Comparison of Microbial Enzymatic Activity of Slope Aspect and Shrub Species in CSUSM Chaparral

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INTRODUCTION

- In the northern hemisphere, the direction a slope is facing influences the microclimate on the slope.
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- Microbial communities play a critical role in nutrient cycling by breaking down organic matter, these processes are often regulated by environmental factors, including slope aspect and plant species (Jackson et al. 2013).
- Soil microbes produce extracellular enzymes that drive the decomposition of organic material and nutrient availability (Vourlitis et al. 2021).
- Therefore, in this study we compare the microbial enzyme activity of the soil from north and south facing slopes of CSUSM chapparal communities. To get at this, the concentration of Phosphatase, NAGase, and β – Glucosidase.

Figure 1. *Salvia mellifera*

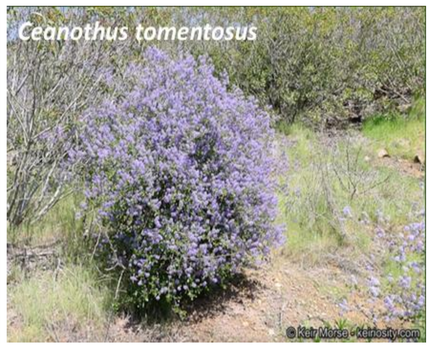


Figure 2. *Ceanothus tomentosus*

METHODS

- Soil was collected along the drip line of each shrub species at 10 different locations per each opposite facing slope.
- Prepped 5 g of sieved soil mixed with 5 mL of 50 mM acetate buffer; saturated for 24 hours at room temperature.
- Assay was created using 150–200 µL of soil slurry pipetted into wells and then adding enzyme specific substrates.
- The samples were then incubated and vortexed, and the supernatant was then extracted for analysis.
- A sample absorbance analysis was then run on the data.

Figure 3. Transect lines for soil collection on each slope in the CSUSM chaparral. 5 sites per line, as well as each species per site.

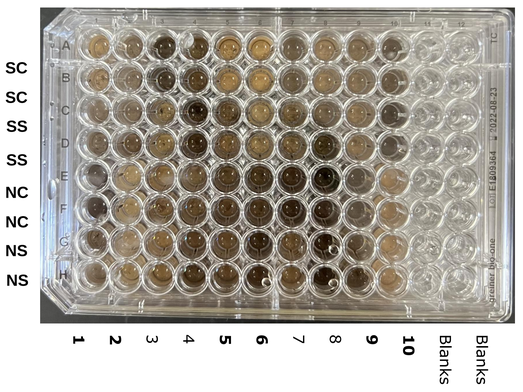


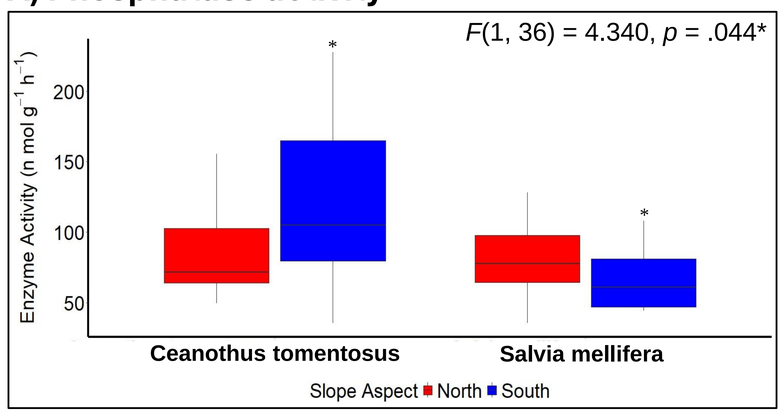
Figure 4. Extracellular Enzyme Assay Setup. Each sample had a duplicate in the same column. Blanks were placed on the final two columns with only buffer and substrate.

RESULTS

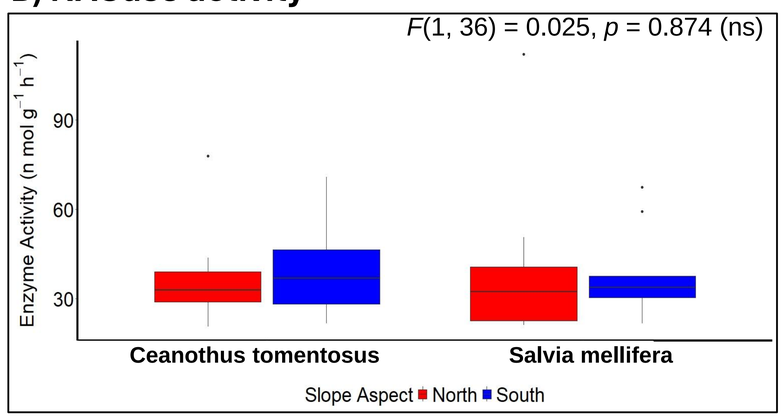
	B_glu	Nag	Phos	
pH	0.09	0.11	-0.03	1
sH2O	0.05	-0.04	0.13	0.8
Adj_NO3	-0.24	-0.12	**-0.36**	0.6
Adj_NH4	-0.09	0.20	-0.11	0.4
DIN	-0.18	0.12	-0.24	0.2
[P]	-0.08	0.08	-0.05	0
SOM	**0.39**	0.30	**0.49**	-0.2
Soil_N%	0.17	0.29	0.03	-0.4
Soil_C%	0.28	**0.33**	**0.40**	-0.6
Soil_CN	0.18	-0.07	**0.41**	-0.8
DOC	**0.34**	0.28	**0.44**	-1

Figure 5. Correlation matrix for soil variables and enzyme activity. Significance values are in bold with a Rcrit = 0.312. Positive correlation is shaded in blue and negative correlation is shaded in red.

A) Phosphatase activity



B) NAGase activity



C) β - Glucosidase activity

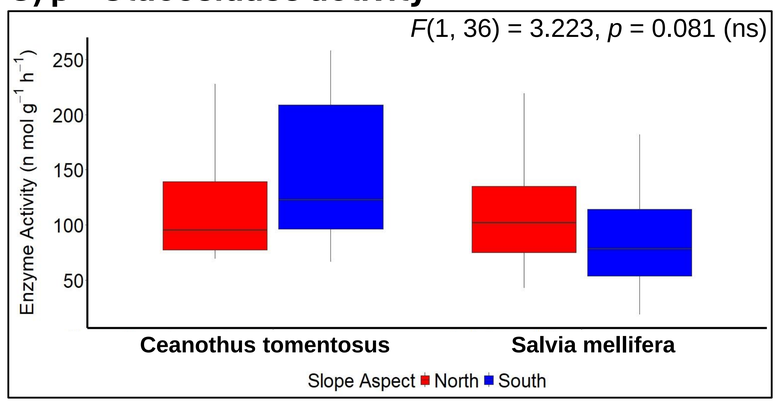


Figure 6. Boxplots of extracellular enzyme activities of soil from in North (Red), South (blue). Error bars represent ±SEM N=10. The F-statistics and p-values were calculated using two-way ANOVA. (a) Average Phosphatase activity , (b) average NAGase activity at each site,(c) average B - Glucosidase activity at each site. Significance is marked with an asterisk (*p<0.05,**p<0.01, ***p<0.001).

CONCLUSIONS

- It was found that microclimate differences of slope aspects did not significantly affect enzyme activity
- We found that phosphatase activity was significantly different based on species.
- SOM, soil C%, Soil CN ratio, and DOC was significantly correlated with phosphatase levels.
- SOM and DOC was significantly correlated with β – Glucosidase.
- Soil C% was positively correlated with NAGase

References

Jackson, C. R., Tyler, H. L., & Millar, J. J. (2013). Determination of Microbial Extracellular Enzyme Activity in Waters, Soils, and Sediments using High Throughput Microplate Assays. *Journal of Visualized Experiments*, *80*. https://doi.org/10.3791/50399

Vourlitis, G. L., Kirby, K., Vallejo, I., Asaeli, J., & Holloway, J. M. (2021). Potential soil extracellular enzyme activity is altered by long-term experimental nitrogen deposition in semiarid shrublands. *Applied Soil Ecology*, *158*, 103779. https://doi.org/10.1016/j.apsoil.2020.103779