Hydrological and geochemical correlations with potential denitrification rates in an arid, urban wash

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Introduction

- Inputs of nitrogen (N) accumulate in arid, urban washes as a result of fertilizer, litter, and atmospheric deposition .
- Deposits in the wash can pollute surrounding waterways when transported by storm water.
- The process of denitrification was studied to better understand how nitrogen exportation from these waterways can be reduced.

Research Objectives

Question: How do hydrological and geochemical factors correlate with potential denitrification rates in an urban desert wash?

Factors studied here: soil moisture content, soil organic matter (SOM), ammonium/nitrate concentrations, chloride concentrations, And soil texture

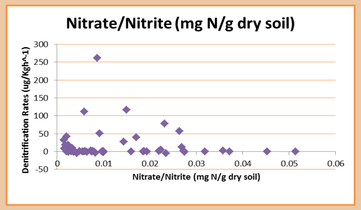
Study Site/ Methods

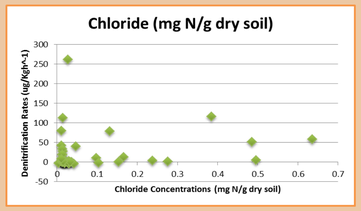
Soil samples were collected from a xeric wash in Scottsdale, AZ in summer, 2012.

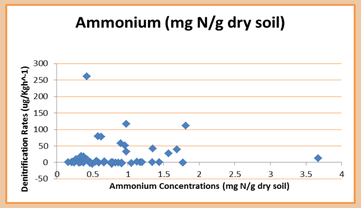
Denitrification enzyme assays were used to determine potential denitrification rates. N20 samples were then analyzed on a gas chromatograph.

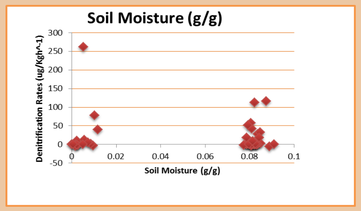
- Soil moisture content and SOM data were ascertained using Loss-on-Ignition.
- Soil texture data were collected using the hydrometer method.
- Ammonium/nitrate/chloride were extracted from soil using wet filtration.

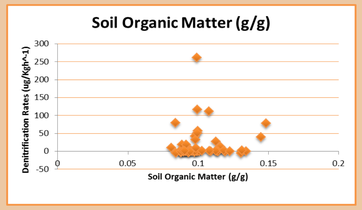
Results: Denitrification and Soil Properties

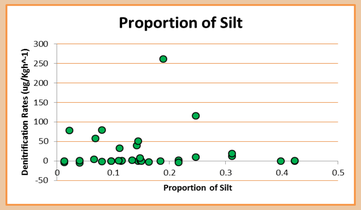


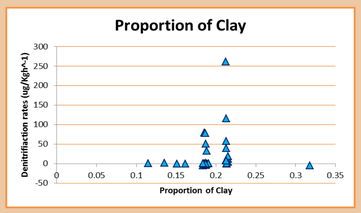


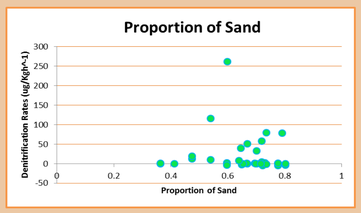










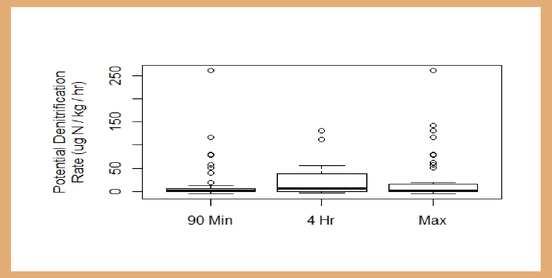


- Potential denitrification rates that ranged from less than zero to 261 ug/Kg h^-1 were plotted against the tested variables.
- There were not any significant correlations between the variables and the potential denitrification rates.

Table 1. Correlation Coefficients and p-values of potential denitrification rates with variables

Variables	r-value	p-value
Sand	-0.04	0.837
Silt	-0.028	0.874
Clay	0.329	0.06
Chloride	0.23	0.1
Nitrate/Nitrite	-0.03	0.83
Ammonium	0.17	0.19
Soil Organic Matter	-0.02	0.91
Soil Moisture	0.06	0.67

Results: Ranges of Potential Denitrification Rates



Potential denitrification rates calculated with 90 minute and 4 hour incubations were not significantly different from each other (paired t-test, p=0.47).

Comparison of Studies

Table 2. Potential Denitrification Rates in xeric wash compared to other urban ecosystems in Phoenix.

Ecosystem Type	Average	Standard Deviation	Min	Max	Reference
Xeric Wash	21	61			This study
Grassy Retention Basin	673		407	1251	Larson 2010
Xeric Retention Basin	285		bdl	1090	Larson 2010
Xeriscape Yard	1503	5569			Hall et al. 2009
Lawn	1511	2868			Hall et al. 2009

*The average and standard deviation for the xeric site were calculated using the maximum potential denitrification rate.

Conclusions/Future Directions

Further research is needed to determine if there is a correlation between the factors studied here and the potential denitrification rates of the study site. The results suggest that there is limited potential for denitrification compared with other urban ecosystems. However, the rates are highly variable.

In the future, we hope to carry out :

- a comparative study of actual denitrification rates
- further investigation of soil moisture effects on denitrification rates; varying soil moisture and obtaining actual denitrification rates
- further investigation of anomalies in the data

Acknowledgements

A special thank you to the Hall Lab, the Central Arizona Phoenix-LTER, and the National Science Foundation for their assistance and provision of materials. I would also like to thank Rebecca Hale for all of her help in the Arizona heat and in the lab, and Stevan Earl and Nancy Grimm for their encouraging support and advisement. I would also like to thank Monica Palta, Emma Holland, Lindsey Pollard, and Jennifer Learned for all of their help.

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