

# Bringing Wetlands to Market: STEM Curriculum Linking Wetlands and Climate Change

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**Purpose:** an informational presentation to give the Ed Council the background necessary to promote and utilize the Bringing Wetlands to Market Curriculum within your communities of practice.

**Goal 1: Science-Informed Society:** An informed society has access to, interest in, and understanding of NOAA-related sciences and their implications for current and future events.

**Goal 2: Conservation and Stewardship:** Individuals and communities are actively involved in stewardship behaviors and decisions that conserve, restore, and protect natural and cultural resources related to NOAA's mission.



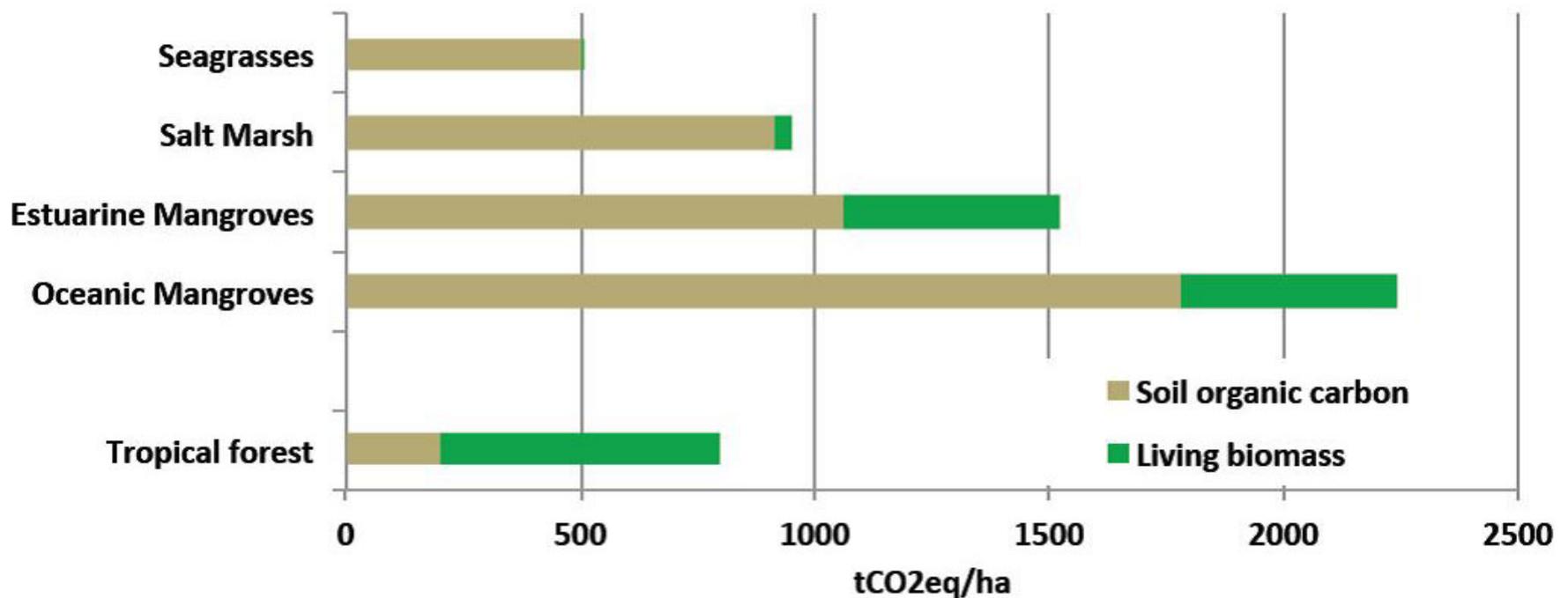
# Carbon Storage as an Ecosystem Service

Which ecosystem can store the most carbon?

- A. Tropical forest
- B. Boreal forest
- C. Temperate Forest
- D. Salt Marsh
- E. Mangroves
- F. Seagrasses



# Green and Blue Carbon



\*Data is per unit area, where tCO<sub>2</sub>eq/ha is tons of carbon dioxide equivalents per hectare

Source: Murray, Brian, Linwood Pendleton, W. Aaron Jenkins, and Samantha Sifleet. 2011. Green Payments for Blue Carbon: Economic Incentives for Protecting Threatened Coastal Habitats. Nicholas Institute Report. NI R 11-04

# What is “Blue Carbon”



Blue Carbon ecosystems can sequester more effectively and more permanently than terrestrial forests. Carbon is stored in peat below coastal vegetation habitats as they accrete vertically. Coastal vegetation also continues to sequester carbon for thousands of years in contrast to forest, where soils can become carbon-saturated relatively quickly.

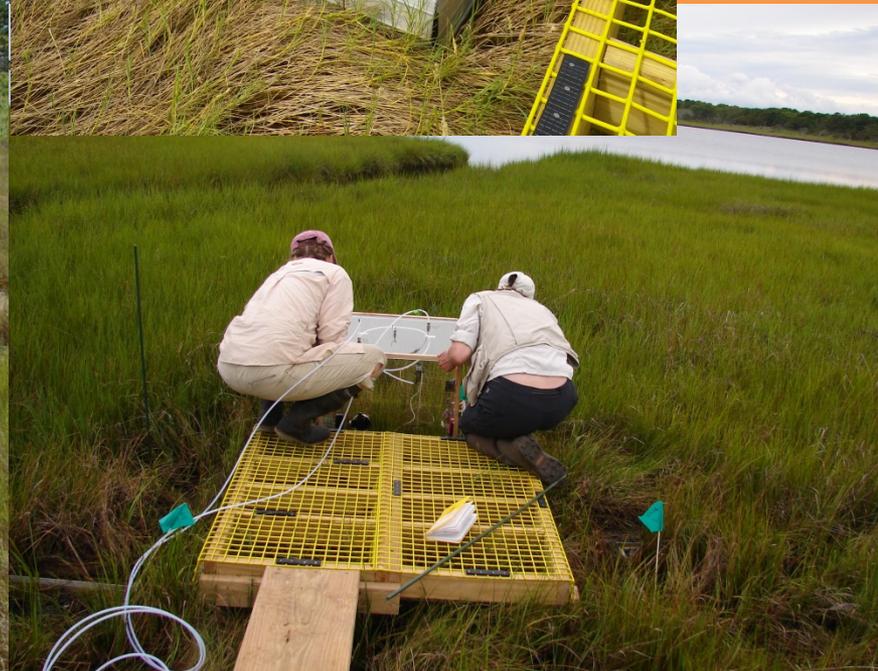


# The Bringing Wetlands to Market Project



2012-2015 NERRS Science Collaborative Project

# GHG flux measurement





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- High School
- Interdisciplinary
- On-line
- Web-based, classroom, and field activities
- Gathers new and existing resources and activities



# How we created the module

NERRS Science Collaborative Transfer Grant  
(team OR and MA, consultant)

Next Generation Science Standards

Needs Assessments (Teachers, NERRS Education Coordinators)

Draft Module

Research Team review

Teacher Advisory Committee review



Summer student program



Teachers on the Estuary Pilots  
and review



Final draft and review



# Components of curriculum

<http://www.waquoitbayreserve.org/research-monitoring/salt-marsh-carbon-project/teachers/>

- General Intro
- Part 1: Background concepts (blue carbon, values of salt marshes)
- Part 2: Research and the process of science and engineering
- Part 3: Economics
- Part 4: Pressures on wetlands and stewardship
- Adopt-a-Wetland stewardship project and Field Study

# Part 1 Introduction: Wetlands and Carbon

- Carbon Walk
- Photosynthesis and carbon storage in coastal wetlands
- Wetland ecological services



# Part 2: Research Project

- Introduction- Research project
- Process of science
- Water quality variability and choosing a study site
- Engineering Design Challenge



# Part 3: Economics and Blue Carbon Simulation

- Valuing your Wetland
- Blue Carbon Trading Simulation



# Part 4: Pressures on Wetlands and Stewardship

- Sea Level Rise
- Nitrogen and Coastal Wetlands
- Stewardship Projects



# Adopt-a Wetland Stewardship Project and Field Study (word and pdf)

## Adopt-a-Wetland Student Designed Studies- Parameters and Carbon Content of Plants



# Adopt-a-Wetland

Fresh and salt and  
virtual



“I have taught science now for close to 30 years. *Bringing Wetlands to Market* curriculum is the first curriculum that I believe helps teachers and students to really wrap their minds around climate change. The integration of genuine cutting edge science with a wide variety of resources and field study in students' backyards create rich experiences that help bring climate change home and make it tangible. Climate change is a tough topic to teach and to get students engaged in the concepts behind climate change in meaningful ways. *Bringing Wetlands to Market* curriculum engages and I found that my students could relate better to the concept of climate change, carbon cycle and ecosystem services. I look forward to integrating more of the curriculum in all my courses in the semesters ahead.

Pilot teacher, TOTE workshop, 2013

# Some examples of what teachers are doing with curriculum

- Using parts in their classroom
- Engineering (lobster trap boardwalk)
- Adopt-a-Wetland
  - Salt
    - Using FaceTime
  - Fresh
  - Forest
  - Meadow



# Next steps

- Add student activities using data and model from Bringing Wetlands to Market project, part 1.
- Field Training for NERRS ECs this fall.
- New England ECs currently working on learning module for Sentinel Sites.





# TOTE: Teachers on the Estuary

<http://estuaries.noaa.gov/Teachers/Default.aspx?ID=170>



<http://www.waquoitbayreserve.org/research-monitoring/salt-marsh-carbon-project/teachers/>

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### Acknowledgements

Curriculum Team  
NERRS Science Collaborative  
WBNERR staff  
BWM Research team  
WBNERR Teacher Advisory Committee  
TOTE 2013 teachers

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