Observing Extracellular Enzyme Activity (EEA) in the Sonoran Desert

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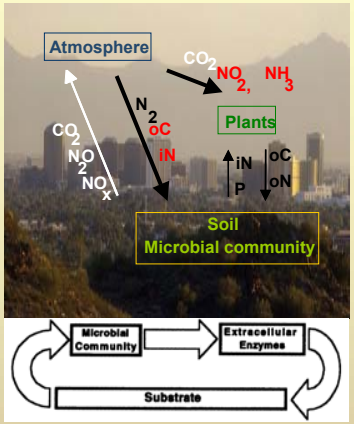
Urbanization and EEA

- Decomposition of soil organic matter is carried out by microorganisms that release enzymes into the environment.
- Urbanization in Phoenix has led to major changes in landscapes, particularly by the inclusion of mesic yards.
- Furthermore, urbanization can also lead to more emission of C and N to the atmosphere. When deposited to the ecosystem, these elements may act as nutrients that can alter the production of extracellular enzymes.



Question: How does urbanization affect extracellular enzyme activity in an arid shrubland?

H I: Introduction of new landscapes and human management of those landscapes alters EEA

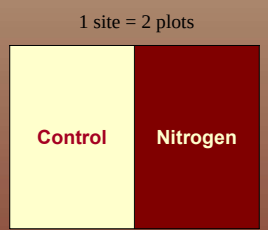
H II: Deposition of nitrogen and other indirect anthropogenic factors alter EEA.

To test human management (Hypothesis I):

- Sampled soils from mesic, urban desert remnant, and outlying desert landscapes

To test indirect human impact (Hypothesis II):

- Sampled soils from desert sites upwind, within (core), and downwind from the city

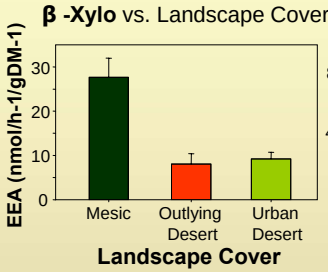


Enzyme Assays

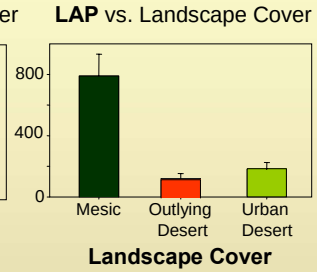
Samples were taken to Albuquerque, NM to be assayed. 1 gram of fresh soil from each sample was placed in 96-well trays with standards, respective substrates and buffers. After reacting, the mixture changed color or fluoresced. Color or fluorescence was read on a spectrophotometer or fluorometer, and EEA calculated from standard curves.

EEA significantly higher in mesic landscapes

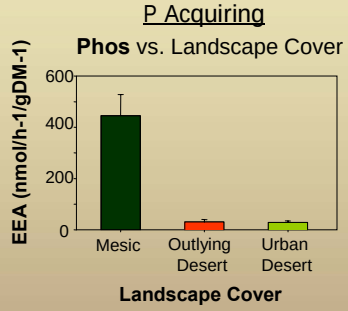
C Acquiring



N Acquiring



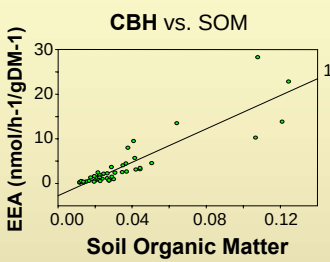
P Acquiring



We hypothesized that introduction of new landscapes and human management would lead to alterations in EEA. Oneway ANOVA tests between mesic, outlying desert and urban desert sites found that for all enzymes there was a significance difference between activity in mesic site and desert sites, but there was no significance between the two desert sites. Shown are examples for C, N, and P-acquiring enzymes.

EEA directly related to SOM

C Acquiring



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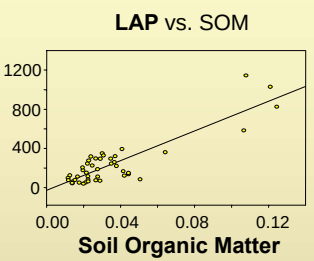
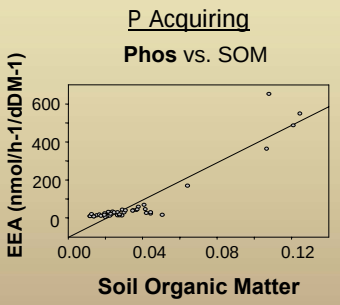


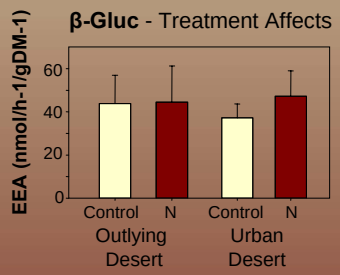
P Acquiring



We found differences in enzyme activity with land cover, but no change in activity with N amendment. Perhaps it was because of soil organic matter (SOM). For all types of enzyme, we found that activity increased as the amount of SOM increased.

N deposition did not affect EEA

C Acquiring



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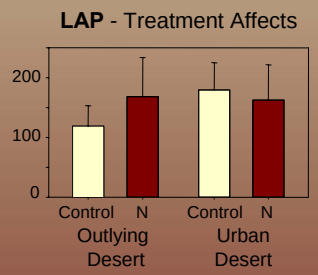

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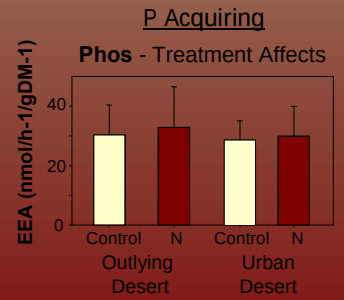

We hypothesized that N deposition and other anthropogenic factors would alter EEA. 3-way and 2-way ANOVA tests found that EEA did not differ between N-enriched and controls plots, nor between urban and outlying deserts.

Reasoning – Multiple Regressions

Enzyme	R^2	Environmental Variable
b-1,4-glucosidase (**β-Gluc**)	**0.46**	**SOM, % Moisture**
b-D- Xylosidase (**β –Xylo**)	**0.63**	**SOM, % Moisture**
Cellobiohydrolase (**CBH**)	**0.65**	**SOM, % Moisture**
Peroxidase	**0.34**	**% Moisture, SOM**
Phenol Oxidase	**NS**	**NS**
b-N-acetylglucosaminidase	**0.66**	**SOM, % Moisture**
Leucyl aminopeptidase (**LAP**)	**0.51**	**SOM, % Moisture**
Acid phosphatase (**Phos**)	**0.94**	**% Moisture, SOM**

As with the case of SOM, we also found that enzyme activity increased with % moisture. For peroxidase and phosphatase, % moisture was a more important factor in determining EEA. Neither factor explained variation in phonol oxidase.

Conclusion

Direct human management has much more profound effect on EEA than does N deposition, which is an indirect effect of human activity.

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