hypothesis predicts the highest diversity occurs at moderate levels of disturbance (9). In this case, both fire and topography are forms of disturbance.




*Douglas Fire burn scar on Rabbit Mountain, Riddle, OR*

## Research Focus

- Does vegetation differ across fire-disturbed topographic gradients? Do different plant communities assemble at different ridgelines?
- If so, how does vegetation differ? How are plant communities different?

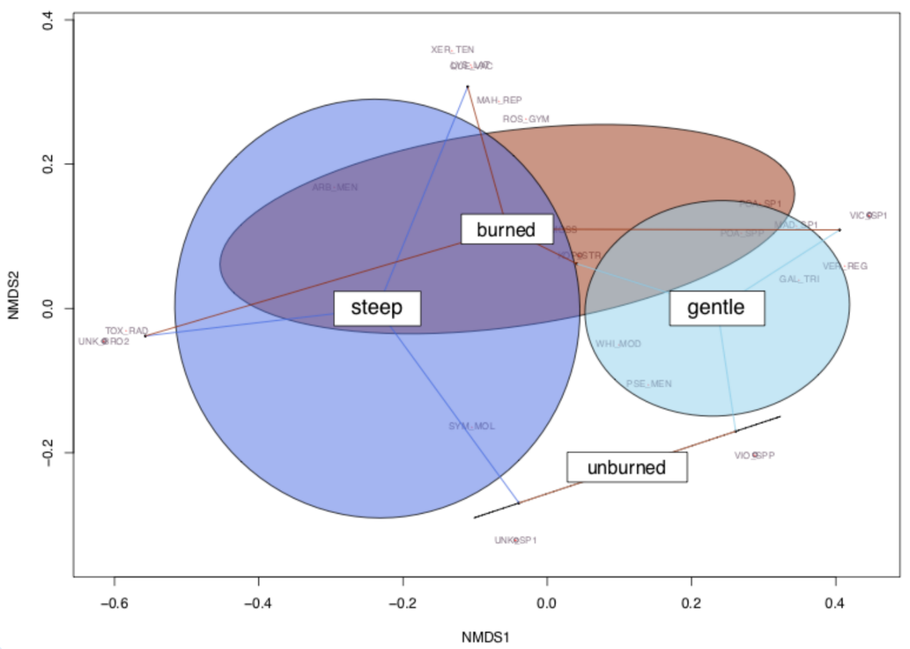
## Methods

- Six ridgelines on Rabbit Mountain were study sites to explore vegetation changes across terrain steepness and wildfire burn severity
- *Quadrat* and *line-point intercept* techniques were used to quantify vegetation cover, relative abundance, community composition.
- Burn severity estimates achieved using relativized differenced Normalized Burn Ratio (RdNBR) via satellite ensor imagery.
- Topographical categories determined by observing curvature of hilltops via topographic lidar analysis of a digital elevation model.
- Statistical Analyses computed in R: Non-metric Multidimensional Scaling, Rank-Abundance Curves, Shannon Diversity Index.

## Findings

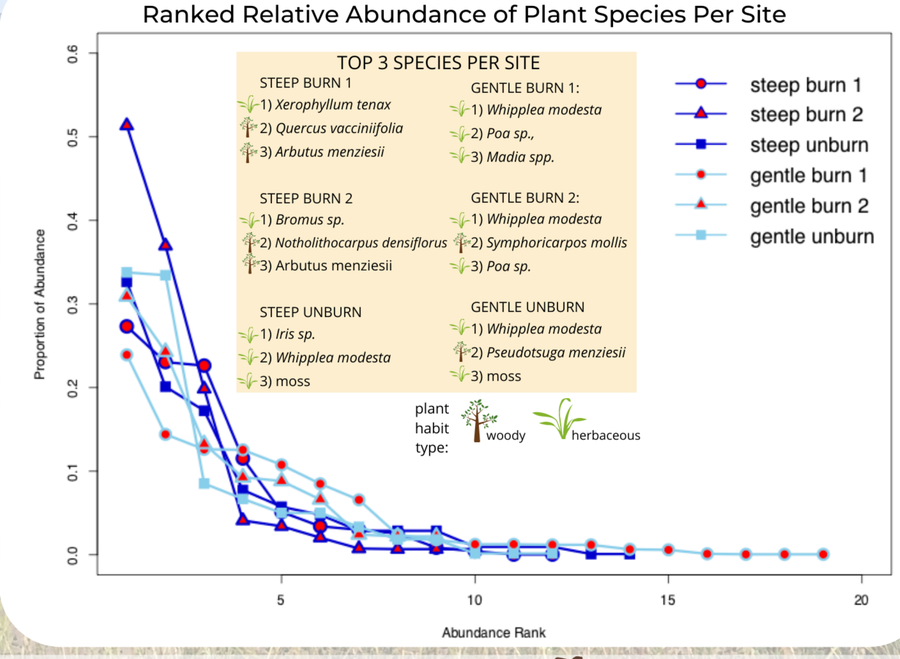
*Non-Metric Multidimensional Scaling:*

A Comparison of Plant Communities via Topographic Gradient and Burn Status




*Whittaker / Rank Abundance Plot:*

Ranked Relative Abundance of Plant Species Per Site




Plant community composition was significantly different between steep and gentle ridgelines.

More overlap between burn/steep than burn/gentle indicates burned and steep communities shared more common species.

Woody species tended to occur in steep communities while herbaceous species tended to grow in gentle communities

The larger ellipse for steep sites indicates more variation/spread among steep communities than gentle communities.

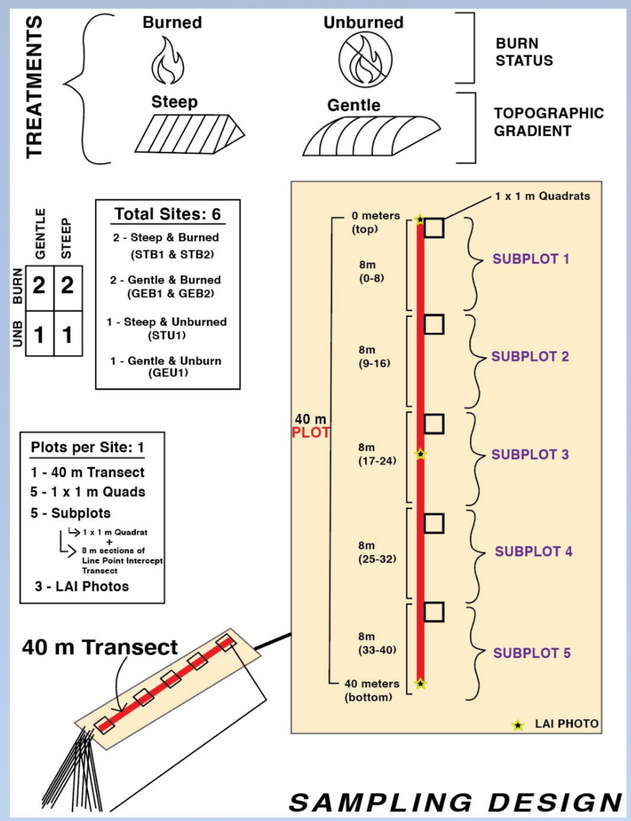
NMDS ellipses for steep and gentle communities do not overlap, indicating statistical difference.

Gentle Burn 1 was the site with the greatest species richness, followed by the Steep Unburned site.

Each point corresponds with a species. Species with an Abundance Rank of "1" were the most abundant at that site, species ranked "2" were the 2nd most abundant at that site, etc.

Sites with steeper lines indicate lower species evenness.

Sites with fewer ranked species indicate lower species richness




## Reflections

- The data supports our hypothesis that plant communities on steep and gentle ridgelines differ in composition. Overall, percent cover was higher at steep ridgelines, and woody species dominated these sites.
- Some woody species, such as *Arbutus menziesii,* prefer shallow, rocky soils and have special post-fire resprouting adaptations which allow them to quickly recolonize areas following disturbance.
- Although species diversity was not significantly different between sites, gentle ridgelines overall had greater richness than steep ridgelines regardless of burn history.
- Limited by our small sample size, we expect increased sampling could to lead to stronger trends in species diversity and community composition. As topographic variance exists more along a gradient, rather than two distinct categories, there is some variance within the fast and slow groups. In future research, a gradient rather than a binary analysis may be insightful.
- Exploratory projects like this offer insight into the mechanisms and importance of the diversity of landscapes and life we see. Studying how landscapes exists in relation to vegetation deepens our understanding of the connectedness of Earth's processes. Land management and conservation practices are only increasing in importance in the face of climate change and bringing together these disciplines will help inform solutions. Further research into the relationship between topography, fire, and vegetation is critical to building our understanding of the connection between these realms

## References


(1) Whittaker 1960. (2) Skinner 2006. (3) Halofsky 2022. (4) Zald and Dunn 2018.
5) Reinhart et al. 2010. (6) Connell 1978. (7) Barton and Poulos. (8) Stein et al. 2014. (9) Huston 1979.



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