

Datasets: Year-round vertical carbon dioxide fluxes in New England salt marshes

This document provides detailed information about the dataset that was generated through a 2023-2024 catalyst project titled *Testing Low-cost, Ultra-portable, Carbon Dioxide Sensors for Monitoring Salt Marsh Ecosystem Services, Resilience, and Restoration*. This [webpage](#) provides information about the project. The project was supported by the National Estuarine Research Reserve System (NERRS) Science Collaborative, which is funded by the National Oceanic and Atmospheric Administration. All Science Collaborative supported projects that collect new data adhere to federal data sharing and archiving requirements.

About the Associated Project

Project page: <https://nerrssciencecollaborative.org/Fulweiler23>

Grant Type: Catalyst

Focus Area(s): Climate Change, Ecosystem Service Valuation

Keyword(s): blue carbon, carbon sequestration, salt marsh, monitoring

Reserve(s): Connecticut; Great Bay, NH; Narragansett Bay, RI; Waquoit Bay, MA; Wells, ME

Project Duration: October 2023 - September 2024

Grant Amount: \$189,594.00

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Project Description

Salt marshes sequester more carbon per unit area than any terrestrial ecosystem and are an important component of “blue carbon” – the atmospheric carbon captured and stored by marine ecosystems. Quantifying fluxes of greenhouse gases like carbon dioxide can help us better understand the role salt marshes play in mitigating climate change. However, there has been limited collection of salt marsh greenhouse gas flux data across the NERRS, in part because traditional methods for measuring these fluxes are time consuming and labor intensive, while more recent technologies can be cost prohibitive and destructive to the salt marsh. This lack of data is a major barrier to developing complete carbon sequestration values for salt marshes. It also limits our knowledge of how climate change impacts and habitat restoration efforts alter blue carbon.

To address these technological and scientific knowledge gaps, this project collaborated with five New England reserves to advance monitoring technology and protocol. The project team worked closely with users at reserves to test low-cost, portable sensors that measure carbon dioxide,

temperature, and humidity in salt marsh environments. The team conducted field trips to collaborating reserves, incorporating iterative user feedback on instrument design, ease of deployment, and alignment with existing monitoring efforts at the NERRs. Over the course of the project, over 480 CO₂ flux measurements were taken across 5 reserves, helping to create a more complete picture of carbon uptake in New England salt marshes and strengthening protocols for SWMP biomonitoring. In addition, this project has deepened collaborative partnerships across the reserves for monitoring blue carbon by advancing reserve knowledge about salt marsh blue carbon in their sites, capacity for measuring fluxes, and goals for future integration of blue carbon monitoring across the NERR system.

About the Project Dataset

Title: Year-round vertical carbon dioxide fluxes in New England salt marshes

Data overview:

This dataset measured CO₂ fluxes in salt marshes throughout the region of New England. Sampling occurred seasonally from December 2023 to Fall 2024. Five sampling time periods captured the dormant season, plant growth, and peak biomass.

More about the data:

Novel sensor packages were used to measure CO₂ concentrations within closed acrylic chambers at multiple locations within each salt marsh and during seasonal sampling throughout one year.

Additional details about field sampling:

- One or two marshes were sampled within each reserve at 5 New England National Estuarine Research Reserves: Connecticut reserve; Narragansett Bay; Waquoit Bay; Wells Reserve; and Great Bay.
- Five sampling time periods included two during the dormant season, one during vegetation green-up, and two during the growing season including peak biomass.
- Variables measured by the sensor package include CO₂ concentration, date time, and temperature.
- Additional data recorded include the marsh vegetation species and cover classification of the sampling location, the coordinates of the sampling location, the marsh site, vegetation monitoring transect and plot, and validation data collected with a Picarro instrument.

The CO₂ concentration data was processed using an R script to calculate the vertical CO₂ fluxes in the salt marshes. These data advance the number of carbon flux measurements in salt marshes, thus providing original year-round, regional, high spatial-resolution sampling of salt marsh blue carbon. This dataset can be used to analyze spatial patterns of CO₂ fluxes within salt marshes, seasonal patterns between growing and dormant periods of the year, and regional drivers of salt marsh blue carbon.

Data collection period:

December 2023 to Fall 2024

Geographic extent:

Note: Boundaries are listed as four coordinates which are the corners of a square area containing all sites sampled in that marsh.

- Wells NERR – Drakes Island (boundary: 43.330405, -70.557434; 43.326830, -70.557182; 43.326787, -70.560714; 43.329861, -70.561083 | nearest town: Wells, ME)
- Great Bay NERR – Sandy Point (boundary: 43.057302, -70.902960; 43.057222, -70.900639; 43.055476, -70.900758; 43.055570, -70.902797 | nearest town: Greenland, NH); Great Bay Farm (boundary: 43.062729, -70.829579; 43.060518, -70.829321; 43.059687, -70.834020; 43.061310, -70.835372 | nearest town: Newington, NH)
- Waquoit Bay NERR – Sage Lot Pond (boundary: 41.554903, -70.507653; 41.555015, -70.505111; 41.552943, -70.505057; 41.553019, -70.507779 | nearest town: Mashpee, MA); Doghead (boundary: 41.555155, -70.501031; 41.555043, -70.504153; 41.552972, -70.504362; 41.552887, -70.501179 | nearest town: Mashpee, MA)
- Narragansett Bay NERR – Coggeshall (boundary: 41.654880, -71.347169; 41.654880, -71.340045; 41.648868, -71.338779; 41.648515, -71.346461 | nearest town: Portsmouth, RI); Nag (boundary: , 41.626795, -71.327977; 41.626819, -71.322677; 41.623988, -71.322076; 41.623976, -71.327570 | nearest town: Portsmouth, RI)
- Connecticut NERR – Mumford Cove (boundary: 41.330638, -72.015728; 41.330735, -72.022208; 41.325337, -72.022465; 41.325224, -72.014698 | nearest town: Groton, CT); Bluff point (boundary: 41.335504, -72.037915; 41.336423, -72.031789; 41.327883, -72.030780; 41.327609, -72.035973 | nearest town: Groton, CT)

File format:

A CSV file can be opened in Excel, or opened in R. The file size is small ~100 KB. All data are included in columns with descriptive headers in one CSV file.

A metadata Word file is included that explains the Data Collection Methods, Data Processing, Quality Control, and the Data Layout including the meaning of the specific headers, units, and variables.

File name(s):

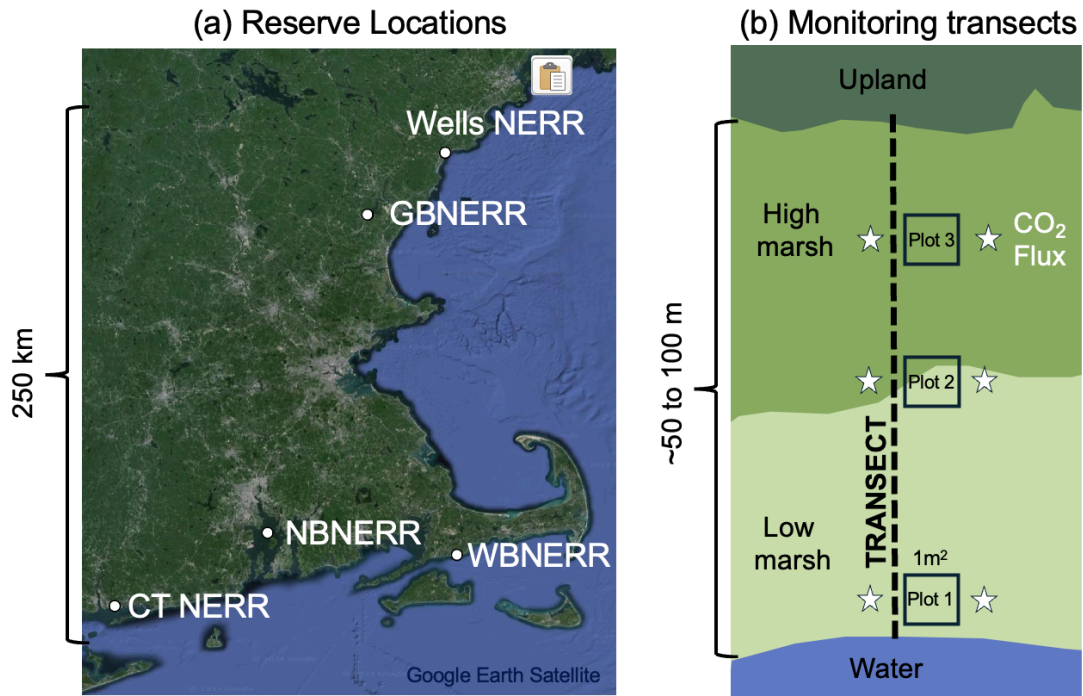
1. “CO2 Flux Dataset at NERRs.csv” (CSV data file)
2. “Metadata_CO2 dataset” (Word metadata file)

Data access and archival:

This dataset is archived with the NERRS Centralized Data Management Office (CDMO). It is publicly available for download at the following link:

[https://cdmo.baruch.sc.edu/science-collaborative/iframe.cfm?project=Year-round vertical carbon dioxide fluxes in New England salt marshes](https://cdmo.baruch.sc.edu/science-collaborative/iframe.cfm?project=Year-round%20vertical%20carbon%20dioxide%20fluxes%20in%20New%20England%20salt%20marshes)

Maps and schematics for data collection:



Locations of sampling including (a) Map of sampling sites at New England NERRs; and (b) Layout of paired CO₂ fluxes measured in proximity to vegetation monitoring plots on established NERR transects.



Field set up for closed chamber measurements using the novel sensor package.