

Study of Ecosystem Services of Marshes of New York City

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Project Focus:
A regional study of the ecosystem services of several marshes in the New York City area, with a focus on wildlife habitat, flood protection, carbon sequestration in Jamaica Bay's four marshes.



NYC Region including Staten Island and Jamaica Bay



Locations:
Focus Jamaica Bay wetlands are circled in red

Abstract:

Wetlands are one of the most productive ecosystems on the planet. In the coming decades, wetland protection must become a priority before all wetland areas are destroyed. In a world where cost and economic profit dominate decisions, it is imperative to assign monetary worth and value to environmental systems. This economic assessment of the ecosystems can be then more easily compared to other regions to ensure that the public is aware of its many values at the local, regional, and global scale. A method using ecosystem services will be utilized for this region. Since 2005, ecosystem services have been incorporated into public policy and conservation fund allotment.

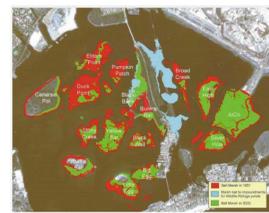
Wetlands provide a myriad of ecosystem services and one of particular interest is the measurement of carbon storage. This "blue carbon" is stored in tidal and riverine marshes. We calculate that Jamaica Bay marshes are 15 km² in area, and four marshes of Jamaica Bay: Big Egg, Four Sparrow, Yellow Bar, and JoCo were cored and measured for carbon content. We calculated 100- 800 g C/m², we have currently 150E6 - 1200E6 g C stored in the surface sediment. We are planning to provide a complete valuation of the ecosystem services of Jamaica Bay in conjunction with data provided by the Jamaica Bay, NYC Audubon and National Park staff.

Value in the Carbon:



Geometry used to calculate total marsh island area of Jamaica Bay

Jamaica Bay Losses since 1951

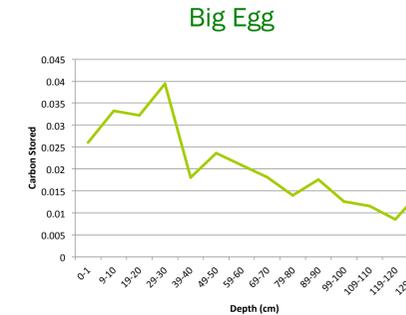
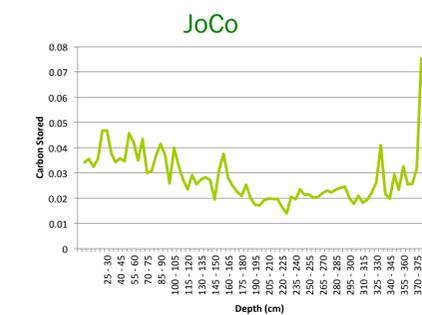
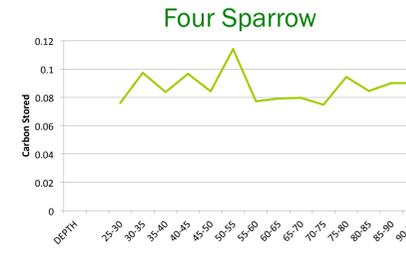


- In 2012, the Army Corps of Engineers calculated the total area of Jamaica bay to be 67.4 km², of which approximately 15.74 km² is saltmarsh.
- Since 1924, approximately 1,400 acres, 5.66 km² of tidal salt marsh were lost
- Between 1994 and 1999, a rapid rate of 47 acres, 0.19 km², was lost each year, a total loss of 220 acres, 0.89 km².
- Left alone, Jamaica Bay was projected to vanish by 2025
- The area, in conjunction with the probed depths, will be used to calculate total carbon stored in the marsh



Wetland comparison 1891 map vs. 2013 map

Results:



Methodology:

On-Site Coring Process:



Fig. 1: Identifying the Core



Fig. 2: Extracting the Core



Fig. 3: Viewing the Core and ready for D-tube storage



Fig. 4: After extraction, the core is taken to solid ground for storage

Loss On Ignition (LOI):



Fig. 5: LOI samples in crucibles after burning

- ❖ Method that indicates the amount of organic matter (weight lost after burning) and inorganic matter (remaining mass after burning) in a sample.
- ❖ A sample of a core is weighed and dried at 100°C, then burned at 500°C and weighed again. Weights are recorded and used for mathematical analysis.

Calculations:

$$LOI = \frac{\text{Dry Weight} - \text{Burned Weight}}{\text{Dry Weight}}$$

$$\text{Carbon} = LOI \times \text{Bulk Density}$$

Where bulk density refers to the mass of the sample

Materials:

The Dachnowski Russian corer Produces semi-cylindrical cores for simple storage and processing



Fig. 6: Microscopic Analysis of Core

Ecosystem Services:

- Defined as, "the benefits that people derive from nature, that directly or indirectly underpin human economies and livelihoods" (World Resources Institute).
- Individual values are specific to certain ecosystem services that are particular to certain landscapes and environments.
- Crucial to human health and sustenance (EPA).
- The Millennium Ecosystem Assessment in 2005 was the first effort to include ecosystem services into public policy and conservation fund allotment.
 - An online survey conducted by the WRI demonstrated that only 40% of questioned environmental assessment professionals have seen ecosystem services addressed in their work.

Some examples of services provided by Jamaica Bay are:

- Migratory bird habitat
- Flood Protection
- Recreation
- Fish and Wildlife Habitat
- Carbon Storage
- Ecotourism
- Erosion Control



Ecosystem Services	Dependent	Shared	Enhanced
Provisioning	Carbon Sequestration, Flood Protection, Recreation, Ecotourism, Erosion Control	Flood Protection, Recreation, Ecotourism, Erosion Control	Carbon Sequestration, Flood Protection, Recreation, Ecotourism, Erosion Control
Regulating	Carbon Sequestration, Flood Protection, Recreation, Ecotourism, Erosion Control	Carbon Sequestration, Flood Protection, Recreation, Ecotourism, Erosion Control	Carbon Sequestration, Flood Protection, Recreation, Ecotourism, Erosion Control
Cultural	Carbon Sequestration, Flood Protection, Recreation, Ecotourism, Erosion Control	Carbon Sequestration, Flood Protection, Recreation, Ecotourism, Erosion Control	Carbon Sequestration, Flood Protection, Recreation, Ecotourism, Erosion Control

It is important to raise awareness of the ecosystem services provided by a region in order to provide adequate funding for conservation efforts. The Army Corps of Engineers have begun a civil works restoration project at Jamaica Bay. There are over 330 species of birds that nest on, or migrate to and from Jamaica Bay every year. The maps of stored carbon indicate regions where the ecosystem service cannot be easily regenerated with restoration.

Conclusions / Future Research:

- One of the least understood wetland ecosystem services is carbon storage
- We calculated 100- 800 g C/m², with a total of 15.74 km² of salt marsh found in Jamaica Bay, we have currently 150E6 - 1200E6 g C stored in the surface sediment.
- Future radiocarbon dating of the sediment will allow us to calculate the rates of carbon storage per year
- We will also calculate how much carbon has been lost based on the average depth and age of the marshes
- We are planning to provide a complete valuation of the ecosystem services of Jamaica Bay in conjunction with data provided by the Jamaica Bay, NYC Audubon and National Park staff. This will be useful in the future, if portions of the NYC marshlands are threatened. Further analysis and monetary values will be developed when proper data is acquired in the future.

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