NEW YORK CITY SOIL SYSTEMS

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ABSTRACT:

National Cooperative Soil Survey efforts in New York City (NYC) now span almost four decades. The results include multiple high-resolution surveys of parks and watershed areas, a city-wide Soil Survey Geographic database (SSURGO) publication at 1:12,000 scale, and over 100 pedons sampled for full characterization. These pioneering efforts not only characterize the properties and geography of natural soils in NYC open spaces but also human-altered and –transported (HAHT) soils occurring throughout the city. The generic map unit descriptions and other database-driven narratives that accompany SSURGO data (accessible via standard soil survey interfaces like Web Soil Survey) do not sufficiently describe the soil-landscape relationships in NYC. NYC occupies a transition between three physiographic sections (New England Upland, Embayed Coastal Plain, and Piedmont Lowland sections; Fenneman 1946) whose dynamic nature is compounded by Pleistocene glaciation and postglacial coastal influences. Intense urban development and varying degrees of alteration of remaining open space further confuses interpretation of NYC’s soils and landscapes. Given this order of complexity, these relationships are best described using the Soil Systems framework in narrative format, as used in the Soils Systems in North Carolina publication (Daniels et al., 1999). The New York City Soil Systems publication will provide:

- detailed descriptions of recurring groups of soils
- a map correlating SSURGO map units to soil systems/subsystems
- a summary of key laboratory data
- detailed discussion of critical urban soil topics including geochemistry of HAHT soils and human artifacts, soil microbiology and biodiversity in urban soils, green infrastructure, soil rehabilitation and restoration, soil contamination, effects of climate change, and urban soil carbon capture

References:

- Sanders, H.J., and Merguerian, D.W. 1994. Soil Systems are distinct groups of soils or catenas … produced by the interaction of stratigraphy, hydrology, geomorphology, and climate.” Daniels et al., 1999

Excerpt from a New York City Soil System narrative:

New England Upland region / Brown Mixed Crystalline System / Brown lodgment till subsystem

Physiography and topography

This Brown lodgment till subsystem is typically located on drumlin or ground moraines, and nearby drainageways and depressions in the Bronx. Sampling in Central Park (Manhattan) suggest that inclusions of lodgment till occur there, although those areas may have over-thickened solums due to both additions of human-transported material and post-glacial accretion of eolian material. (Drumlins are landforms specifically shaped by the depositional processes forming lodgment till. These landforms typically have longer slope length, less steep slopes, and simpler slope geometry than bedrock-controlled hills and moraines associated with till-out till. Relatively large landform size, oval or elongated, and long axes parallel the direction of drumlin landforms. Additionally, the long axes of drumlins typically parallel the direction of glacial movement. The multiple glaciations that shaped New York City varied in ice-flow direction from NW/SE to NNE/SSW (Bardlein and Nienhuis 1994). Examples of drumlins with long axis directions matching both of these ice-flow directions can be found in the Bronx, in Van Cortlandt and Pelham Bay parks (Figure 1).

Soils

Soils of the Brown lodgment till subsystem are primarily characterized by the presence of a Densic horizon within 1 meter of depth. The friable silts above undrained soil development with bright, saturated matrix colors and weak or moderate soil structure. Rock fragments tend to be less than 35 percent throughout. Soil textures are typically loam, fine sandy loam, or sandy loam in the friable silt, and fine sandy loam or sandy loam in the dense subsoil. Some bedrock-controlled hills may have deposits of lodgment till over the bedrock. This sequence has been documented in some areas of Central Park in Manhattan.

Parent Material

Lodgment till is unconsolidated, unsorted material deposited at the bottom of a glacier. The weight of ice moving over the deposited material results in compaction of the till, and soils formed in lodgment till typically have observable compacted layers within 1 meter of the soil surface. This is referred to as Densic material in Soil Taxonomy (Soil Survey Staff 1999). Densic material, being a product of the glacial deposition, is distinguished from fragipan restriction features by a few key properties. Fragipan features are not inherent to the parent material they form and develop over time due to pedogenic processes. Further, fragipan found in New York City typically have coarse or very coarse porosity structural units that allow non-solution on their surfaces, whereas Densic material is either massive or contains plate-like divisions.

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