Blue is the New Green

carbon storage in coastal wetlands

Benefits of a Healthy Coast

Most of us who live or vacation on Cape Cod are attracted by the beauty, recreational, and economic opportunities of the coast. However, coastal communities like ours are among the most vulnerable to threats such as sea level rise, intense storms, erosion, and flooding.

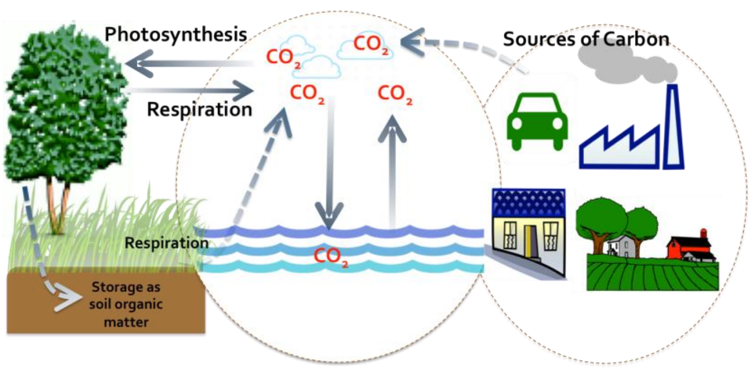
WETLANDS are one line of defense against these threats. Characterized by plants adapted to frequent flooding, they are a widespread feature of our landscape. In fact, wetlands make up 12-16% of the land on Cape Cod – an area about the size of Nantucket Island. In addition to comprising a central and important part of our landscape, wetlands provide a number of **ECOSYSTEM SERVICES** – essential benefits to our economy and culture. These services include:

- **Erosion control**
- **Flood protection**
- **Clean water**
- **Healthy fisheries**
- **Biodiversity protection**
- **Aesthetics and recreation**
- **Carbon sequestration (storage)**

Wetlands on Waquoit Bay, MA.

Carbon Storage

Of these many benefits, **CARBON SEQUESTRATION**, or storage, is getting increased attention as a way to reduce excess carbon dioxide (CO_2) and other greenhouse gases in our atmosphere from the burning of fossil fuels. These gases are leading to negative impacts worldwide on climate, food production, and human health and livelihoods. To counteract this trend, people are looking not only at reducing greenhouse gas emissions, but also at protecting and enhancing ecosystems that naturally sequester them.



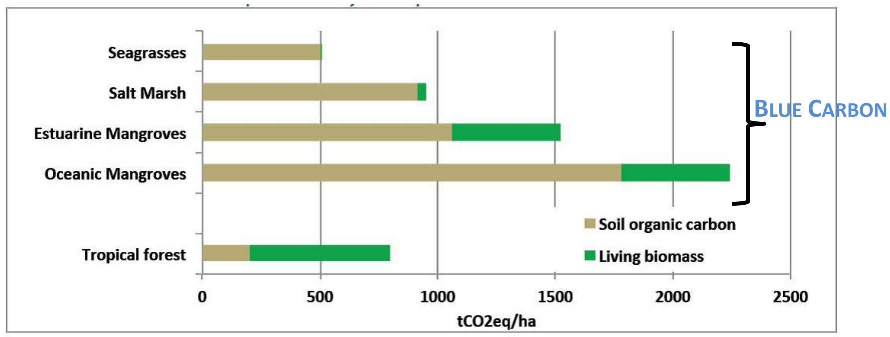
The Carbon Cycle

BIOLOGICAL CARBON SEQUESTRATION is a process in which carbon is captured through photosynthesis by trees, plants, or other organisms, and stored in soils or other organic matter such as leaves and roots. Maximizing biological carbon sequestration by protecting and restoring ecosystems which naturally do this well, can help balance the amount of carbon in our atmosphere.

Blue Carbon

It is well known that forests take in and store large amounts of atmospheric carbon; this is known as *GREEN CARBON*. However, less is known about carbon that is absorbed and stored by ocean and coastal ecosystems like wetlands and tropical mangroves, known as ***BLUE CARBON***.

Research suggests that coastal wetlands capture and store carbon at rates three to five times greater than tropical forests, which makes them efficient and essential carbon sinks (Murray et al., 2011).



Carbon storage abilities of different habitat types.
Units are in tons of carbon dioxide equivalent per hectare.
Source: Murray et al., 2011

How do wetlands store carbon?

High carbon sequestration occurs in ecosystems where plants convert a lot of carbon dioxide to oxygen (*photosynthesis*) and where there is a lot of organic matter. Wet soils have the highest capacity for carbon storage because they have low oxygen levels, which slows down decomposition. This means the carbon in the soil can remain there for centuries.

If wetlands are able to keep up with sea level rise (through a process known as accretion or the building up of soils), then they could potentially store even more carbon in their soils because of the increase in soil depth.

Threats to Blue Carbon

Research suggests that nitrogen from septic systems, stormwater runoff, and the air can significantly reduce a wetland's ability to store carbon.

In some cases, high nitrogen pollution can increase the rate at which carbon breaks down in coastal wetland soils, leading to the release of carbon dioxide and nitrous oxide (a greenhouse gas that is about 300 times more powerful than carbon dioxide). Additionally, when wetlands are damaged or destroyed for development or agriculture, they release their store of soil carbon, which contributes to climate change and permanently removes that wetland as a natural sink for future carbon. Maximizing the potential of wetlands to store carbon must not only include protecting and restoring these areas, but also reducing the amount of nitrogen that enters them.

- *Nationwide, wetlands are disappearing at a rapid rate.*
  In Massachusetts, we have lost more than 40% of our salt marshes since pre-colonial times.
- *Though wetland restoration goals & plans exist throughout the U.S., research has shown that we are meeting less than 3% of these goals annually.*
- *Nitrogen entering Cape Cod estuaries has increased dramatically over time following increases in population and development. Most of the nitrogen entering groundwater and adjacent estuaries comes from wastewater (residential septic systems).*

Importance to Local Communities

It is clear that our economy and way of life on Cape Cod are dependent on healthy wetlands, not only because of their aesthetic and recreational benefits, but because of the role they play in mitigating the impacts of climate change, cleaning up our water, protecting us from storms and erosion, and providing important habitat. Protection of the resources of the region and the natural benefits they provide should therefore be an integral part of planning and decision-making. For instance, preserving and restoring Cape Cod's wetlands will help buffer impacts of storms and store large quantities of atmospheric carbon, increasing resilience to climate change. By protecting coastal marsh integrity, towns will reduce future costs, minimize health and safety impacts, and lessen damage to natural resources and built infrastructure.

Monitoring fish populations in a Cape Cod estuary.

Osprey use wetlands for nesting and feeding.

Wetlands offering flood protection during Hurricane Sandy, 2012.

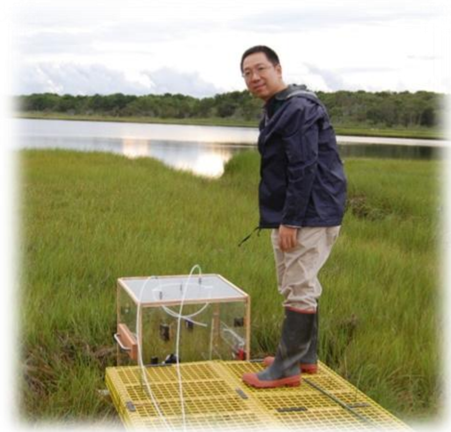
Bringing Wetlands to Market – *Nitrogen and Coastal Blue Carbon Project*

A 3-year project is currently underway, led by the Waquoit Bay National Estuarine Research Reserve, examining the relationship between coastal wetlands, climate change, and nitrogen pollution – critical issues facing many coastal communities. The project team aims to generate science and management tools to:

- Support wetlands protection and conservation efforts
- Manage nitrogen pollution
- Create policies and economic incentives to reduce greenhouse gases

The project team is working collaboratively with end-users, such as the wetlands restoration community, coastal resource managers, conservation organizations, and local towns to ensure that the project results and tools are used.

Scientists measuring dissolved gases between the salt marsh and adjacent estuary.



Gas chamber on marsh measuring greenhouse gas exchange between the salt marsh and the air.

To learn more about

BRINGING WETLANDS TO MARKET – NITROGEN AND COASTAL BLUE CARBON PROJECT

please visit: **www.wbnerrwetlandscarbon.net**

Author & Designer: Meg Gardner, TIDES Graduate Fellow, University of New Hampshire
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P.O. Box 3092, Waquoit, MA 02536
TEL: (508) 457-0495 **FAX:** (617) 727-5537
EMAIL: waquoit.bay@state.ma.us
www.waquoitbayreserve.org

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Project Partners:

National Estuarine Research Reserve System Science Collaborative | Waquoit Bay National Estuarine Research Reserve | MBL | Manomet Center for Conservation Sciences | Restore America's Estuaries | The University of Rhode Island | USGS science for a changing world