A new vegetation chamber to investigate the role of macrophytes in the CH_4 and N_2O gas fluxes from the Tres Rios constructed wetland in Phoenix, AZ.

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Introduction

- Macrophytes can increase nutrient retention in wetlands constructed to reduce nutrient pollution and for this reason, *Typha spp*., are frequently planted in constructed wetlands (CWS).
- However, macrophytes can also play a role as a significant pathway, even sometimes the dominant pathway, of methane (CH_4) and nitrous oxide (N_2O) emissions from wetland ecosystems.
- We aimed to investigate the GHG fluxes emitted from *Typha spp.* in the Tres Rios CWS to increase our knowledge of the role macrophytic vegetation plays in constructed ecosystems in arid regions.

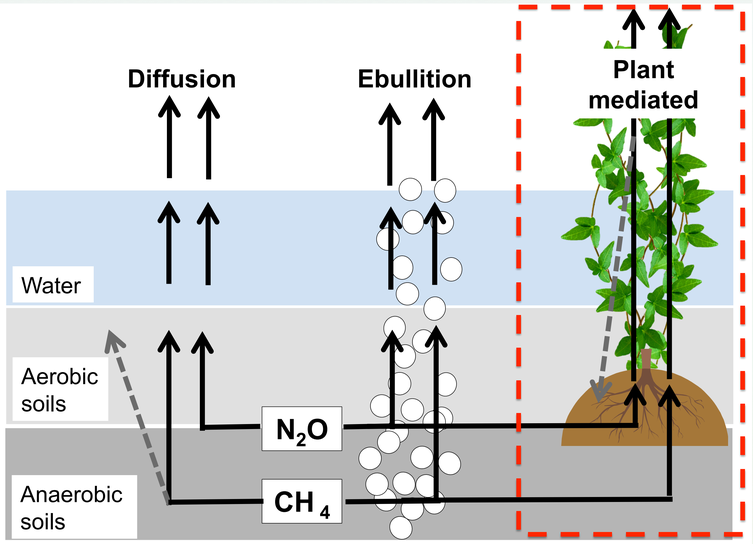
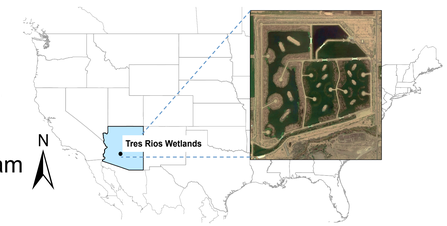


Figure 1. Fluxes across the soil-water-atmosphere interphase of methane and nitrous oxide in saturated wetland soils can occur via diffusion, ebullition, and plant mediated transport (in red box and the focus of this research presentation).

Site Description and Methods



- Tres Rios Constructed Wetland is located approx. 20 km east of Phoenix, AZ.
- The Study Cell 1 is approx. 42 ha with 21 ha of it shallower, with clay loam and sandy loam soils.
- It has approx. N loading rates of 2-5 g N m^{-2} d^{-1} and it removes approx. **30-40% of excess N** from the water.
- We constructed vegetation **chambers** to collect and measure gas samples from two **transects** (**inflow, outflow**); along two **subsites** within the transects (**shore, open-water**); & at two heights **(low, high**) of ***Typha spp.*** (Fig. 3).

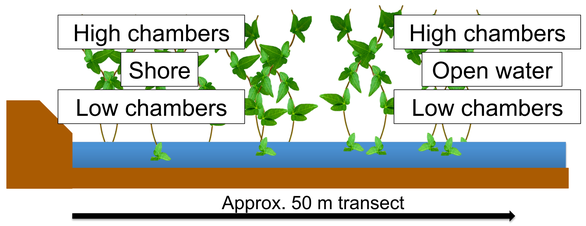


Figure 2. Representation of vegetation chamber placement along the transects' subsites and at the two heights of *Typha spp*.

- Gas samples were taken every 15 min during a 45 min period at two daytimes (8AM & 12PM) in July and Nov 2014.
- Samples were analyzed using a Varian CP-3800 GC and fluxes were calculated using the HMR package in R (Pedersen 2013).

Figure 3. Image depicts the vegetation chambers at the two different heights of *Typha spp.* at the shoreline subsite in the outlet transect of the Tres Rios CWS.

Vegetation Chamber Results

Methane (CH_4)

Nitrous Oxide (N_2O)

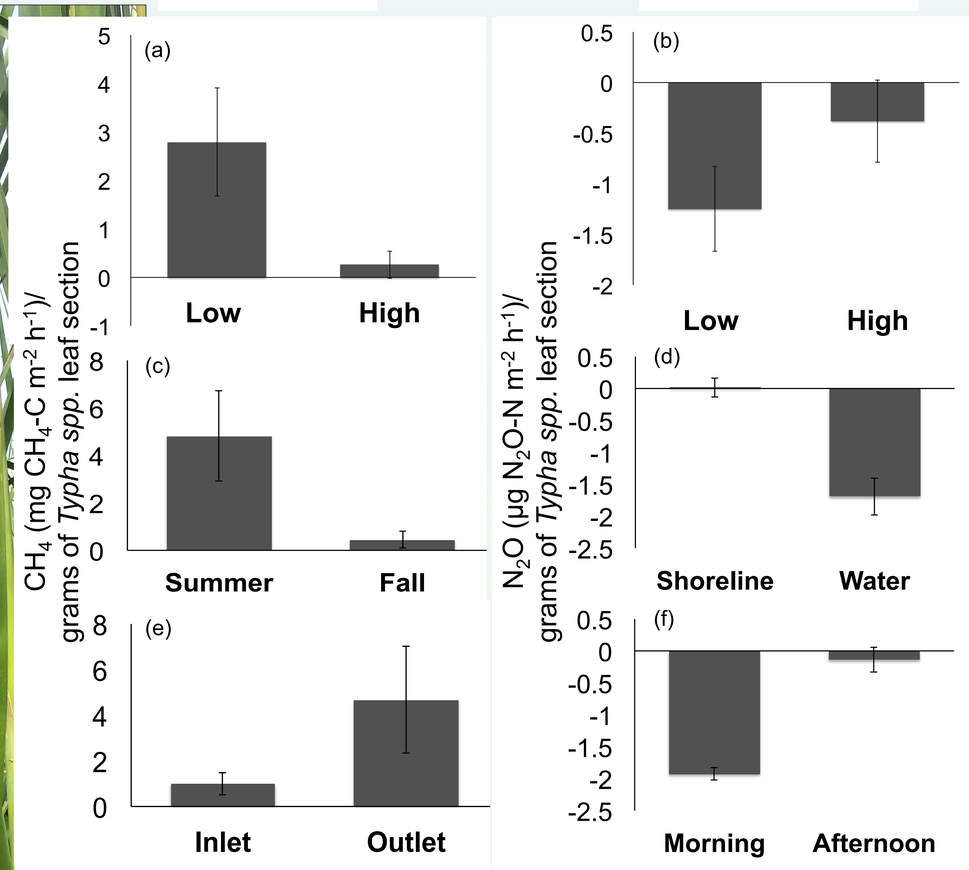


Figure 4. Preliminary results of methane (CH_4) fluxes with respect to plant height (a), seasonality (c), and transect (e); and of nitrous oxide (N_2O) fluxes with respect to plant height (b), subsite (d), and daytime (f).

Preliminary Analysis Summary

- Means of all CH_4 fluxes are not different between, transects, subsites, time, and plant height. However, summer CH_4 fluxes are sig. greater at low *Typha spp*. ($p<0.05$, Fig. 4a) and show a sig. interaction effect with subsite and transect factors ($p<0.01$).
- Means of all N_2O fluxes show gas uptake; are not different between transect, subsite, and time. Fall N_2O fluxes are greater from higher parts of *Typha spp*. (Fig. 4b) and show a sig. interaction effect with subsite ($p<0.01$).
- Significant fluxes show higher CH_4 fluxes in July ($p>0.05$, Fig. 4c) and outlet ($p<0.049$, Fig. 4e); and for N_2O, higher in shoreline subsite ($p<0.01$, Fig. 4d) and in the afternoon ($p<0.01$, Fig. 4f).

Conclusions

- Our results emphasize the need to develop new and more feasible methods to better resolve the role of vegetation in the biogeochemical cycling of methane (CH_4) and nitrous oxide (N_2O) fluxes as an important component of closing the gap in the greenhouse gas fluxes from novel wetland ecosystems.
- Due to the increased development of CW worldwide, it is important not just to study their effectiveness in purifying water but also the design factors, vegetation, & environmental conditions that control GHG fluxes.

We thank past and current Wetland Ecosystem Ecology Lab, ASU SoLS members for their assistance with methods and field work & City of Phoenix for their cooperation. This research has been supported by NSF GRFP, CAP LTER Program Graduate Grant (SBE-1026865), MGE@MSA, & SoLS FIGG Grant.