

Comparative Effects of Alien Plants in The Lake Waco Wetlands

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Abstract | The proposed experiment was to compare nitrogen and phosphorus levels by constructing mesocosms. The plants compared were the cattail (*Typha spp.*), an invasive plant species (Aquatic Plants in Pen-and-Ink, 1997) in The Lake Waco Wetlands that is considered nuisance (Stutzenbaker, 1999) and the bulrush (*Schoenoplectus californicus*), a common (Achintya N. Bezbaruah, Tian C. Zhang, 2004) wetland plant. The experiment demonstrated cattails and bulrush do fix nitrogen and lower phosphorus levels in soil. Cattails were compared to bulrush by transplanting sixteen plants and separating them into mesocosms and taking weekly soil samples. Data showed bulrush soil had an average of 17.00 ppm phosphorus and 7.88 ppm nitrogen. Cattail soil had 16.25 ppm phosphorus and 6.50 ppm nitrogen. It can be inferred, cattail can be helpful fixing nitrogen and taking phosphorus out of the ecology of the Wetlands. Although this is a valid conclusion, there are certain levels of error that must be taken into account when interpreting the data.



Introduction | Increased use of fertilizer in agriculture potentially causes serious environmental damage due to excessive nitrogen and phosphorous entering fresh water streams in runoff from farms. Many methods of naturally reducing nitrogen and phosphorous content have been sought. Two common plants implemented for this purpose are cattail and bulrush. Literature concerning cattail and bulrush has previously shown either little effect (McIntyre and Riha, 1991; Zhu and Sikora, 1995) or greater nitrogen removal by cattail (Bachand and Horne, 2000; Hume et al., 2002). In the Lake Waco Wetlands as well as other wetland environments, cattail is considered a nuisance (Stutzenbaker, 1999) while bulrush is one of the most widely used plants in constructed wetlands (cite). In an effort to display the usefulness of cattail, the objective of this research was to test the working hypothesis that nitrate and phosphorus removal is greater using the cattail versus bulrush. Results were mixed and indicated, from week 1 to week 4, the phosphorous content in the soil containing cattail dropped 1ppm and the concentration in the bulrush soil dropped 2ppm. Conversely, the cattail fixed more nitrogen, which is evidenced by a 5ppm difference in nitrogen content between week 1 and week 4. The bulrush nitrogen content decreased 2ppm from the first week to the fourth week.

Materials and Methods | Eight cattail and eight bulrush were collected in close proximity to each other so they would originate from similar environments. Soil was collected from the same location in the wetlands. The cattail, bulrush, and soil was separated into six different clear boxes (57.2cm X 41cm X 12.7cm). Eight cattail were placed in two containers, totaling 16 cattail in mesocosm one. Sixteen clusters of bulrush were transplanted into two containers and placed in mesocosm two. Finally, the soil was used as a control to quantify the difference in nitrogen and phosphorous fixation between the soil samples with and without the plants. The mesocosms were (121.92 cm X 81cm X 50.8cm). Each mesocosm was filled with water to approximately 18.3cm \pm 1.1cm (Figure 1). Weekly samples were taken by scooping a pint of soil from each of the six plastic containers. After collecting the sample from each plastic container, the shovel was rinsed before sampling the next container. The soil sample was spread into six separate plastic containers before they were dried and sent to Texas A&M labs for processing. The results from each mesocosm were averaged.



Figure 1: (A) cattail, after three weeks ; (B) bulrush, after three weeks ; (C) Soil, after three weeks

Results | The results were inconsistent with the original hypothesis. Comparatively, the bulrush was able to remove more phosphorus from the soil than the cattail. The net change in the concentration of phosphorus from week 1 to week 4 for the bulrush was 2 ppm but only a difference in 1 ppm for the cattail. The bulrush was able to remove twice as much phosphorus from the soil than the cattail. However, in terms of nitrogen fixation, the cattail outperformed the bulrush. The net change in the concentration of nitrogen from week 1 to week 4 for the bulrush was 2 ppm and a difference of 5 ppm for the cattail. The cattail fixed more than two times the amount of nitrogen than the bulrush. Both the results of the phosphorous and nitrogen soil samples were consistent with the declines found in the concentrations for the constant over the four week experiment.

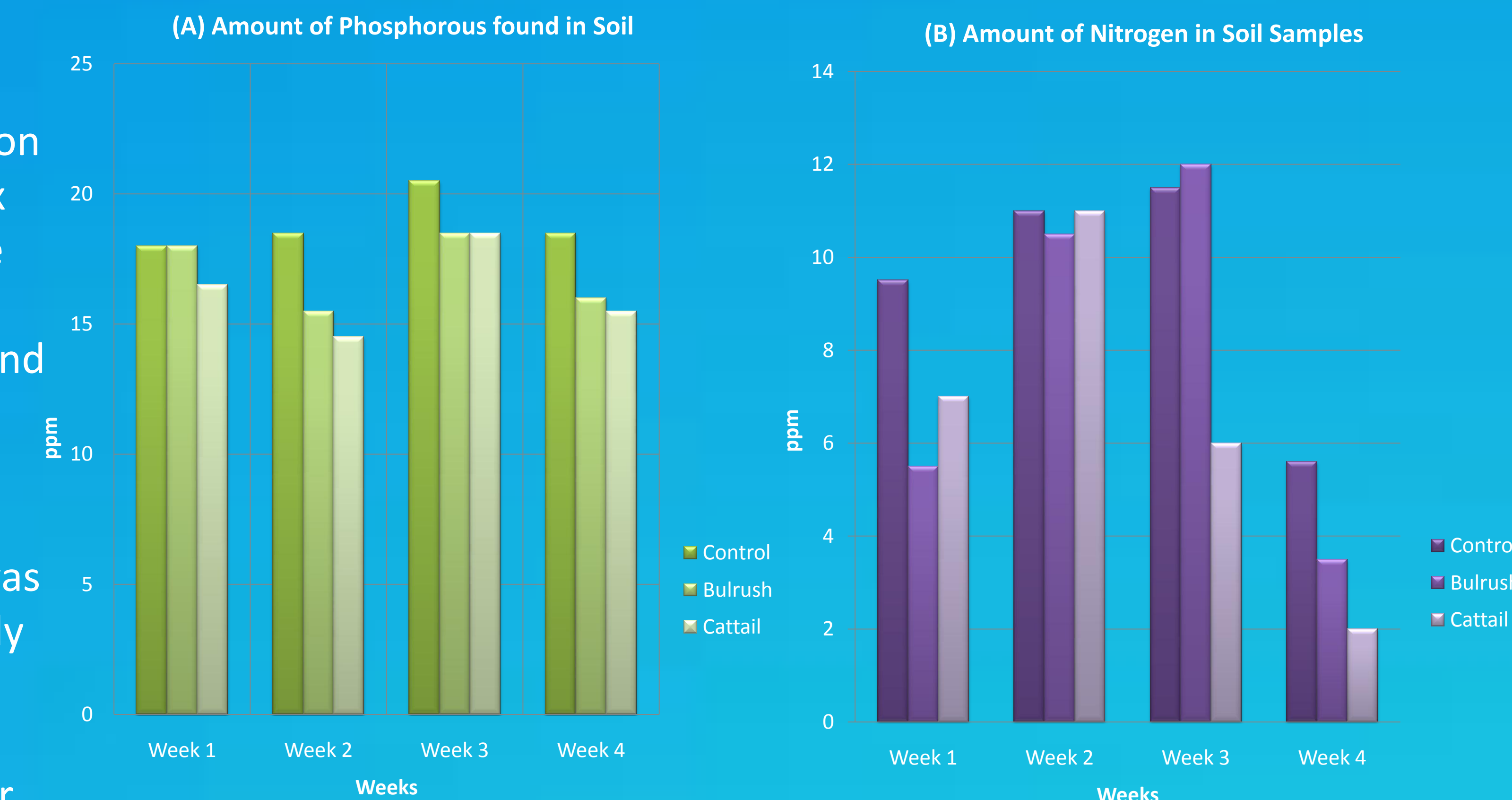


Figure 2: (A) Amount of Phosphorous found in Soil Samples; (B) Amount of Nitrogen in Soil Samples

Discussion and Conclusion | Phosphorous concentrations were comparatively higher in cattail soil samples than bulrush soil samples. As Figure 2 (A) shows, soil samples taken from bulrush mesocosms had a net concentration difference of phosphorus from week 1 to week 4 that was half that of the soil samples taken from cattail mesocosms. Conversely, nitrogen concentrations were found to be higher in bulrush soil samples than in cattail samples. Figure 2 (B) shows that the net difference in the nitrogen concentration in the cattail samples was significantly less than the bulrush soil samples. There are several factors that could have contributed to the varied results. Recovering from the shock of transplantation likely contributed to the drastic changes in phosphorus and nitrogen concentrations from week 1 to week 2. Additionally, during the four week experiment, the city of Waco received several inches of rain which caused the mesocosms to overflow. This could have also varied the results as rain water and roof runoff could have entered the mesocosms. In light of these circumstances whose true magnitude can not be calculated and the inconsistencies in the results, the hypothesis is neither accepted nor rejected.

Literature Cited

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