The Effectiveness of Floating Treatment Wetlands for Water Quality Best Management Practices

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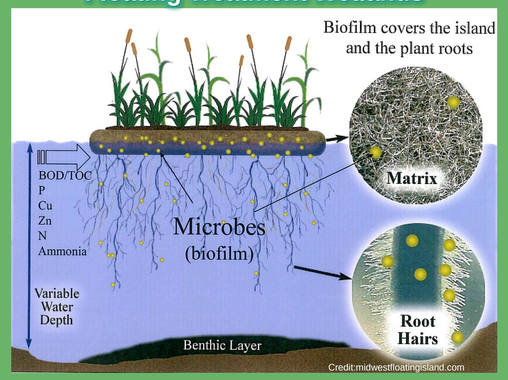
ABSTRACT

Floating Treatment Wetlands (FTW) is a technique of growing semiaquatic plants in which the plants are suspended on the aquatic body's surface. One of the biggest benefits of this technique is that the plants rise and fall with the height of the water column, thereby continually absorbing nutrients and oxygenating the water. Wetlands data was compared with simulated wetlands in a greenhouse. Both had similar pH and nutrient levels. It was found that enhanced nitrate levels in the simulated wetlands produced plants that had more vitality, greener leaves, and a greater leaf mass but a reduced root mass. Elemental analysis of the root and vegetation tissues showed that both tissues had a marked increase in nitrogen content. Enhanced phosphate levels produced similar vegetation but with an increase in the root mass.

BACKGROUD AND SIGNIFICANCE

Floating Treatment Wetlands



Plant Selection

Semi- aquatic macrophytes native of North America
Fast growing
Larger roots for nutrient absorption

Focus on nitrate and phosphate

Salts present :	An important cause of algae growth in water bodies	In large quantities can pose risks to aquatic ecosystems and their biotic components
•Fertilizers •Waste water •Detergents •Other household items		

METHODS

Real Wetlands

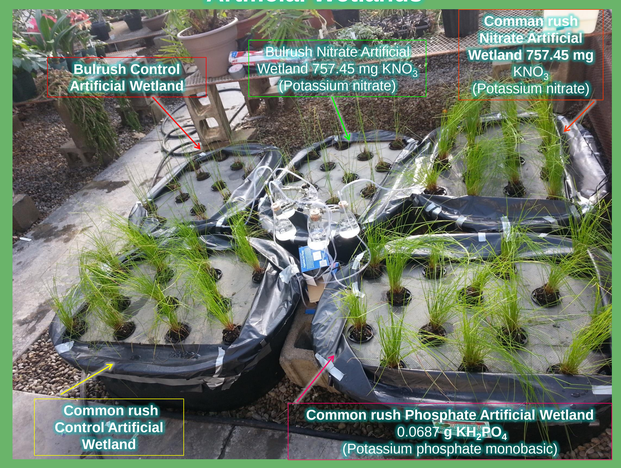
Six wetlands divided in pairs: one control and one experimental group (with the FTW). Water samples taken from bank other data taken near FTW. The three usage areas were residential, golf course and agricultural.

Artificial Wetlands

Five water tanks were prepared with water from the residential pond in the greenhouse of Miami University. A polyester mat with a capacity for 14 plants was floated in each tank. The plant plugs were purchased from a commercial greenhouse and placed into cups that were suspended from the mat into the water column. Each tank had an air bubbler to keep the water oxygenated. The edges of each tank were covered with black plastic to minimize the growth of algae, bacteria and other organisms. Each tank was sampled for analysis of nitrite, phosphate, and pH. After eight weeks, the vegetation and roots were removed, allowed to dry, weighed, and analyzed for nitrogen and phosphorous content.

Testing Methods

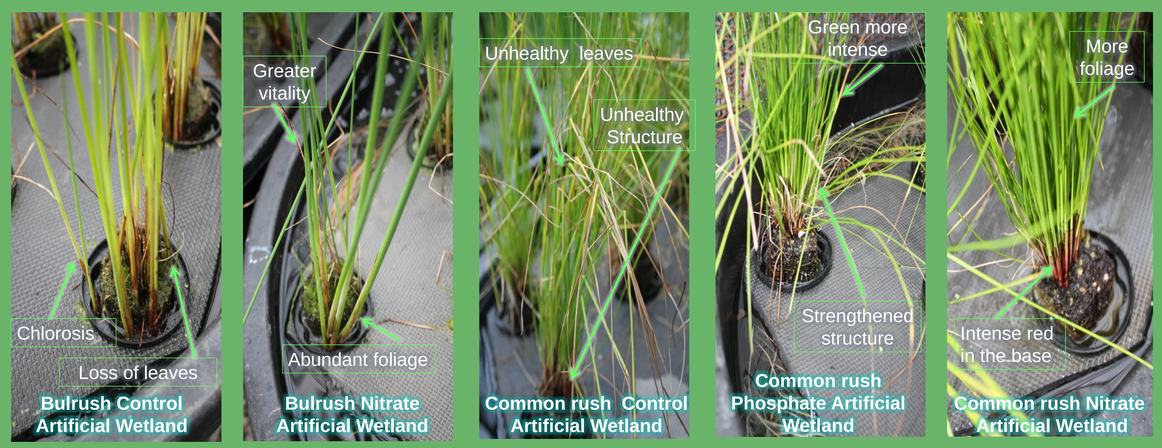
Artificial Wetlands



DATA

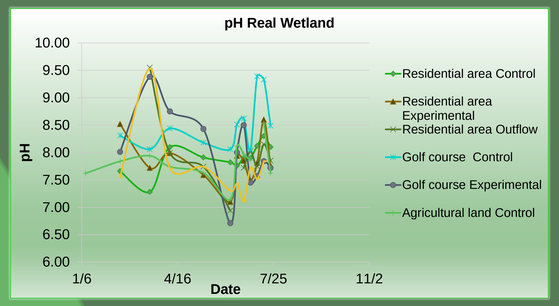
Visual Comparison

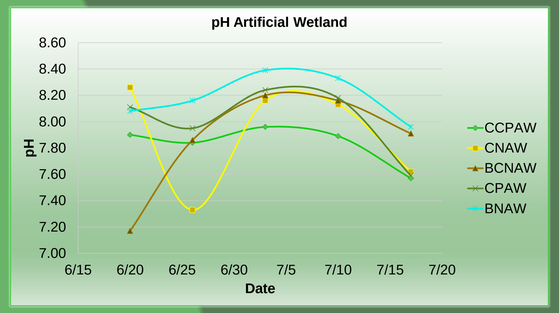
After eight weeks of growing in the water from the residential pond, the vegetation in the control wetlands started to yellow and fall over. The vegetation in the nitrate enhanced wetlands remained green, tall and healthy. The vegetation in the phosphate enhanced wetlands had a green hue but were not as tall nor as healthy as the nitrate enhanced wetland plants.

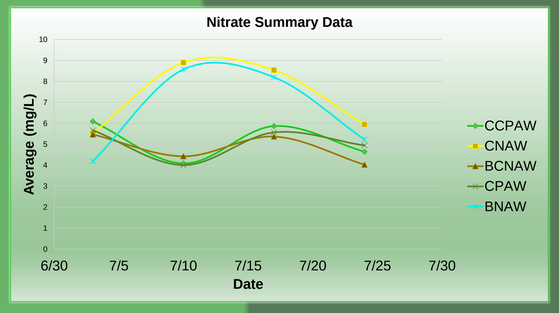


Vegetation Mass (g)	
Bulrush Control Artificial Wetland	102.00 g
Bulrush Nitrate Artificial Wetland	188.12 g
Common rush Control Artificial Wetland	146.98 g
Common rush Phosphate Artificial Wetland	156.94 g
Common rush Nitrate Artificial Wetland	217.28 g

Dry Root Mass (g)	
Bulrush Control Artificial Wetland	26.745 g
Bulrush Nitrate Artificial Wetland	4.825 g
Common rush Control Artificial Wetland	27.940 g
Common rush Phosphate Artificial Wetland	16.474 g
Common rush Nitrate Artificial Wetland	8.377 g







Greenhouse Studies – preliminary findings

Enhanced Nitrate	
Root mass	**Vegetation mass**
Bulrush 58% reduction	Bulrush 184% increase
Common rush 62% reduction	Common rush 148% increase
%N in Roots	**%N in Vegetation**
Bulrush 139% increase	Bulrush 200% increase
Common rush 153% increase	Common rush 174% increase
Enhanced Phosphate	
Root mass	**Vegetation mass**
Common rush 104% increase	Common rush 104% increase

CONCLUSION

- The plants have an accelerated uptake of nitrate and phosphate
- The nutrient which had a greater effect on the plants was nitrate
- Suspending plants on the water column is effective at reducing nutrient levels.
- Preliminary comparisons of artificial ponds with real wetlands support the effectiveness of plants for water treatment, nutrients uptake, and pH control.

FUTURE RESEARCH

- Continue to gather data and water samples from the real wetlands .
- Identify a new technique to determine the pond's phosphate concentration.
- Enhance plant propagation.
- Optimize plant selection.

BIBLIOGRAPHY

Tanner, C.C., Headley, T.R. "Components of floating emergent macrophyte treatment wetlands influencing removal of stormwater pollutants", Ecological Engineering 37 (2011) 474-486.

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