Final Soil Project

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EVS2193C-2 Environmental Sampling Techniques

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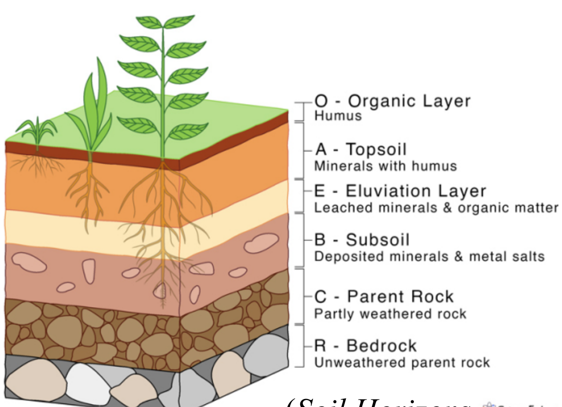
Introduction

Soil composition is like an auto-biography for the ground. Having nutrient-rich soil reaps many benefits such as holding water and providing quality conditions for plants to grow. Homeowners and avid gardeners need to know information about soil to understand if they have any flood prevention and to ensure they select adequate locations for planting vegetation in their gardens. Additionally, farmers, home builders, and water-quality professionals would all be interested in this study because their respective fields all need soil information to better their understanding of how to best complete their jobs. Comparing soil quality from different locations and the web soil survey will add to the repository of information regarding soil health. Information from the Web Soil Survey will accurately describe the soil profile at five different sites.

Literature Review

Different types of soil, with their own distinct characteristics, are known as soil horizons. Soil horizons are found in different layers in the ground and act as the history of soil (*Soil Horizons,* 2022).

There are six main soil layers that are displayed in the image below (Image 1). While all six layers exist in nature, not all are present in each ecosystem. Pelegrino (2020) states that layer O is normally the top layer and consists of mainly organic matter.

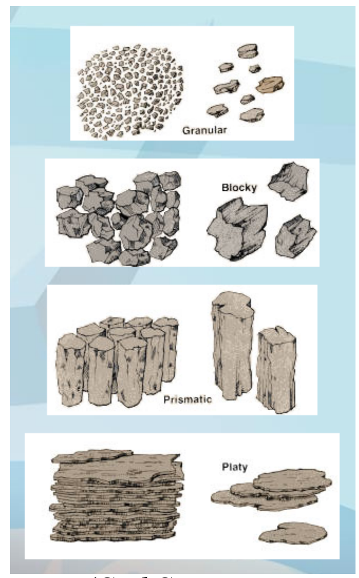


(*Soil Horizons,* 2021)

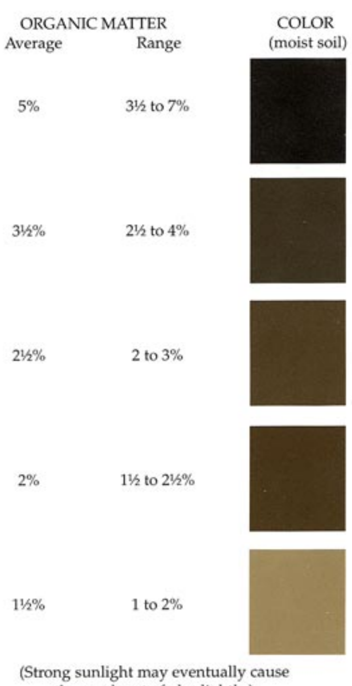
Image 1: Description of different soil horizons

This layer is crucial to the growth of crops because it contains vital nutrients, such as carbon, nitrogen, phosphorus, and sulfur. This level also works to absorb water and prevent flooding.

Layer A, known as topsoil, is made of minerals and decomposed organic matter with a granular soil structure. This layer results from variation in animal and plant activity. Continuing, horizon E consists of washed out organic matter and clay. It is lighter in color and is ashy when one touches it. The horizon is found in habitats that have a high temporary water table. Layer B, the zone of accumulation, includes the build up of minerals leached out of the layers above it. This layer has a greater amount of clay and fewer amounts of organic material forming a blocky and prismatic structure. Following, horizon C is closest to the bedrock and is unaffected by the soil formation process. Layer R, known as Bedrock, is the deepest layer made up of compacted, unbreakable materials like granite, sandstone, or limestone (Pelegrino, 2020). Soil structure varies depending on the layer. As explained by *Soil Structure* (n.d.), four common types of soil structure are granular, blocky, prismatic, and platy. A granular structure has distinct particles clustered together to form somewhat spherical forms. Blocky structures have distinct particles that form angular blocks; larger blocks conclude that water does not penetrate well through soil. When soil particles form vertical pillars with cracks, prismatic structure is formed with extremely poor drainage. Finally, platy soil structure contains particles that form thin horizontal sheets (*Soil Structure,* n.d.).



(*Soil Structure,* n.d.)
Image 2: Composition of soil particles



(Obreza and Collins, 2022)
Image 3: Levels of organic matter in soil

As reinforced by Obreza and Collins (2022), the color of soil is formed by many factors including organic matter and mineral matter. Carbon, Nitrogen, and Sulfur are the prominent elements that make up organic matter. The shade or darkness of soil indicates the amount of these elements present in the horizon. Organic matter is crucial to any habitat because it acts to help prevent erosion. The ideal composition of organic matter is five percent. Conversely, mineral matter is weathered rocks that contribute to the physical composition of soil, such as color and texture. Yellow or orange soil occurs when iron comes in contact with oxygen. Similarly, when iron is saturated with water, gray soil is formed. Soil is white when there are increased levels of calcium carbonates and magnesium (Obreza and Collins, 2022).

Methods

Site Descriptions

Pond sites - Four sites were selected around the JERFSA pond. The pond sites were all located within the boundary of Jupiter Community High School. There are parking lots surrounding the pond on the north and west sides. The south and east sides are bordered by main roads.

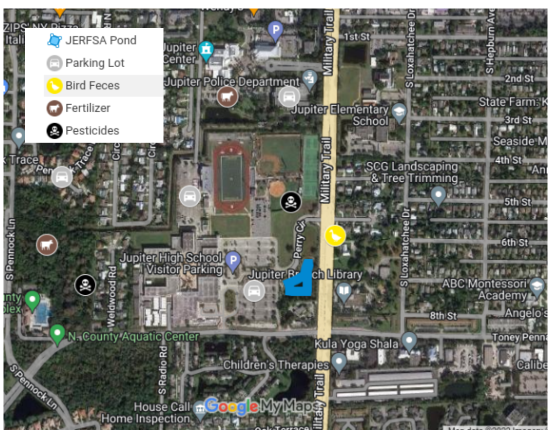
- North: This site was located at a low elevation which resulted in the hole reaching the water table. The site was shaded by trees and had moist soil. There was abundant vegetation and lots of rocks.
- East: This site was located relatively close to the water level of the pond and did not have a wide variety of vegetation or grass surrounding it. There were few trees shading the area and the hole quickly filled with water when it was initially dug.
- South: This site was located at the highest elevation and furthest away from the pond water level. There was grass surrounding the site, but it lacked other types of vegetation.

With that being said, there was not much shade on the site. This area was the driest out of all of the pond sites.

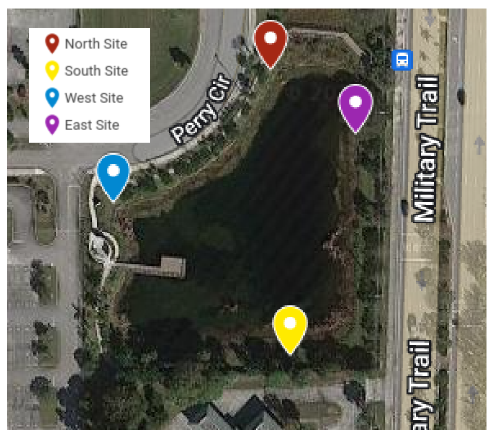
- West: This site was located about 10 feet away from the pond and was at about the same elevation as the east hole. It had drier conditions on the ground, but the hole reached the water table. There was sparse surrounding vegetation, but not as much as the north site.

<u>Home site</u> - One site was located in a neighborhood on the Jupiter Intracoastal. The area was built up by fill over forty years ago. The elevation is about ten feet above sea level. There is good shade and a large patch of grass on the site. There is also a water pipeline beneath the site. The hole was dug about twenty feet away from the house in the front yard. There is a line of bushes dividing the patch of grass from the road.

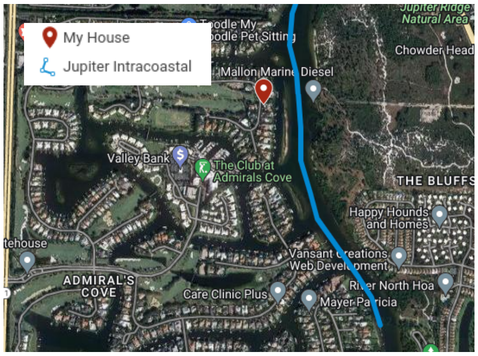
Maps



Map 1: Overview of Jupiter High School and surrounding areas



Map 2: Aerial view of the Perry J. Cohen Retention Pond (referred to as JERFSA Pond)



Map 3: Overview map of site 5 and surrounding areas

Map 4: Aerial view of the hole located at site 5

Procedure

The first step in this study was to evaluate if permission was needed or not. Since the pond sites were located at school, permission was obtained from Dr. Teresa Thornton. These sites have been commonly used in the past, so locations were chosen directly on the pond. Sites were selected based on distance from the pond, elevation, easy access, and direction. The site not at the pond did not require any formal permission. This site was determined by the distance from the house and absence of tree roots. The equipment utilized for the procedure were a shovel, a meter stick, a mobile phone (camera), and a Munsell color chart. Each hole was dug to about 3 feet in depth, including the holes submerged in water. Once the hole was dug, a meter stick was placed into the hole and a photograph was taken to capture the different horizons present. Next, the different colors of soil were identified using the Munsell color chart and recorded in the Notes application. Following, data was taken from the Web Soil Survey–a global database on soil created by the National Cooperative Soil Survey– in order to determine similarities and differences between the soil data. Within the Web Soil Survey , the locations of the sites were retrieved to determine what was currently in the database. The area of interest feature allows each site to be selected and provides an in-depth description of the soil present in each area. Finally, the database and findings from the study were compared and contrasted to each other

Results

Image 4: North Site

Image 5: South Site

Image 6: West Site

Image 7: East Site

Image 8: House Site

Palm Beach County Area, Florida (FL611)			
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Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
44	Kesson mucky sand, tidal	0.7	100.0%
Totals for Area of Interest		**0.7**	**100.0%**

44—Kesson mucky sand, tidal

Map Unit Setting
National map unit symbol: 1j7dw
Elevation: 0 to 20 feet
Mean annual precipitation: 48 to 56 inches
Mean annual air temperature: 70 to 77 degrees F
Frost-free period: 358 to 365 days
Farmland classification: Not prime farmland

Map Unit Composition
Kesson, tidal, and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kesson, Tidal

Setting
Landform: Mangrove swamps on marine terraces
Landform position (three-dimensional): Interfluve, talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy marine deposits with shells

Typical profile
A - 0 to 6 inches: mucky sand
C1 - 6 to 23 inches: sand
C2 - 23 to 38 inches: sand
C3 - 38 to 80 inches: sand

Properties and qualities
Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): High to very high (1.98 to 19.98 in/hr)
Depth to water table: About 0 inches
Frequency of flooding: Very frequent
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Strongly saline (16.0 to 32.0 mmhos/cm)
Sodium adsorption ratio, maximum: 30.0
Available water supply, 0 to 60 inches: Moderate (about 7.4 inches)

Image 9: Information from Web Soil Survey about site 5

Palm Beach County Area, Florida (FL611)			
Palm Beach County Area, Florida (FL611)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
18	Immokalee fine sand, 0 to 2 percent slopes	5.2	100.0%
Totals for Area of Interest		**5.2**	**100.0%**

18—Immokalee fine sand, 0 to 2 percent slopes

Map Unit Setting
National map unit symbol: 2s3lk
Elevation: 0 to 130 feet
Mean annual precipitation: 42 to 68 inches
Mean annual air temperature: 68 to 77 degrees F
Frost-free period: 350 to 365 days
Farmland classification: Not prime farmland

Map Unit Composition
Immokalee and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Immokalee

Setting
Landform: Flatwoods on marine terraces
Landform position (three-dimensional): Riser, talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy marine deposits

Typical profile
A - 0 to 6 inches: fine sand
E - 6 to 35 inches: fine sand
Bh - 35 to 54 inches: fine sand
BC - 54 to 80 inches: fine sand

Properties and qualities
Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 4.0
Available water supply, 0 to 60 inches: Low (about 5.9 inches)

Image 10: Information from Web Soil Survey about sites 1-4

Discussion

The results from Images 4 to 8 do not support Images 9 and 10 from the Web Soil Survey. As stated by Image 10, the JERFSA pond sites should have strictly one layer that is Immokalee fine sand. Images 4, 5, 6, and 7 all show there to be at least three soil horizons. There is an organic layer present in Image 4 that supports Map 1 and Pelegrino (2020) because it is located close to the football field where fertilizers are often sprayed. This promotes access to nutrients; therefore, it aids in increasing growth of vegetation. Pelegrino explains that the organic layer is the highest horizon with Images 7 and 4 displaying that. Additionally, the variety of colors present demonstrate how there is more than one layer indicated by Image 10. Images 6 and 7 show pockets of gray soil that coincides with information presented from Obreza and Collins (2022). Gray soil indicates iron saturated with water, and both of those sites had water fill in the holes. Image 5 provides an accurate example of Image 1 by *Soil Horizons* (2021) because there are discrete soil layers present. The site descriptions further explain why Image 5 did not reach the water table due to it having the highest elevation. Web Soil Survey does not have any of this information included in its soil profile about these sites (Image 10). The Web Soil Survey is inaccurate because it describes the pond site as flatwoods on marine terraces, but the ecosystem is slough.

To further evaluate the accuracy of Web Soil Survey, another site located in a completely different area was chosen. Image 9 describes site 5 as having a single layer of Kesson mucky sand. Image 8 refutes this because there are different layers of organic matter. Some are lighter in color and some are richer in color. The soil deeper in the hole is darker, which is supported from Map 4 because the hole is located relatively close to the intracoastal. With that being said, the community was built up on fill over 40 years ago, so human interaction with the environment altered the soil profile of the land. The parent material in Image 9 is completely off being sandy marine shell deposits, considering there are no shells present. Additionally, there is no white color present which represents deposits of calcium carbonate (Obreza and Collins, 2022). Web Soil Survey claims the depth to the water table is about 0 inches and that claim is refuted. The only accurate description presented in Image 9 is that the area is not prime farmland.

Conclusion

Results from this study concluded that the Web Soil Survey database does not support the findings from each site. For all of the sites, the database stated there was only one layer of soil, but all of the sites had at least two horizons. As seen in Image 8, site 5 lacked a metestick in the image. This provided some discrepancies with the depth of the hole. Additionally, site 5 was dug at about 6:00 p.m., resulting in it already being dark outside. If this study was repeated, the rainfall from the day prior should be recorded to note if that is a factor in soil moisture. As site 5 is a private residency, a large portion of it is artificial turf. This left a small selection choice of where the hole could be dug. The next time this study is conducted, it would be beneficial to dig all of the holes during the same day to ensure the conditions are constant. This data can be used by landscapers to determine what plants would best grow at each site. In the future, scientists should quantify the amount of nitrates at different locations to determine where the most contamination occurs.

References

Obreza, T. A., & Collins, M. E. (2022). *Common soils used for citrus production in Florida*. University of Florida IFAS Extension. Retrieved December 9, 2022, from https://ufdcimages.uflib.ufl.edu/IR/00/00/31/34/00001/SS40300.pdf

Pelegrino, J. (2020, May 15). *Ag 101: Soil Horizons*. Future Farmers of America. Retrieved December 8, 2022, from https://www.ffa.org/ag-101/ag-101-soil-horizons/

Soil Horizons. (2021, January 18). ScienceFacts.net. Retrieved December 9, 2022, from https://www.sciencefacts.net/soil-horizons.html

Soil Horizons. (2022). Soil Science Society of America. Retrieved December 8, 2022, from https://www.soils4teachers.org/soil-horizons/

Soil Structure. (n.d.). Food and Agriculture Organization of the United Nations. Retrieved December 8, 2022, from - https://www.fao.org/fishery/docs/CDrom/FAO_Training/FAO_Training/General/x6706e/x6706e07.htm#:~:text=Soil%20structure%20is%20defined%20by,resulting%20in%20different%20soil%20structures.

Web Soil Survey. (2022). *United States Department of Agriculture National Resource Conservation Service*. Retrieved December 9, 2022, from https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx