Economic Benefits of Wetlands versus Water Treatment Plants When Reducing Metals

Katie Barney, Amanda Cornish, Katia Palza
Baylor University, Waco, TX 78798

Abstract

The purpose of this preliminary experiment was to compare the average loss of copper and chromium from the Lake Waco Wetlands to the average loss in the Mount Carmel water treatment facility. After reading Ornes' article, we hypothesized that, when taking maintenance costs into consideration, the wetlands would be more economically efficient than a water treatment facility. We took four samples from the input and output cells as well as obtained water and financial data from the Mt. Carmel water treatment facility and the wetlands. There was not sufficient data to support our hypothesis.

Introduction

Historically, wetlands have been used as water filtration systems (Bobbink). Currently there are some locations where the people do not have water treatment plants, but instead are dependent on large wetlands to naturally filter their water supply (Bobbink). This experiment investigated the efficiency a wetland provides in comparison to a water treatment facility and hypothesized that wetlands are economically more efficient in purifying water than a water treatment facility. The efficiency was studied by comparing the removal of heavy metals from water by the wetlands and a water treatment facility. Ideally, the results will contribute to an expanding knowledge on the filtration system of metals, specifically copper and chromium, in water to reduce negative health effects they both can potentially cause.

Materials and Methods

Four 250 mL water samples were collected from the input cell as well as four 250 mL water samples from the output cell (**Figure 1**). Water samples were tested for copper and chromium by a certified lab (TestAmerica Inc.) Additionally, water data from the Mt. Carmel Water Treatment Plant (Waco, Texas) as well as the costs of building and maintaining both the wetlands and the water treatment facilities were collected to determine if one is more economically beneficial (**Table 2**).

Katia Palza and Katie Barney at the wetlands.

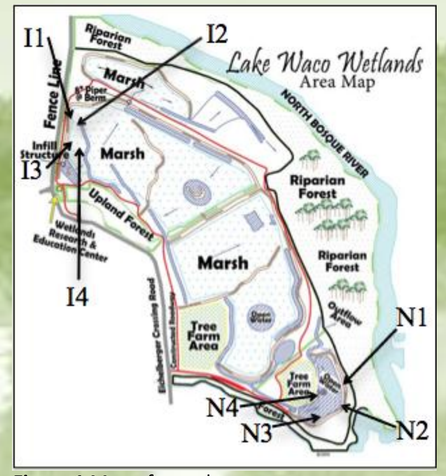

Figure 1 Map of sample source

Results

The minimum levels of detection for copper and chromium in the wetlands and the water treatment facility are found in **Table 1**. The finances and capacities for the wetlands and the water treatment facility are shown in **Table 2**.

	Wetland		Treatment Facility
	Input Cell	Output Cell	Output
Copper	< 0.025 mg/L	< 0.025 mg/L	0.073 mg/L
Chromium	< 0.005 mg/L	< 0.005 mg/L	< 0.001mg/L

Table 1 Results of water test from wetlands and water treatment facility. Compliments of Sally French.

	Wetlands	Treatment Facility
Construction Costs	$600,000	$80,000,000
Annual Budget	$200,000	$4,000,000
Average Capacity (gallons/day)	6,000,000	28,000,000
Maximum Capacity (gallons/day)	11,000,000	42,000,000

Table 2 Cost and capacity statistics for the wetlands and water treatment facility. Compliments of Tom Conry and Steve Ash.

Amanda Cornish gathering water samples at the wetlands

Water Drinking Standards:
Copper: < 1.3 mg/L
Chromium: < 0.1 mg/L
Calculated cost per gallon:
Wetlands: $9.13x10^-5
Treatment plant: $39.1x10^-5

Discussion and Conclusion

Based on the preliminary results, the hypothesis could not be accepted. The water tests used were not sensitive enough to detect either copper or chromium in the wetland water. However, the metals are present, but in a lower quantity that can be tested for. It was also found that Mt. Carmel did not detect chromium in their water, but copper was detected. A concurrent experiment testing for two other metals showed no detection in the water samples either. However, the *Schoenoplectus californicus* (bulrush) samples that were taken, each from the same location as the water sample, tested positive for the presence of metals. The bulrush is also known to take up copper and chromium (Murray-Gulde). Because of this, it is possible to conclude that copper and chromium were present in the water, but in small, undetectable amounts. Mt Carmel's water had a higher amount of copper in it's water sample than the wetland's for various reasons. One possible reason is the water was exposed to copper as it passed through the treatment plant. Even so, it meets the national water drinking standards of <1.3 mg of copper per liter and probably will not cause any potential health problems such as gastrointestinal distress or liver and kidney damage if exposed to high amounts. Since the preliminary results did not have specific concentrations of these metals, it is impossible to determine which filtration system is more effective in removing these metals. However, it was determined that the wetland's cost per gallon of water is less than that of the water treatment facility. The hypothesis was proven wrong based on these results.

Literature Cited

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