Seasonal and Spatial Patterns of Aquatic Net Primary Productivity in an aridland Constructed Treatment Wetland

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Introduction

Aquatic Net Primary Productivity (ANPP) measurements in an aridland Constructed Treatment Wetland (CTW) may provide useful data on biotic and abiotic factors affecting tertiary wastewater treatment.

- Previous research suggests that the Tres Rios CTW system continues to successfully deliver its designed tertiary treatment services in hot and dry conditions (Weller et al. 2016, Sanchez et al. 2016).
- The potential effects that ANPP has on tertiary treatment in these conditions are not yet well understood.

Goals:

1) Investigate ANPP in aridland CTW over space and time using the light and dark bottle method to measure dissolved oxygen (DO).
2) Continue collecting ANPP data every other month to complete a full year of research and identify any seasonal patterns or variability.

Experimental Design

We used the light and dark bottle method to measure DO at inflow and outflow sites within a single treatment cell of Tres Rios CTW every other month from May to November 2017.

Figure 1. Constructed wetland study cell. Arrows indicate location and direction of inflow(top arrow) and outflow(bottom arrow) sites. Red lines indicate transect locations.

Method:

- Six dark and six light bottles were filled with water from each site
- Initial concentrations (mg/L) and percent saturation (%) of DO were measured using a YSI model 52 DO probe
- The bottles were set to incubate *in situ* for several hours
- Final DO concentrations (mg/L) and percentages (%) were taken with the DO probe
- Final ANPP and Respiration amounts were calculated by taking the difference between initial and final DO and dividing by time.

Results

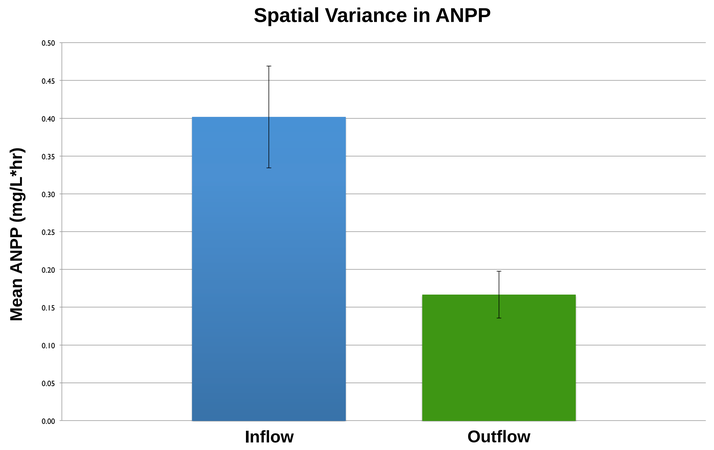

Figure 2. Mean ANPP measurements taken every other month from May to November 2017 at Inflow(blue) and Outflow(green) sites.

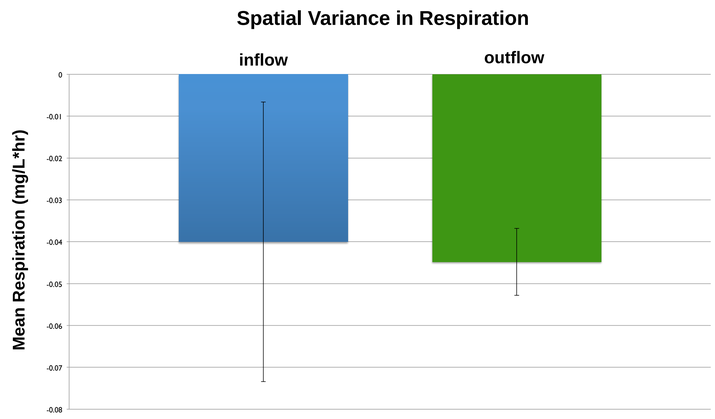

Figure 3. Mean Respiration measurements taken every other month from May to November 2017 at Inflow (blue) and Outflow (green) sites.

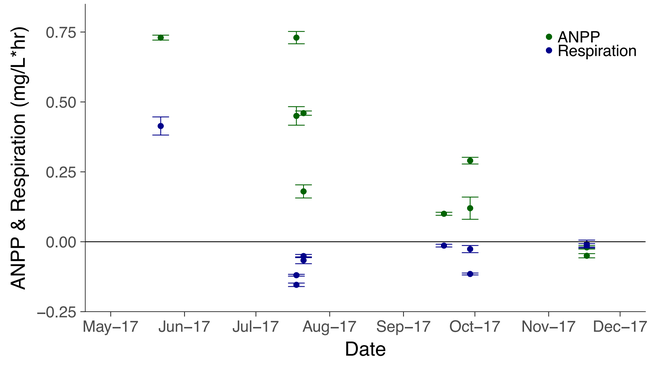

Figure 4. Time series of mean ANPP and Respiration in mg/L*hr every other month from May to November 2017 at both inflow and outflow sites.

Results (continued)

- Figure 2 shows us that ANPP was overall greater at the inflow site than it was at the outflow site ($p < 0.001$) over the seven months data was collected.
- Figure 3 indicates no significant difference between inflow and outflow sites ($p < 0.1$)
- Figure 4 shows a gradual decrease in ANPP as temperatures decrease over the months data was collected. It also shows a gradual overall increase in respiration. Water temperatures varied from 31 °C (March) to 23 °C (November)

Discussion

Initial findings suggest rates of ANPP and respiration are higher over the summer months (higher temperatures) and decrease as temperatures decline. Rates were also found to be higher at system inflow compared to outflow.

- Increased ANPP at inflow sites may be due to observed turbidity of the water.
- Long-term data research tells us there are higher levels of nutrients (nitrate and ammonium) at outflow sites compared to inflow (weller et al. 2016)
- Decreased salinity at inflow sites may cause higher ANPP
- Negative ANPP readings may be due to overcast weather when photosyntheticly active radiation (PAR) was minimal.

Conclusion and future directions

- We plan to continue measurements through a full year of data to further establish temporal and spatial patterns of ANPP and respiration
- Continue to investigate relationship between ANPP and Respiration and the key ecosystem regulatory variables

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References: Weller et al. 2016, Sanchez et al. 2016. Weller et al. 2016. Photo retrieved from: http://www.aeromoe.com/Tresrios.html.