The Effects of Urbanization on Restored and Reference Wetlands

NRCA Student: Victoria O'Malley[1]

Community Partners: April Doroski[2] and Ashley Helton[2]

[1]Bridgeport Regional Aquaculture School [2]University of Connecticut

ABSTRACT

- The area around the Steward B. McKinney National Wildlife Refuge is highly urbanized.
- This project looked at whether the urbanization of land adjacent to the wetland had a positive or negative effect on soil and water quality.
- Our subject area was two separate wetlands, one was affected by restoration effort and the other was used as a reference.
- We took soil samples, which we tested for metals commonly found in urban runoff.
- We took water samples to test the amount of ortho-phosphate, nitrate, and ammonium.
- We also looked at the visual differences between the two wetlands.
- We found:
  - nitrate was below detection in both the wetlands;
  - phosphate was higher in the reference wetland;
  - nickel and copper were higher in the restored wetland; and
  - lead was higher in the reference wetland.
- Our data showed that not only does the adjacent land use have an effect on the wetland, but it has an overall negative effect.

INTRODUCTION

Wetlands in the Steward B. McKinney National Wildlife Refuge (Fig.1) are highly important to the local environment. They provide habitats to countless species of animals, as well as many plant species.[1] Wetlands are also important when it comes to water quality. Wetlands have the ability to retain excess nutrients and pollutants, protecting the water quality downstream.[1]

The refuge is surrounded by the highly urbanized towns of Bridgeport and Stratford, CT. The urban environment around the refuge has grown substantially in recent years. The industrial runoff from this urban setting can contain excess nutrients and pollutants, which can be retained within the wetland. This experiment quantifies how land use, adjacent to the wetlands, affects the nutrient and contaminant retention and accumulation.

Fig 1. The above photo shows the study area, including points that represent the two sampling sites.

REFERENCES

[1]Functions and Values of Wetlands | Washington State Department of Ecology. Accessed 15 Feb. 2016. <http://www.ecy.wa.gov/programs/sea/wetlands/functions.html>.

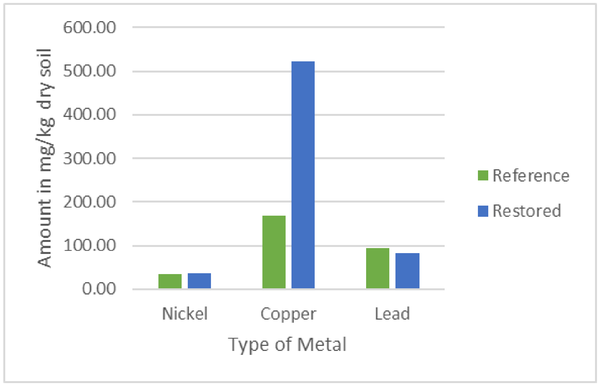
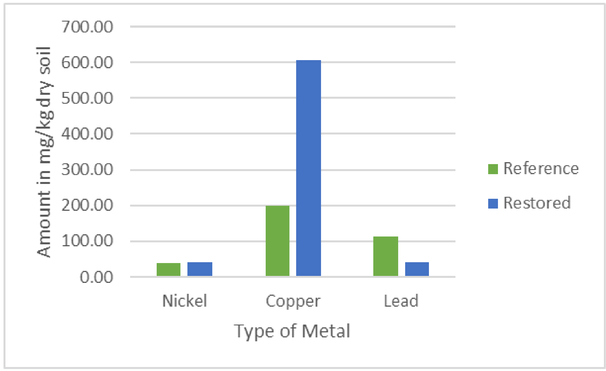


Fig 5. Graph to the left shows the amount of nickel, copper and lead in mg/kg dry soil from a depth of zero to five centimeters for the reference and restored wetlands.

Fig 6. Graph to the right shows the amount of nickel, copper and lead in mg/kg dry soil from a depth of five to ten centimeters for the reference and restored wetlands.



METHODS

Study Area and Organism

Project Study Area Identification

- The Steward B. McKinney National Wildlife Refuge in between Bridgeport and Stratford, CT.
- Two wetland sites both on the refuge: one was the reference site, free from restoration activities and the other was a restored site.

Parameters Measured

- Lead (Pb)
- Nickel (Ni)
- Copper (Cu)

1. Nitrate (NO_3^-)

- Ortho-phosphate (PO_4^{3-})

Data Collection Protocol

- Weather conditions including air temperature and barometric pressure were recorded at each site.
- Water was tested for conductivity, temperature, salinity and dissolved oxygen using a YSI multiparameter device. Grab samples were also collected and later tested for nutrients.
- Soil samples were collected at four different points within each of the sites. A slide hammer was used to collect the samples. Once the samples were collected, they were sieved to separated the soil from roots and other impurities. The contents of the soil was later analyzed (Fig. 2).
- GPS coordinates were taken at each of the sample sites.

Data Collection: Dates and Times

- August 7, 2015 at 2:00 pm
- August 26, 2015 at 10:57 am and 11:53 am
- September 14, 2015 at 12:55 pm and 1:25 pm
- November 3, 2015 at 2:04 and 2:22 pm

RESULTS

Visual Standpoint

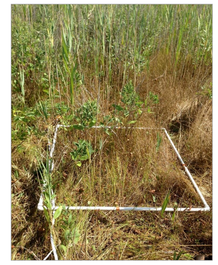
- Based on a purely visual standpoint the plant life in the reference wetland appeared healthier than that of the restored wetland (Figs. 2 and 3).
- The plants in the reference wetland looked healthier, compared to the restored wetland where there was large amounts of dead plant life as well as iron floc.

Chemical Parameters

- The levels of NO3- in the water were below detection in both wetlands, possibly due to the iron levels (Fig. 4).
- The levels of PO43- were higher in the reference wetland. It was 1.3 mg/L compared to 0.1 Mg/L.
- In both soil samples, the levels of nickel were nearly the same, but slightly higher in the samples from the restored site.
- In both soil samples, the levels of copper were much higher in the restored wetland (Figs. 5 and 6).
- In both soil samples, the levels of lead were higher in the reference wetland, although not by much.

Fig 2. Photo to the left shows a sample of the plant life in the reference wetland.

Fig 3. Photo to the right shows an example of the plant life in the restored wetland.



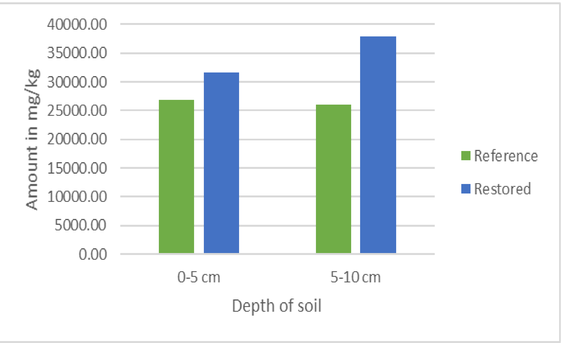


Fig 4. The graph to the left shows the levels of iron in dry soil at a depth of 0-10 cm.

CONCLUSIONS

Based on the levels of several nutrients as well as the levels of metals measured, our data suggested that the land use bordering the restored wetland had an impact. Although both wetlands received variations of urban runoff, the data gave off the impression that the restored wetland received higher amounts. Also, from a purely visual standpoint, the reference wetland looked healthier. In the restored wetland, there was abundant dead plant matter as well as ample amounts of iron floc. It can be concluded that not only did the adjacent land use have an effect on the wetland, but also a generally negative effect.

ACKNOWLEDGEMENTS

I want to say thank you to my community partners April Dorosky and Ashely Helton. Emma Gallagher who with me alongside with our shared community partners. Laura Cisneros the NRCA coordinator and everyone at the Natural Resource Academy.