Examining Soil Quality in Relation to Plant Diversity in NYC Wetlands

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Abstract:
In order to analyze the overall soil quality in NYC wetlands, several aspects of the soil were studied. This study serves to investigate the effects of urbanization on soil porosity, as little to no information is known about this relationship. Soil moisture was measured using a drying oven, and soil porosity within the sand, silt, and clay layers was measured using settling containers. Dry soil samples were sieved to also compare soil porosity. Contrary to what was expected, the site with more clay had higher plant diversity and lower soil moisture. This may have been as a result of the date that each site was created. Further studies should focus on using sites created around the same time frame.

Introduction:

Importance of wetland soils:

- A wetland is an ecosystem where the water table is in level with the ground. They filter our water, provide a natural buffer to storms, and provide habitats for a variety of organisms (Sharpe & Baldwin, 2009).
- Soil is important for plant abundance and richness; poor soil quality can result in wetlands that won't function properly.

Urban Effects on Soil and Wetland Quality

- Soils are a mix of mineral and organic solids, water, and open pores (Faulkner & Richardson, 1989).
- The ideal balance between soil particles is 7-27% clay, 28-50% silt, and less than 52% sand (USDA, 2015).
- Moisture in the soil is beneficial to plants up to a certain threshold. Once that threshold is reached, it creates an anaerobic environment which hinders plant growth. (Baldwin *et al.,* 1996).
- Urbanization leads to wetland loss and accounts for as much as 58% of total wetland loss (Ehrenfeld, 2000).
- The impact of the urban environment on soil composition and porosity is little-studied.

Hypotheses:

- If there is an imbalance between sand, silt, or clay, then there will be a decrease in plant diversity.
- Inwood Hill will have a greater percentage of soil moisture than the other sites, which will lead to an increase in plant diversity.

Methods:

- Triplicate soil core samples were taken from randomized plots
- Wet soil was placed in settling jars with water and soap, shaken up, and allowed to separate based on size and weight
- Soil was dried in a drying oven and weighed for moisture content
- Dried soil samples were separated using a standard sieve set based on particle size

Results:

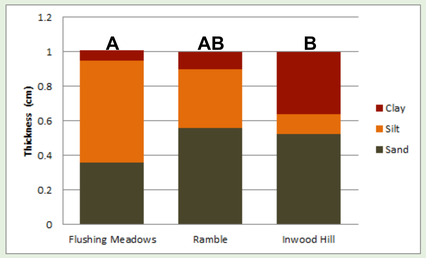

Figure 1: Composition of soil within the sites. Flushing Meadows had the greatest amount of silt and the least amount of clay.

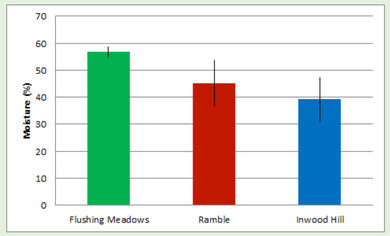

Figure 2: Soil moisture within all three sites. Flushing Meadows had the greatest percentage of moisture and Inwood Hill had the lowest.

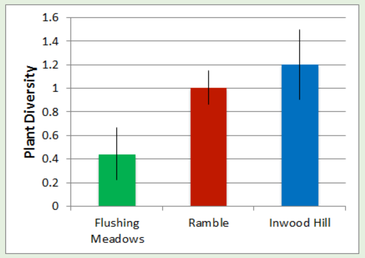

Figure 3: Plant diversity (Shannon-Wiener Index) of Flushing Meadows, the Ramble, and Inwood Hill. Inwood Hill had the greatest diversity while Flushing Meadows had the lowest.

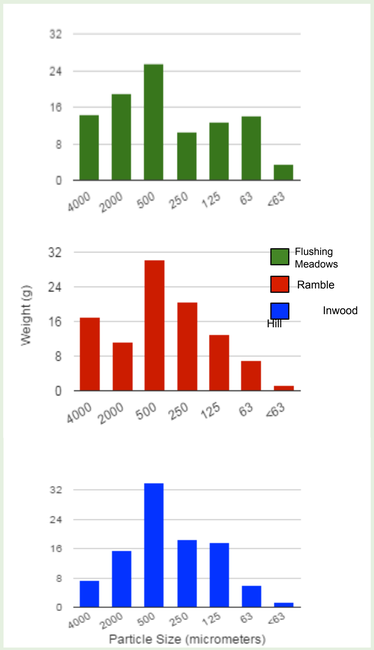

Figure 4: Soil particle size within all three sites. The 500 micrometer section was the largest among all three sites. Flushing Meadows had a greater proportion of smaller sized particles, while the Ramble had larger particles.

Discussion:

- The data did not support the hypothesis that an imbalance of sand, silt, or clay will lead to a decrease in plant diversity. Instead, the site with the least amount of silt and greatest amount of clay had a greater plant diversity.
- The data did not fully support the hypothesis that Inwood Hill would have a greater percentage of soil moisture. Inwood Hill did have a greater plant diversity, but it had the least amount of moisture in the soil.
- Inwood Hill was created in 2014, whereas Flushing Meadows was created in the 1930s. Therefore, Inwood Hill has not had sufficient time to be exposed to invasive species that may decrease plant diversity.

Future Research:

- Further studies should research the plant diversity in these sites over time.
- Future studies can also research the effect of soil composition on plant diversity in sites that were created around the same time.

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