Ammonia Volatilization in an Intermittent Stream

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INTRODUCTION

We examined how stream sediment pH and moisture content affected ammonia emissions in an intermittent stream. Intermittent streams, those streams that do not flow year round, are some of the most common streams and due to climate change there are now more intermittent streams than before.

- Seasonal drying can result in variabile stream-bed sediment moisture that may influence ammonia emissions.
- Ammonia vaporizes (volatilization) from soils rich in nitrogen at high pH.
- Higher sediment moisture content lowers ammonia concentrations in the soil and therefore less ammonia is lost through volatilisation.

Despite their common occurrence, these streams are not well studied, especially with regards to ammonia emissions. Gaining insight into background emissions is important for understanding how increased drying or disturbance such as fire may alter these emissions.

Methods

pH:

- Soil pH was collected with a pH meter (Oakton PCTs 50 Waterproof), calibrated before use, three replicates of each sample mixed with deionized water.

Soil Moisture:

- We weighed both the wet and dry soil. We removed the rocks from the sample and subtracted rock weight from the sample. The end value was then divided by the dry weight.

Ammonia Volatilization:

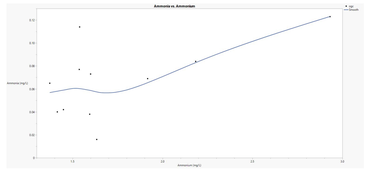
- Passive ammonia samplers, Ogawas, were deployed at each of the 13 sampling sites to capture the released ammonia in the area. These were deployed for 2 weeks before collection and extraction of the ammonia took place.

Data/ Results

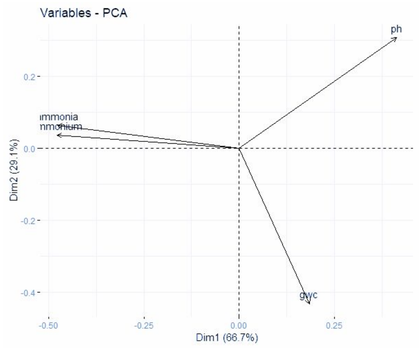
Analysis of Greatest Impact

AIC	vif (pH)	vif (gravimetric water content{gwc})	vif (ammonium)	vif (nitrate)	Model
-38.65	2.68	1.18	1.07	2.85	ammonia~pH+gwc+ammonium+nitrate
-40.56	NA	1.12	1.03	1.14	ammonia~gwc+ammonium+nitrate
-42.35	NA	NA	1.02	1.0	ammonia~ammonium+nitrate
-44.00	NA	NA	NA	NA	ammonia~ammonium

Akaike information criterion (AIC) and Variance inflation factor (VIF) test results



Graph of Ammonia concentration vs Ammonium concentration



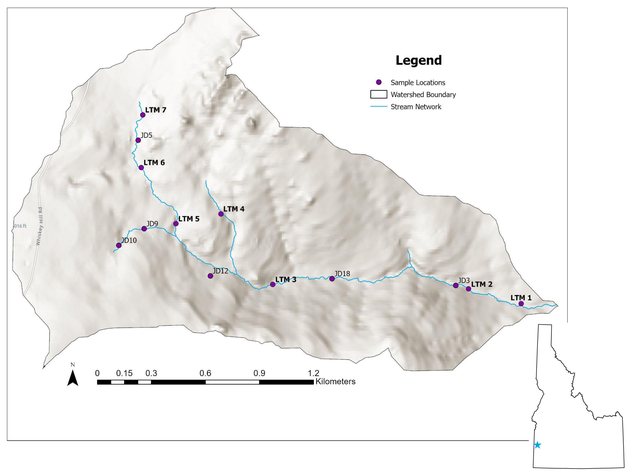
Factors in a Principal components analysis (PCA) plot

Data Considered for Comparison

Site	Date	pH	Gravimetric Water Content (%)	Ammonia (mg/L)	Ammonium (mg/L)	Nitrate (mg/L)
JSS01	06/06/2023	6.79	116.83	0.073	1.6	0.1684
JPZ02	06/06/2023	7.05	36.55	0.077	1.537	0.5847
JPZ03	06/06/2023	6.74	63.27	0.042	1.449	0.1684
JPZ04	06/06/2023	6.04	53.10	0.069	1.917	0.0238
JPZ05	06/06/2023	6.63	46.88	0.084	2.184	0.2193
JPZ06	06/06/2023	6.41	79.37	0.04	1.415	0.0301
JPZ07	06/06/2023	6.03	833.43	NA	2.556	0.0201
JD3	06/06/2023	6.42	65.15	0.123	2.931	0.1125
JD5	06/06/2023	6.83	63.74	0.016	1.634	0.5847
JD9	06/06/2023	6.19	69.17	0.038	1.595	0.031
JD10	06/06/2023	6.19	63.83	0.114	1.539	0.117
JD12	06/06/2023	6.38	82.76	NA	1.475	0.0512
JD18	06/06/2023	6.79	41.18	0.065	1.373	0.1696

Data Table with all Factors Looked at Present

Study Area:



Stream sediment analyzed in this experiment was gathered from the Johnston Draw watershed, an intermittent watershed.Thirteen samples were taken throughout the stream network. These sampling locations that were sampled are part of a bigger experiment started in 2021 with hydrological, biogeochemical and microbial data being collected. (as represented by purple dots)

CONCLUSION

- Soil pH and Sediment moisture content were not the driving predictor of ammonia emissions.
- The ammonium concentrations obtained from a concurrent study involving sediment were found to be correlated with ammonia emissions
- This indicates that in intermittent streams there may be different driving factors to ammonia volatilization rates than in perennial streams and soils.

Looking Forward

- This experiment is part of a larger study centered on a experimental wildfire that is supposed to take place at Johnston Draw this Fall, aimed at understanding post-wildfire intermittent stream response.
- Ammonia concentrations from the wet streambed will be compared to ammonia concentrations from the post-fire streambed.
- There is very little data about pre-fire conditions as wildfires happen with little to no warning, therefore only post-fire data can be collected. This pre-fire data is important as it provides more context on what changed due to fire, from ammonia emission rates to organics found in the water.

References

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Acknowledgements

IDAHO EPSCoR

National Science Foundation
WHERE DISCOVERIES BEGIN

AIMS

Reynolds Creek
Critical Zone Observatory