The effect of vegetation and topography on extracellular enzyme activity at the Luquillo Critical Zone

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Background

- Extracellular enzyme activity (EEA) in soils is the proximate cause of organic matter decomposition
- Studies on microbial decomposition and EEA are limited in tropical systems
- The Luquillo CZO is a montane tropical forest in which broad environmental gradients exist due to differences in parent material, dominant vegetation, topography and climate. This offers a unique opportunity to determine specific environmental controls on critical zone processes such as decomposition.

Research Question

How does EEA change across dominant forest types and landscape slope positions at the LCZO?

Enzymes measured in this study, their functions and substrates

(Germain et al. 2011)

<table>
<thead>
<tr>
<th>Enzyme</th>
<th>Function</th>
<th>Substrate</th>
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<tbody>
<tr>
<td>β-1,4-glucosidase</td>
<td>Catalyzes the hydrolysis of terminal 1,4 linked β-D-glucose residues from β-D-glucosides, including short chain cellulose oligomers.</td>
<td>4-MUB-β-D-glucoside</td>
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<tr>
<td>Acid phosphatase</td>
<td>Mineralizes organic P into phosphate by hydrolyzing phosphoric (mono) ester bonds under acidic conditions.</td>
<td>4-MUB-phosphate</td>
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<tr>
<td>Leucine aminopeptidase</td>
<td>Catalyzes the hydrolysis of leucine and other amino acid residues from the N terminus of peptides. Amino acid amides and methyl esters are also readily hydrolyzed by this enzyme.</td>
<td>L-Leucine-7-amino-4-methylcoumarin</td>
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<tr>
<td>Polyphenol oxidase</td>
<td>Mediates free-radical oxidation reactions on heterocyclic compounds.</td>
<td>L-3,4-dihydroxyphenylalanine</td>
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Hypotheses

1) C acquiring EEA will decrease with landscape slope due to decreased soil C availability
2) C acquiring EEA will be higher in Colorado forest relative to Tabunuco due to greater microbial C-limitation
3) N and P acquiring EEA will remain constant across catena positions and forest types

Results

- Higher levels of P than C acquiring EEA are found across both forest types
- Higher levels of P and C acquiring EEA in Colorado relative to Tabunuco forest
- Declines in EEA with higher slope position for both P and C acquiring enzymes

Conclusions

- Continue measuring activity of N, P and C acquiring enzymes
- Incorporate other important landscape variables, including bedrock and climate gradients