Exploring Tres Rios Wetlands through Soil Dynamics

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Introduction

As cities progress in developing sustainable infrastructure and adopt practices to meet the increasing demand for resources, especially water, there poses a need for effective water resource management. Wetlands offer inherent benefits, including support of wildlife habitat and resources. They also naturally remove pollutants, particularly nitrogen and excess nutrients from wastewater, to improve water quality. Incorporating constructed treatment wetlands (CTWs) into urban development has proven to be a cost-effective and low-maintenance solution for treating wastewater. Given Arizona's rising demand for water resources, exploring CTW performance in cities with arid climates is vital. This research focuses on reviewing soil nitrogen content at the Tres Rios Constructed Treatment Wetland in Phoenix, Arizona, with the goal of contributing insights to improve wastewater management and ecosystem health

Nitrogen Removal in Wetlands

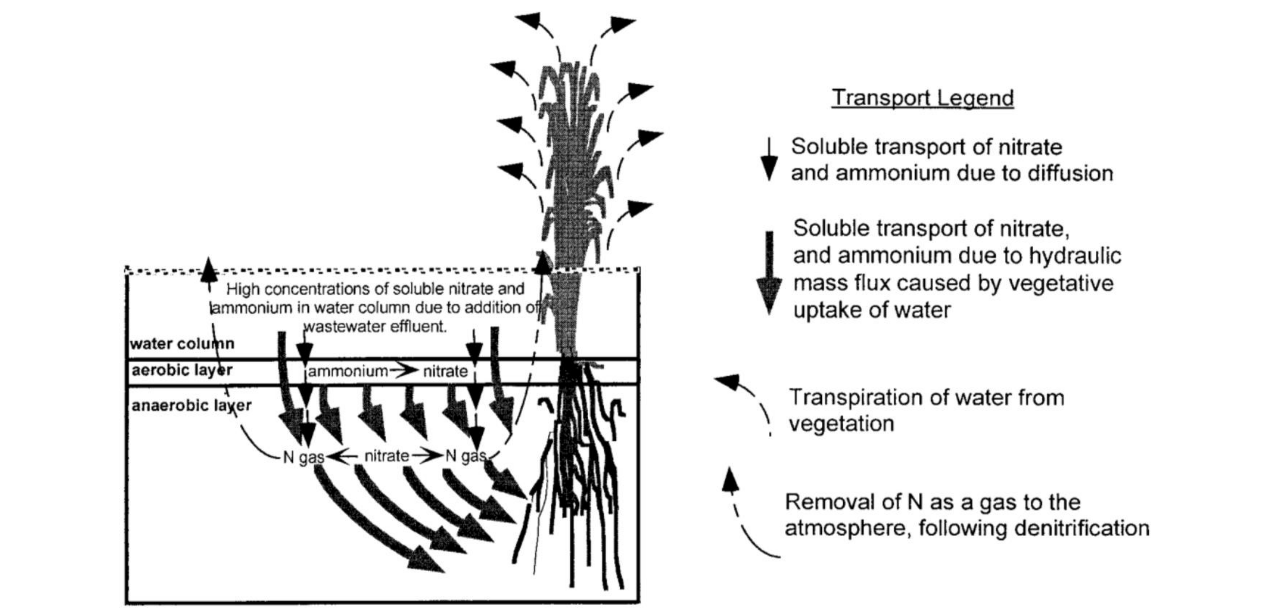

Figure 1. Wastewater nitrogen removal from wetlands is dependent upon the transport of nitrogen species between soil layers where a chain of processes take place resulting in eventual nitrogen removal as a gas. Nitrification transforms ammonium to nitrate and takes place primarily in aerobic soil zones. Denitrification transforms nitrate to nitrogen gas and primarily takes place in anaerobic soil zones. Transport via hydraulic mass flux caused by the vegetative uptake of water may increase the movement of nitrate to anaerobic soil layers.

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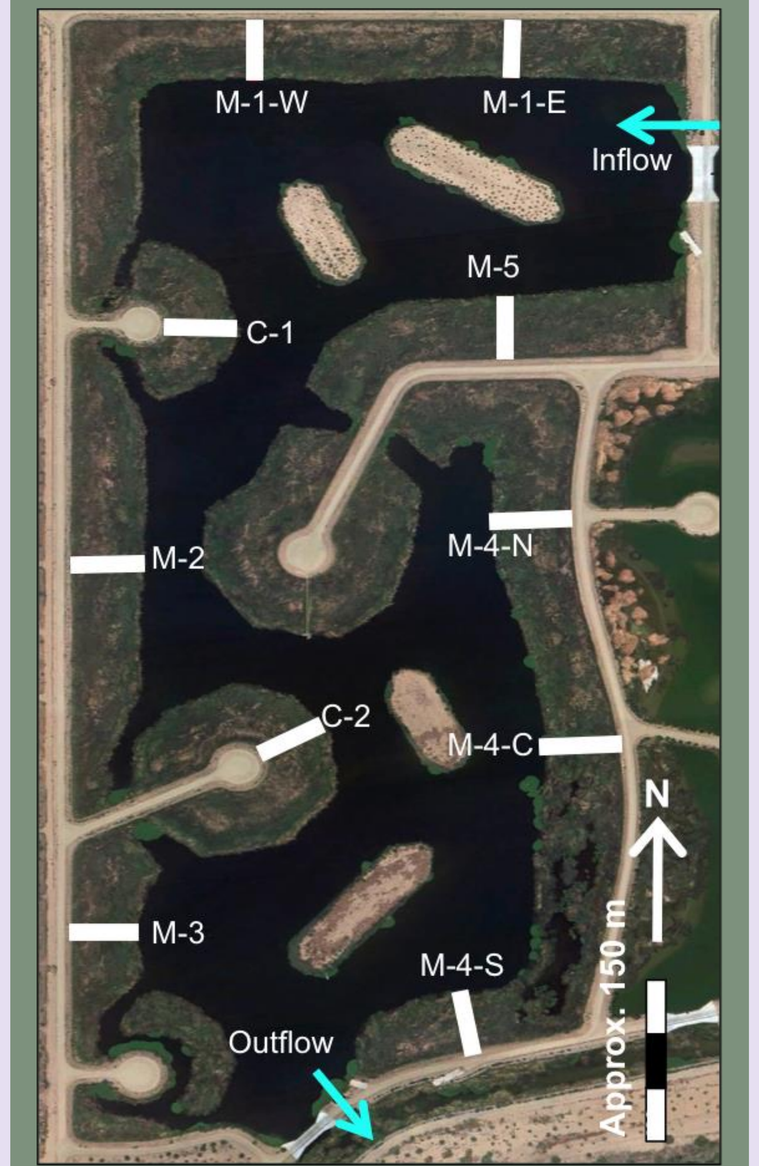
- Nitrogen can come from multiple sources:
  - Human waste
  - Fertilizer
  - Industrial activities
- Excess nitrogen can lead to:
  - Algae blooms
  - Limited water resource
  - Biodiversity loss

Objectives

- Examine nitrogen content over multiple years to identify trends.
- Analyze the percentage of nitrogen at various depths to identify variations.
- Evaluate nitrogen content at specific locations, including the inflow, outflow, and center transect to understand spatial differences and patterns.

Methods

Tres Rios Constructed Treatment Wetlands



- **Collecting and Prepping Samples**
  - Soil samples were collected from transects with attention to M1E (inflow), M4N, and M4S (outflow) at the water and shore.
  - Samples were separated by depth, 0-2 cm, 2-5 cm, 5+cm
  - The samples were then dried, homogenized, and weighed to prep for the CHN nutrient analyzer.
- **CHN Nutrient Content Analysis**
  - Analyzer is used to determine elemental properties of a sample, measuring the amount of carbon (C), hydrogen (H), and nitrogen (N) through combustion.

Expected Results

- Based on current data, we would expect to see a greater nitrogen content in samples taken from the open water.
- We expect to see higher nitrogen content near the root portion of the soil and deeper in the soil, as nutrients move between the aerobic and anaerobic layers.

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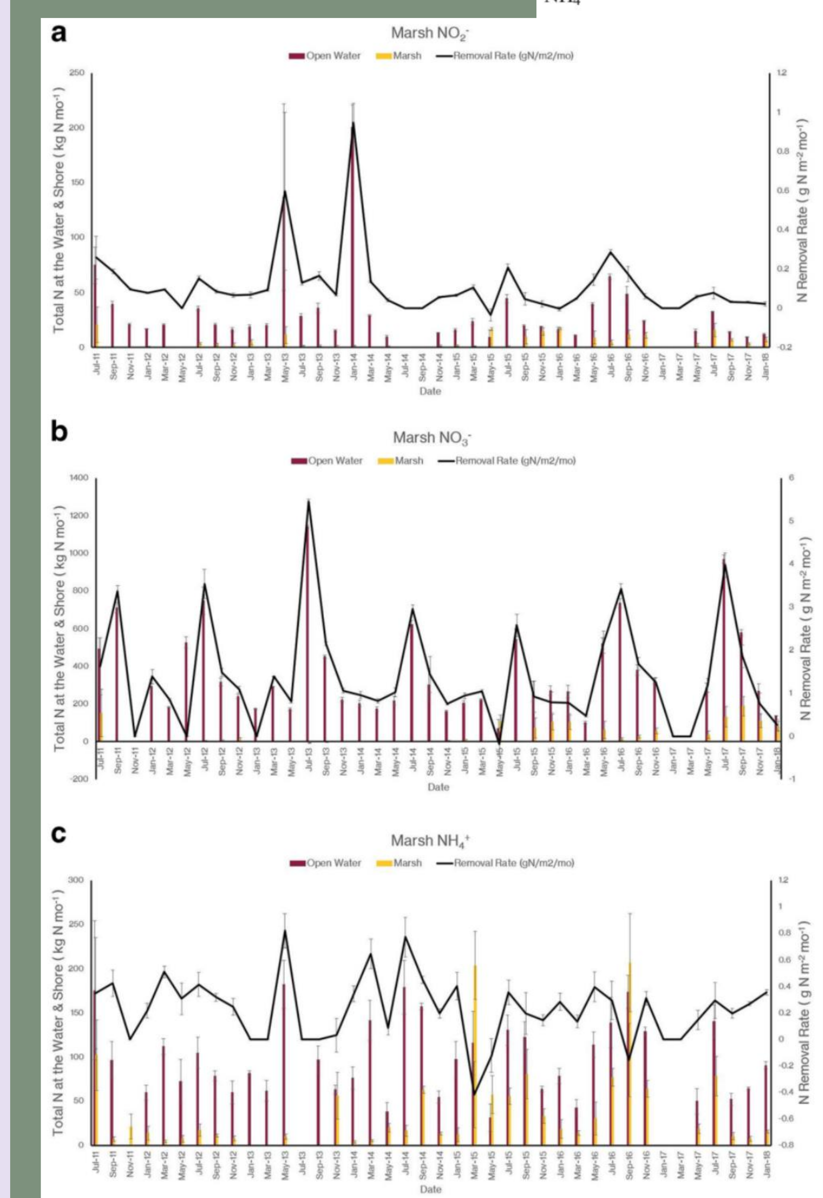
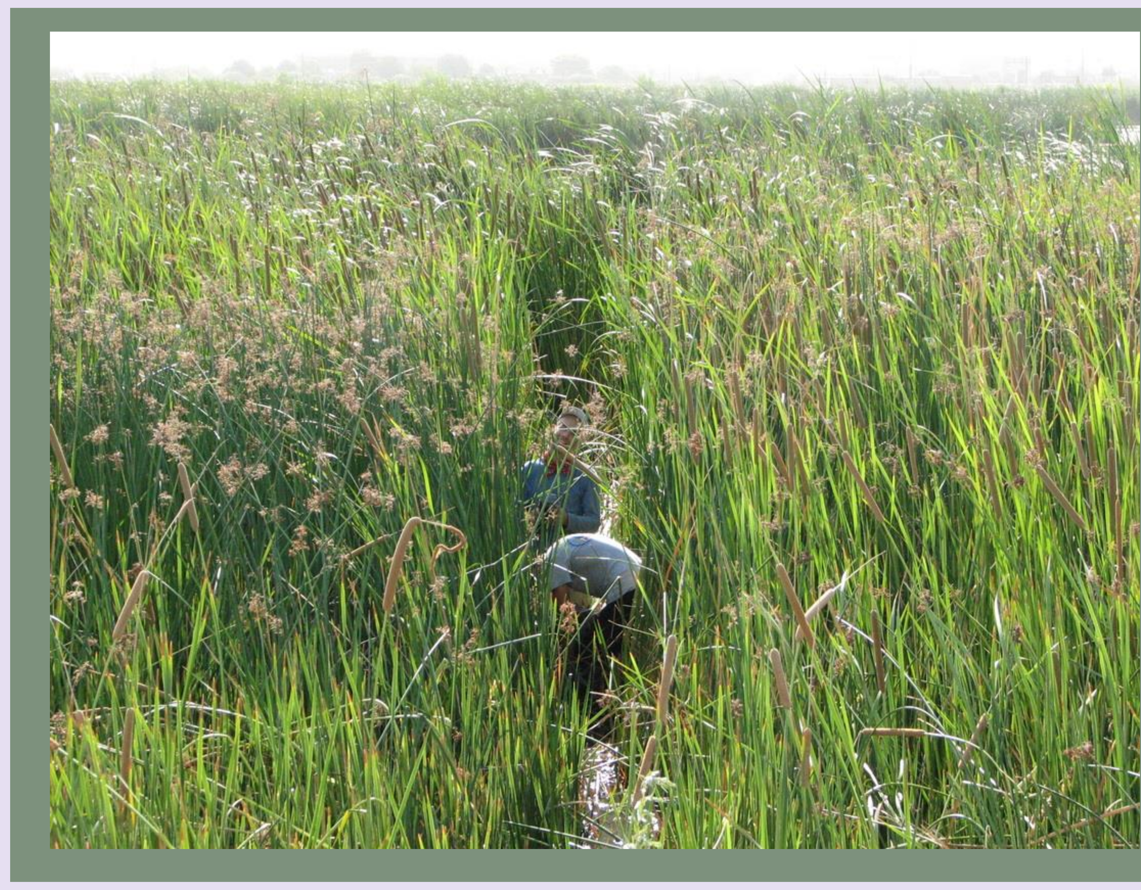
Fig. 7 Nitrogen flux at the open water interface (open water) and near the shore (marsh), and the N removal rates (ARR) for the marsh subsystem, for (top) NO_2^-, (middle) NO_3^-, and (bottom) NH_4^+



Implications for Management

- Our research results will provide valuable insight into how constructed treatment wetlands, specifically in arid climates, to efficiently process nitrogen throughout the entire system.



Conservation

- Support wildlife that depend on wetlands for habitat and resources, such as migratory birds and fish populations.
- Support plant community health and species selection
- Water treated from Tres Rios flows into the Salt River, allowing it to be reused by Phoenix.
  - Reuse of water resources for agricultural irrigation and drinking water. The Salt River also supports many recreational activities in Arizona (2).
  - CTWs can also be a vital water source in times of drought.

References

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