
# MAWWG Meeting 9-24-2025

# Is climate change and road salt salinization undermining nitrogen removal by freshwater urban/suburban wetlands?

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# Wetlands – important nutrient filters

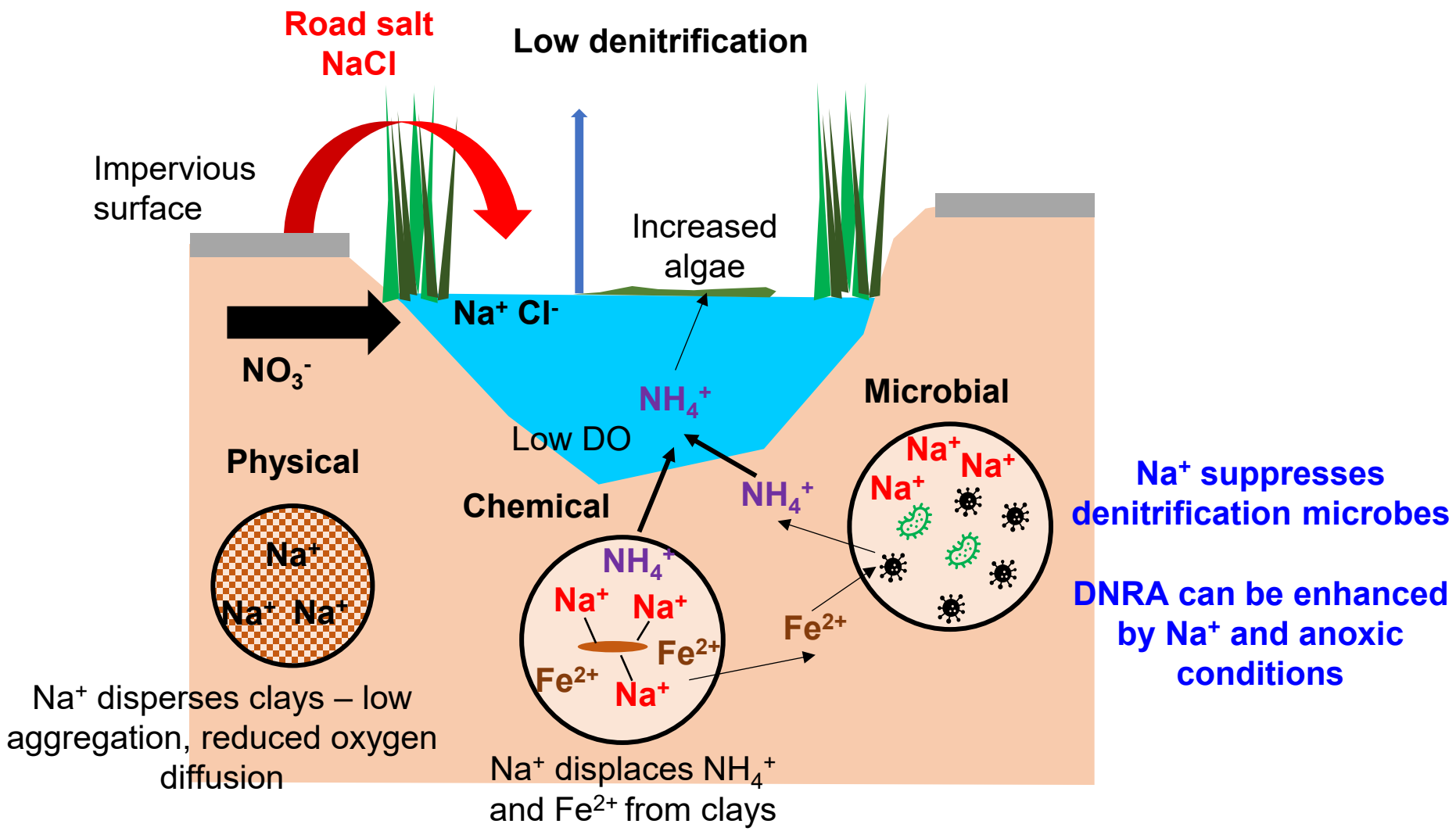
- **Wetlands are kidneys of the urban landscape**
- **Help remove excess nutrients and pollutants from runoff**
- **Example - remove nitrate nitrogen via denitrification**
- **Ecosystem services - important in managed landscapes – urban, suburban, and agricultural**

# Road salt impact on wetlands

- Road salt application is the key management practice in urban and suburban landscapes to address winter ice & road safety

- But road salt can degrade wetland nitrogen filtering services

**Urban/suburban wetland N regime impacted by road salt**




# Road salt effects that undermine nitrogen removal processes in wetlands

# Key Questions

- How do $Na^+$ concentrations alter the balance of **sorbed $NH_4^+$ concentrations in wetland sediments**?
- How do road salt NaCl concentrations and soil temperatures affect the **rates of denitrification and DNRA** in freshwater wetland sediments?
- Are **microbial populations** lower in wetlands affected by road salt and higher soil temperatures?

# Key Tasks

- **T1: Field sampling and characterization of road salt impacted urban/suburban and reference wetland soils**
- **T2: Controlled laboratory experiment to assess salt levels and temperatures**
- **T3: Existing data synthesis to assess salt trends and nitrogen concentration impacts**

# Task 1: Wetland Sampling & Characterization

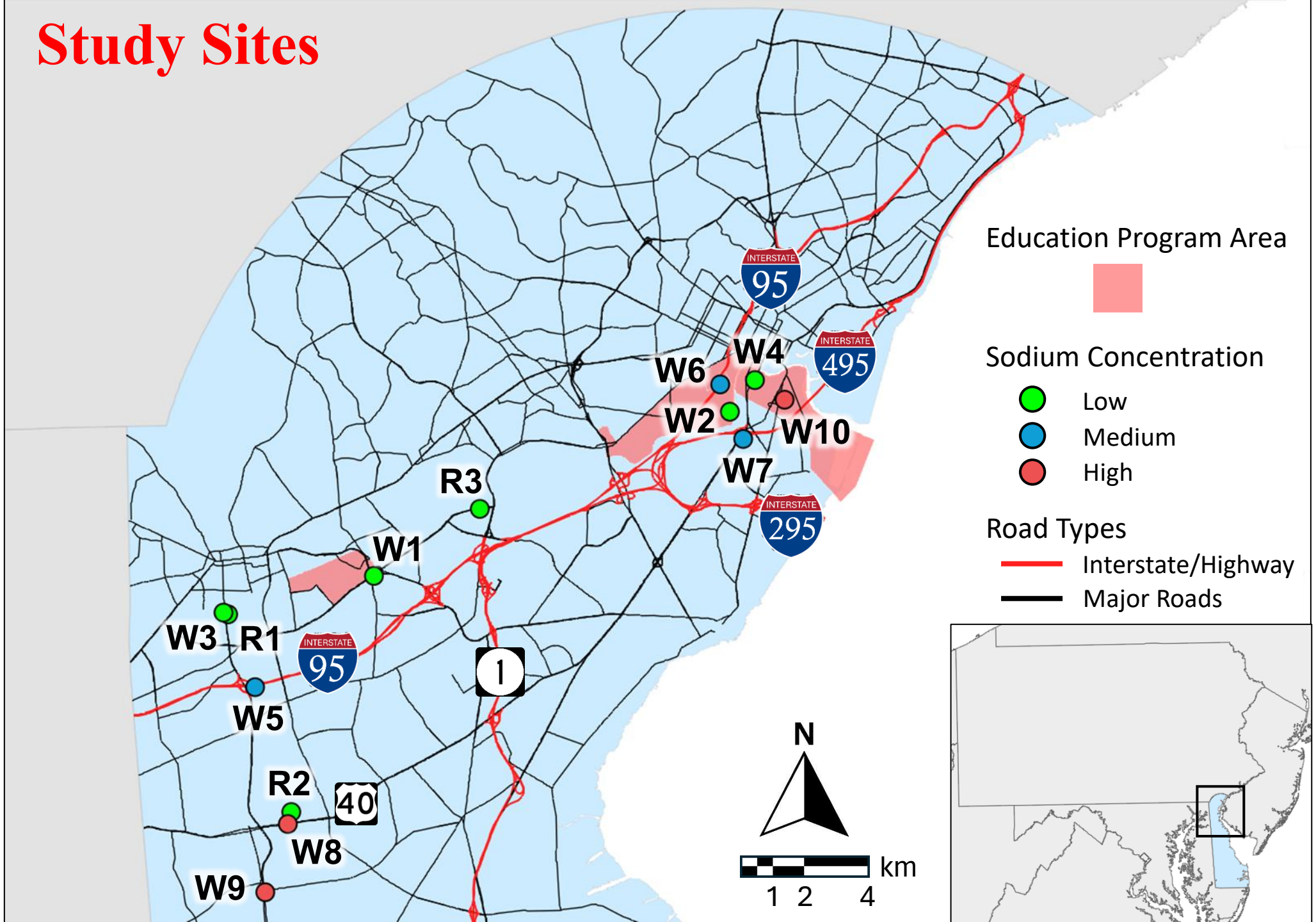
# Hypotheses:

H1: Road salt affected wetlands sediments will have **poor soil aggregation**.

H2: Higher concentrations of $Na^+$ in soil due to road salt will result in **release of soil/sediment bound $NH_4^+$.**

H3: Elevated $Na^+$ concentrations will **decrease denitrification rates but increase DNRA rates**.

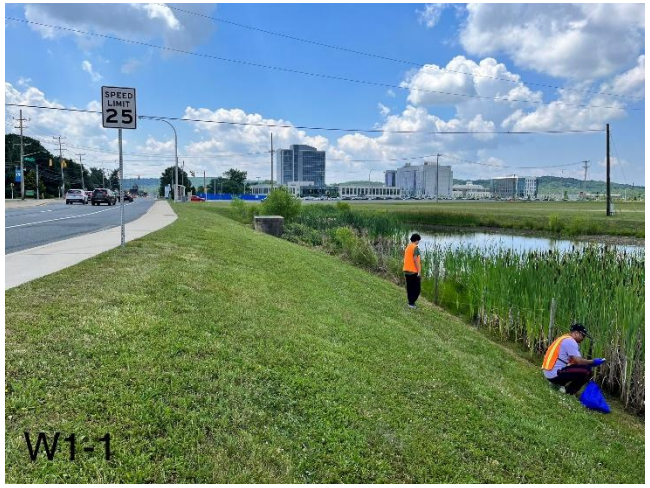
H4: Road salt will **decrease denitrification functional genes (nosZ), but increase DNRA genes (nrfA)**


Study Sites
W1
W2
W3
W4
W5
W6
W7
W8
W9
W10
R1
R2
R3
INTERSTATE 95
INTERSTATE 495
INTERSTATE 295
1
40
Education Program Area
Sodium Concentration
Low
Medium
High
Road Types
Interstate/Highway
Major Roads
N
km
1 2 4

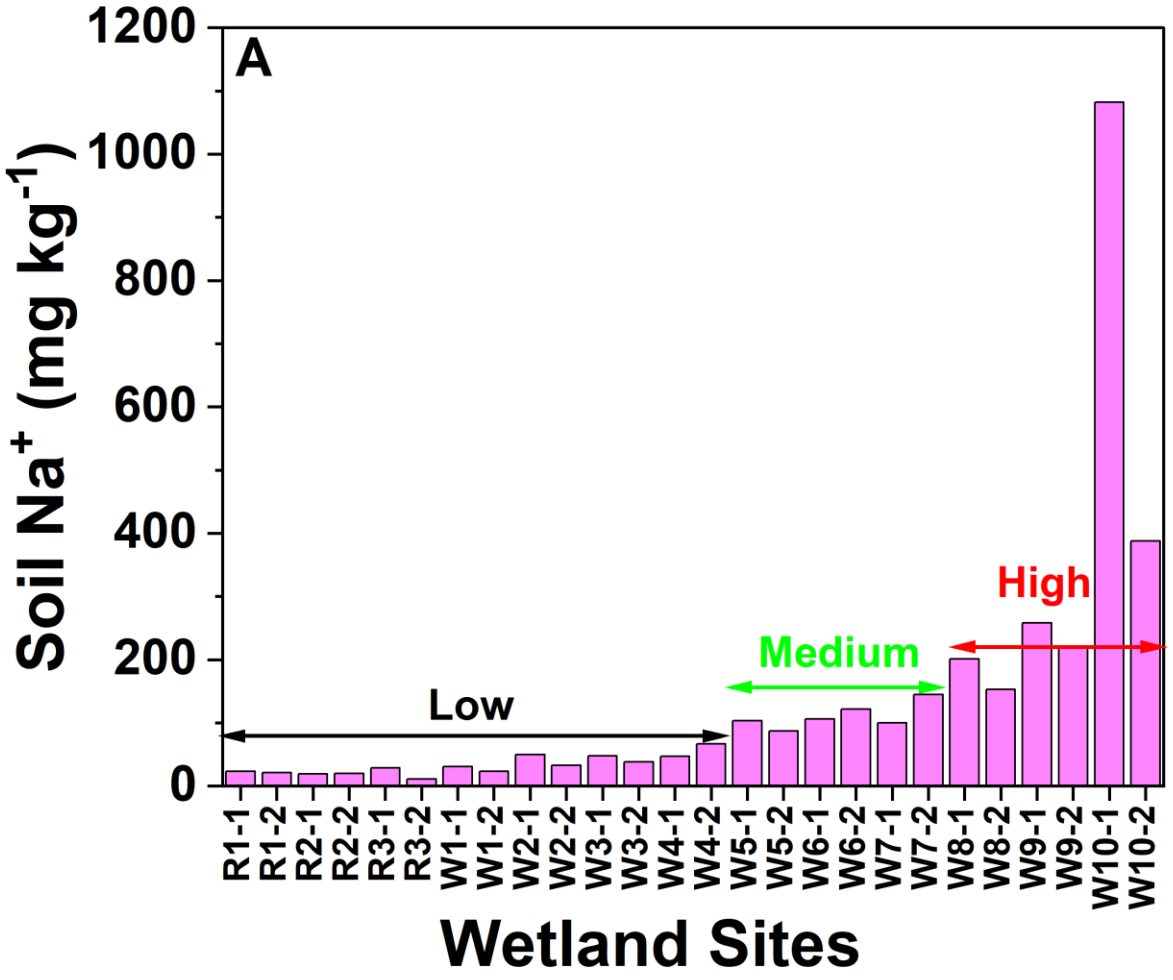
# Collecting Soil and Water Samples

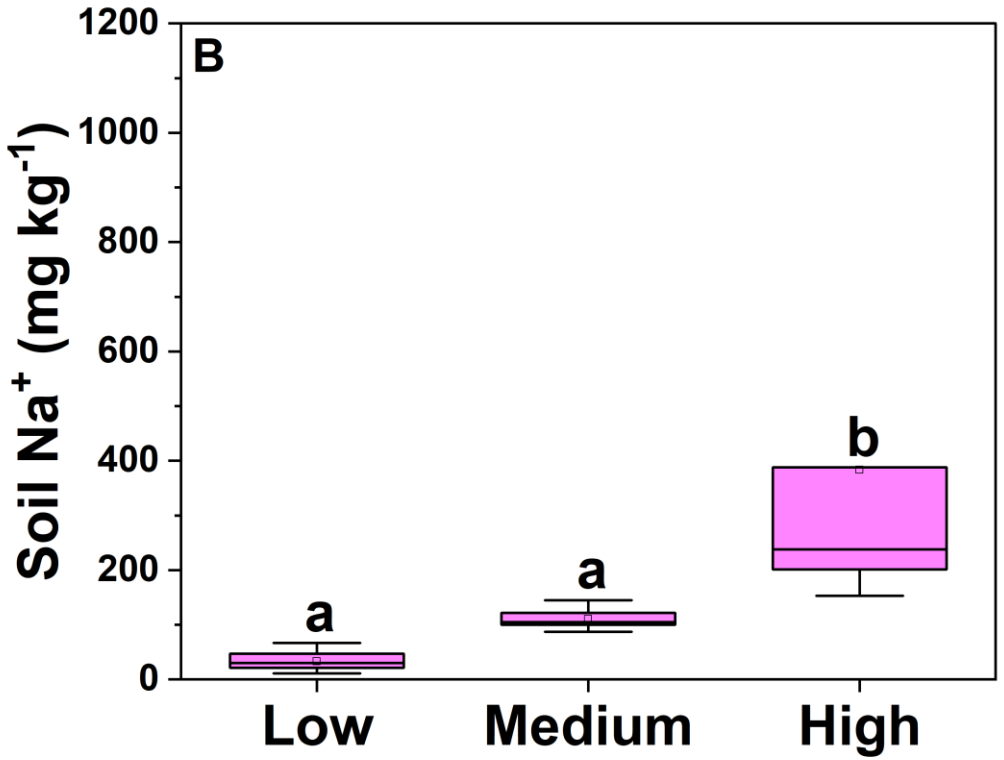




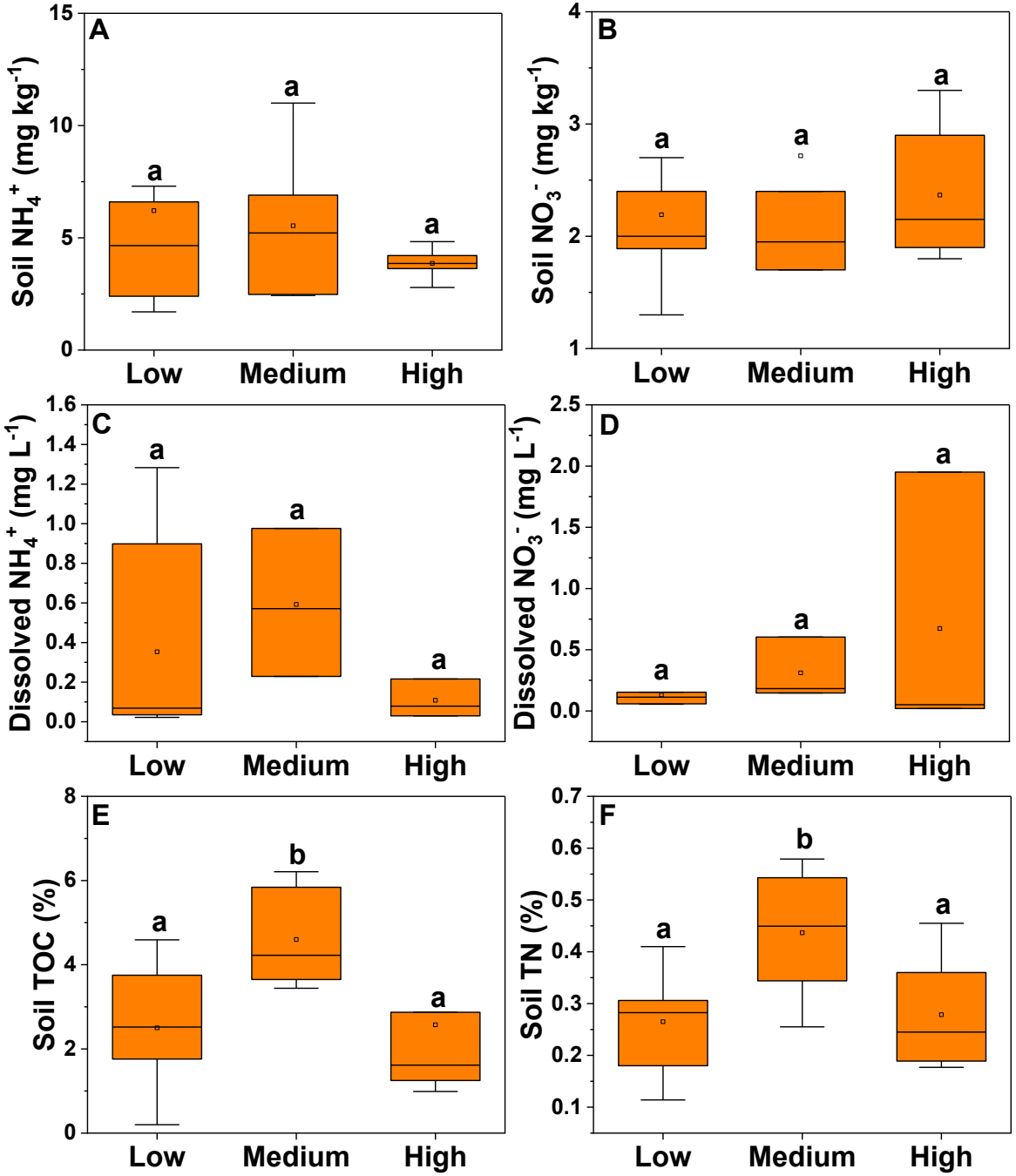

# $Na^+$ concentrations across sampling sites and categories



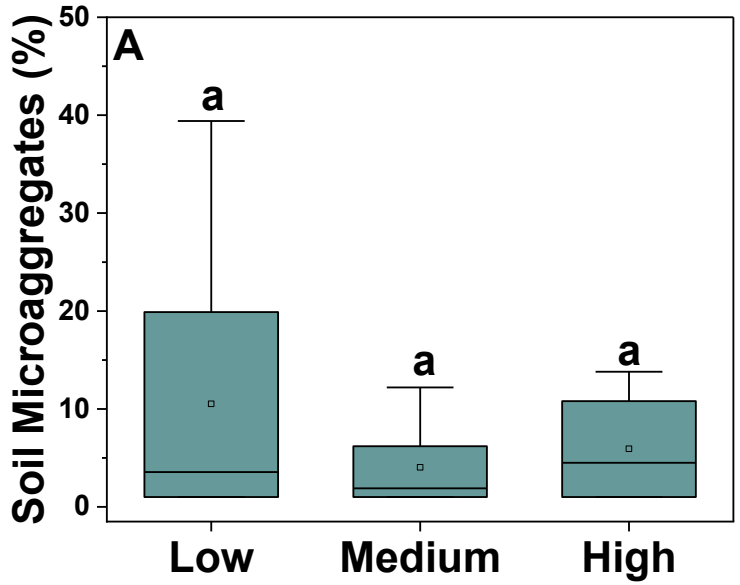



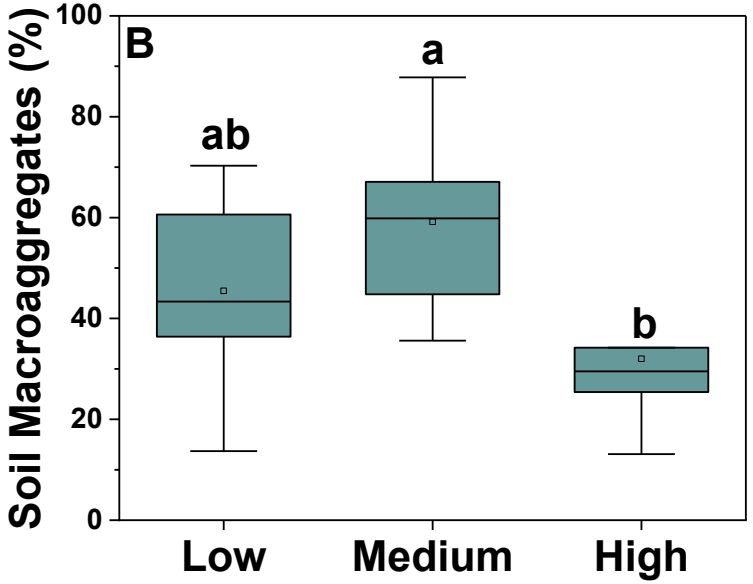

**Sites divided into 3 categories**

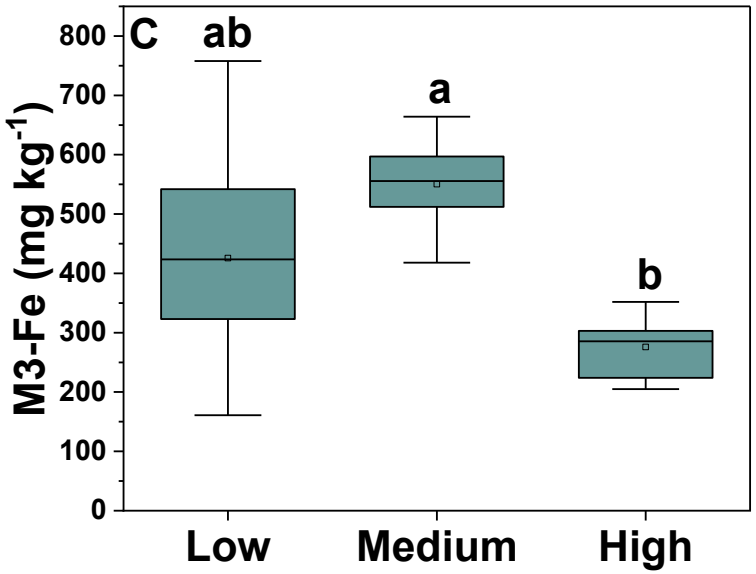
# Impact on N Species, OC & TN

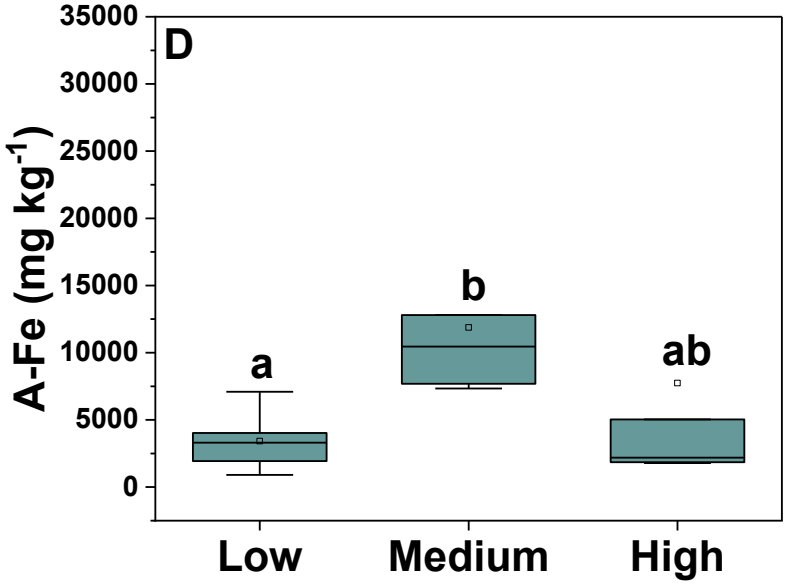


# Soil aggregation and Fe release

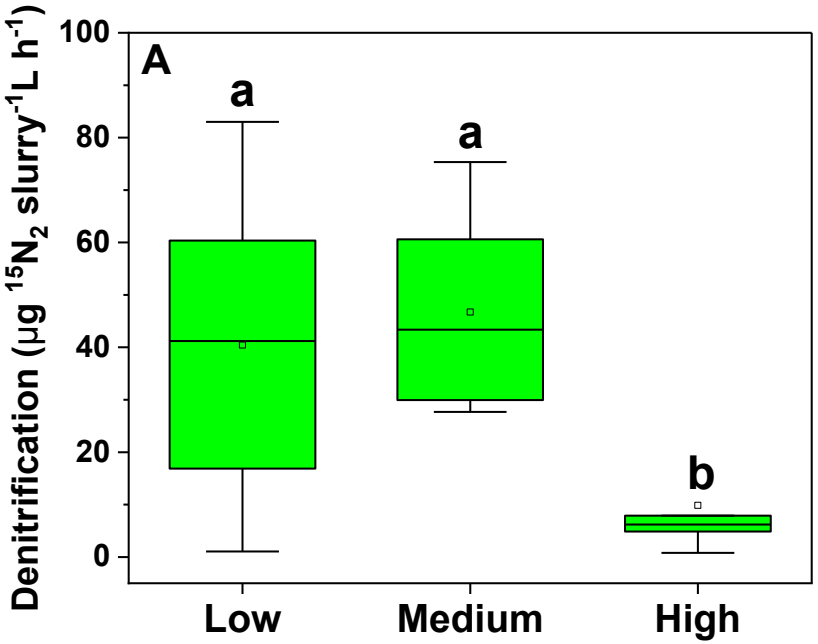


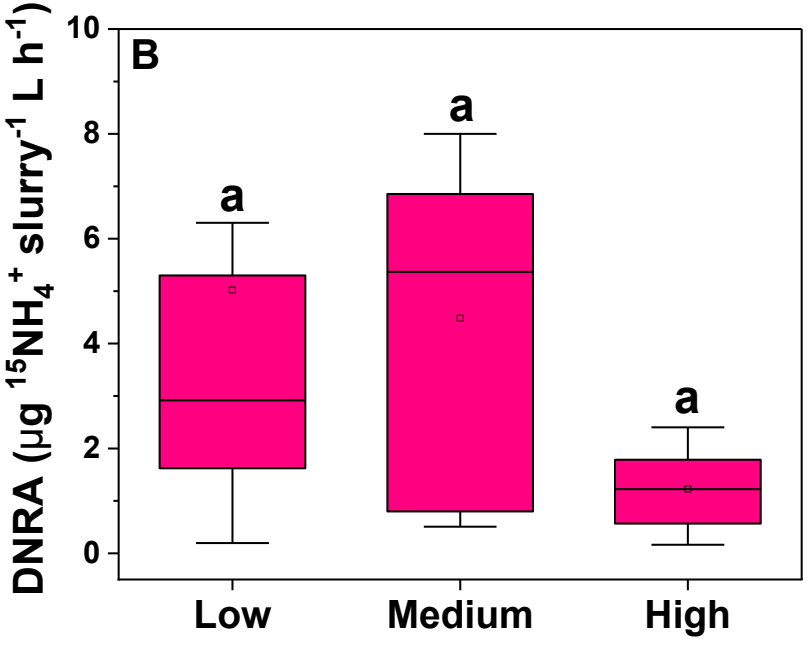



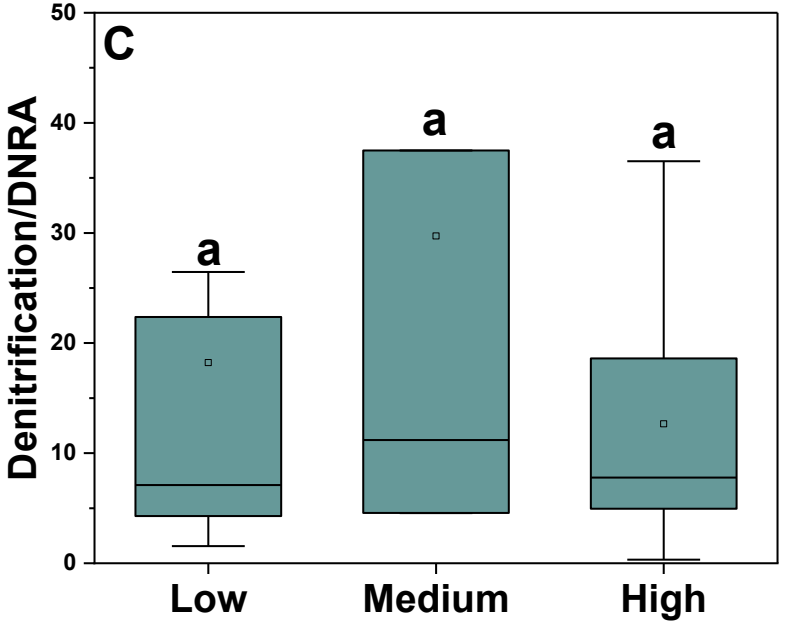



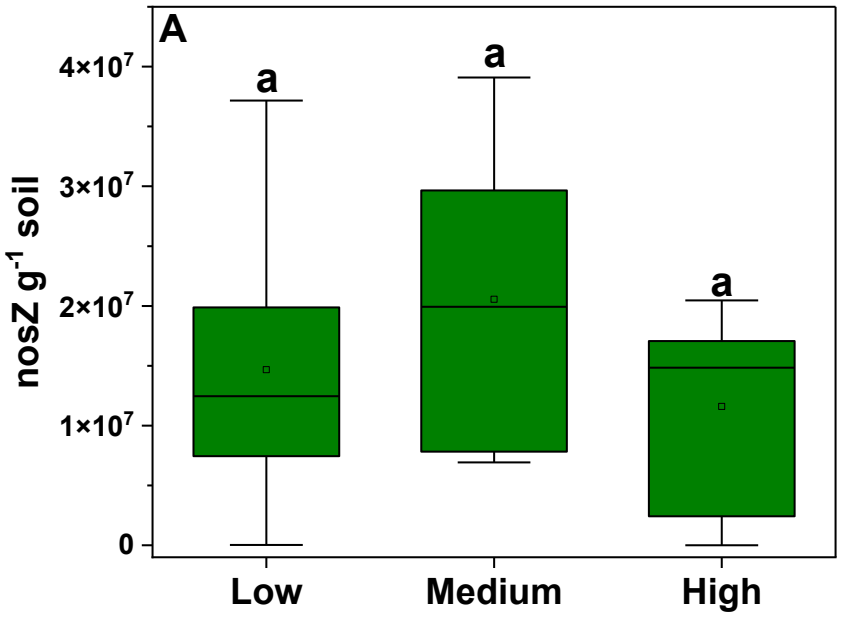



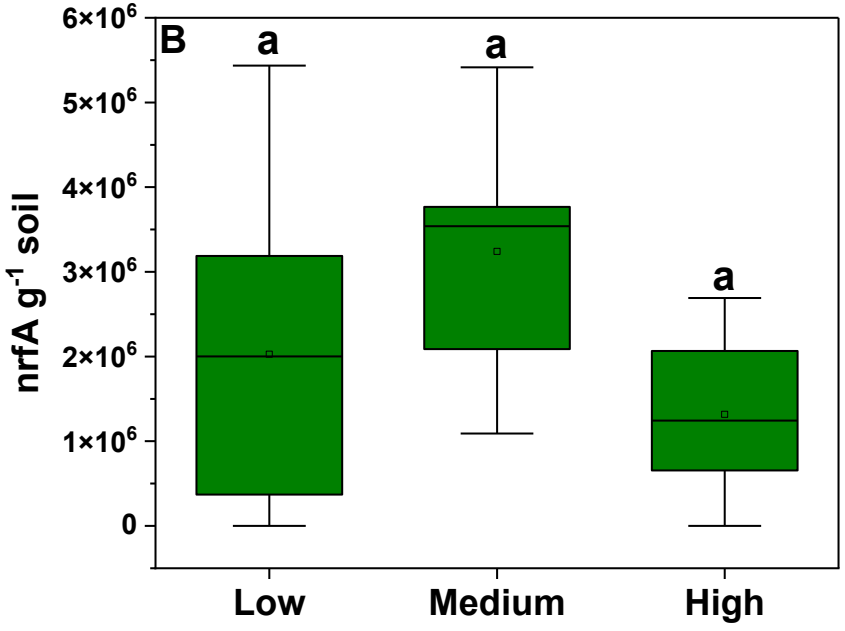
# Effects on process rates and microbial functional genes

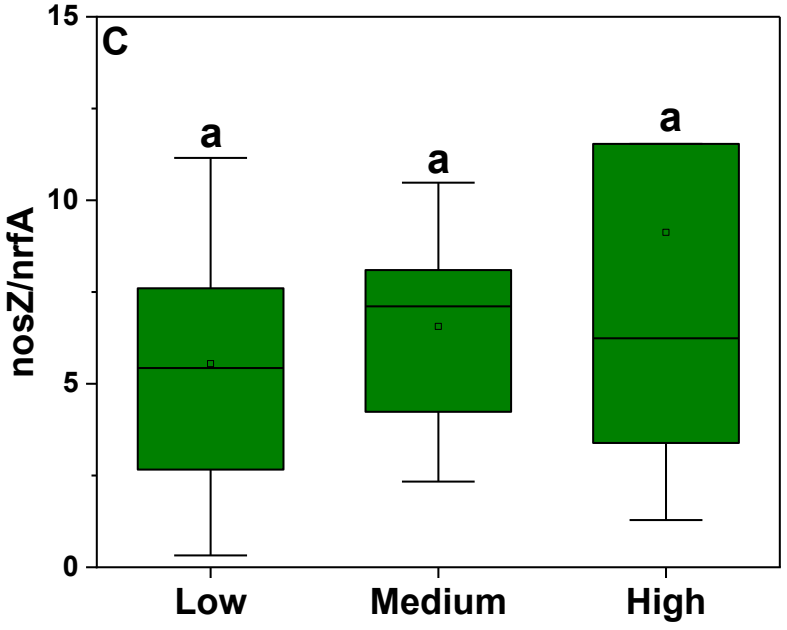


# Key Takeways

- Denitrification was impacted more significantly by road salt than DNRA
- Release of solid phase and accumulation of dissolved phase $NH_4^+$ was not enhanced by road salt
- Soil macro-aggregation decreased significantly in the high compared to the medium salt category wetlands
- There was no significant impact of road salt on overall microbial abundance and functional genes

# Manuscript In Review with Wetland Journal

Wetlands

**Effects of road salt on nitrogen removal by freshwater urban wetlands**

--Manuscript Draft--

| | | |
|---|---|---|
| Manuscript Number: | | |
| Full Title: | Effects of road salt on nitrogen removal by freshwater urban wetlands | |
| Article Type: | Original research article | |
| Keywords: | Wetland; road salt; sodium; nitrogen; denitrification; DNRA | |
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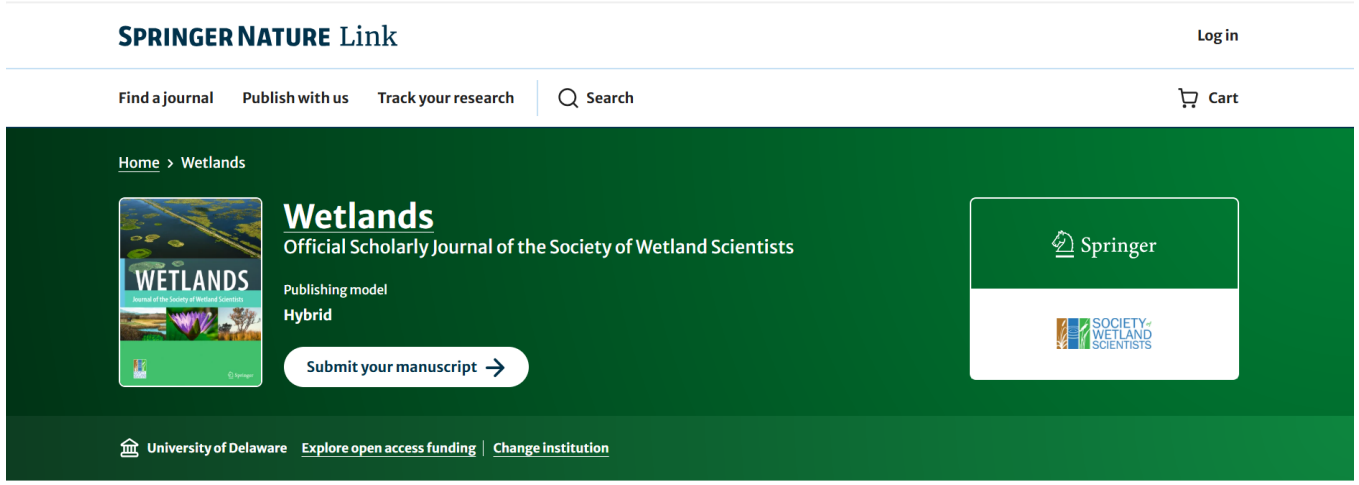
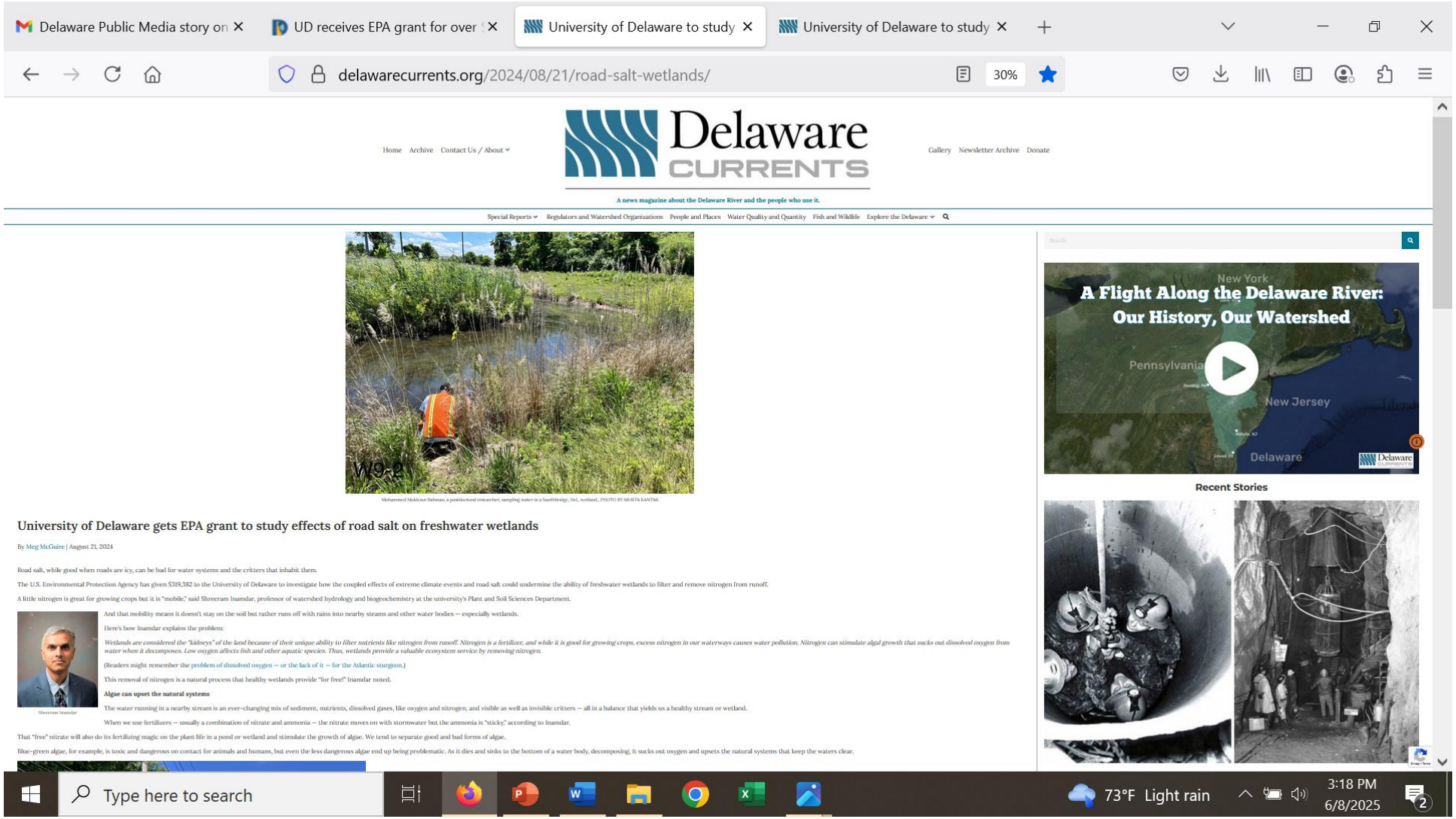
| Abstract: | Freshwater urban wetlands are important ecosystems that can naturally filter and remove excess nitrogen (N) through the process of denitrification (DNF). However, anthropogenic inputs such as road salt application may affect the N removal capacity of urban wetlands by affecting the relative rates of DNF and another competing reductive process that retains N – dissimilatory nitrate reduction to ammonium (DNRA). Here, we assessed 13 roadside wetlands in urban/suburban areas of Delaware, USA to determine the effects of road salt sodium (Na+) on soil physical, chemical, and | |



# Public Outreach & Spotlight

## Research featured on – Delaware Currents & Delaware Public Media outlets



# Thank you all

## Any questions or comments???

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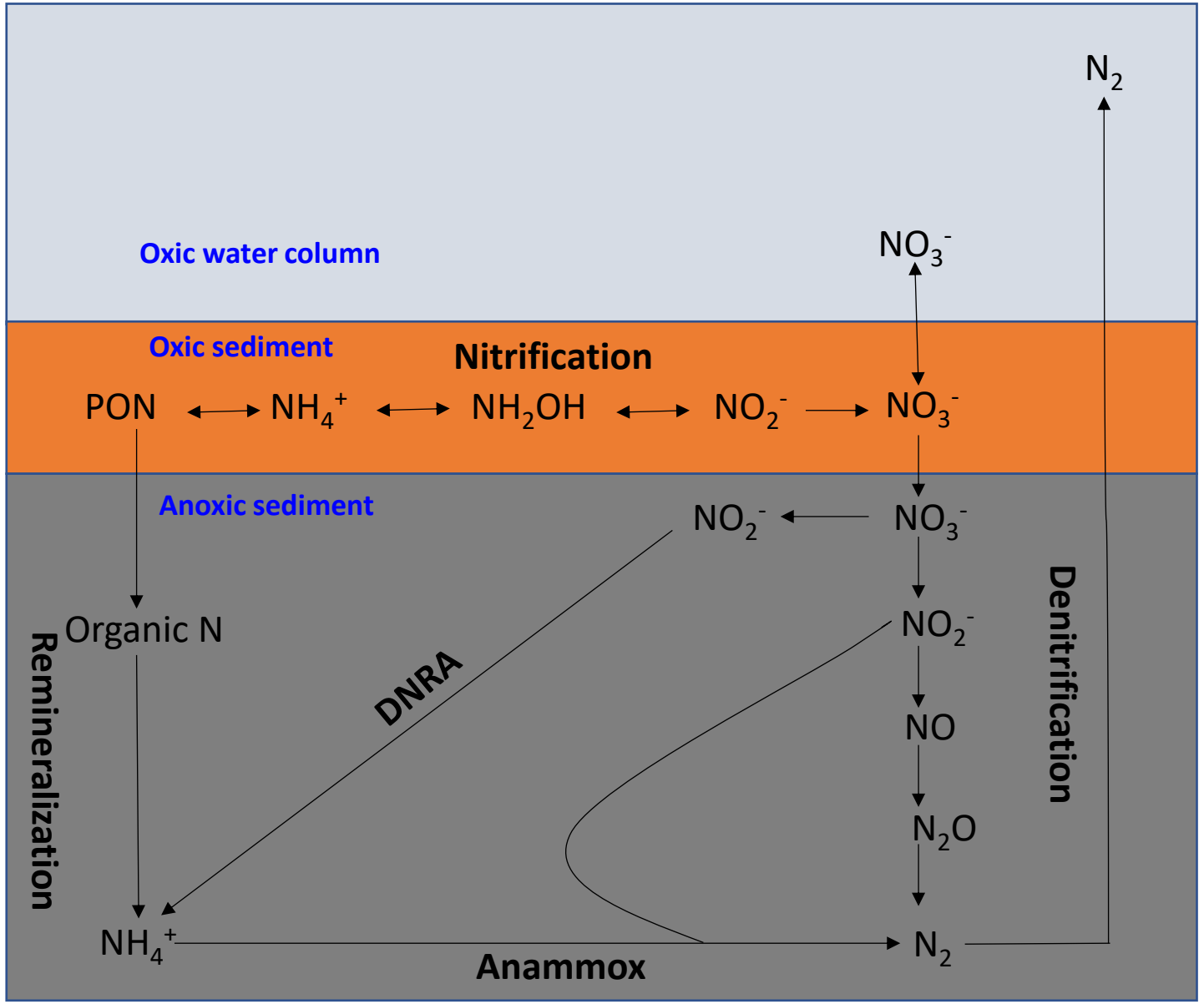
# Nitrogen Cycling Processes




Microbial N transformations above, below and across a suboxic/anoxic sediment interface (modified from *Francis et al., 2007).*