

Datasets: Greenhouse gas emissions and carbon sequestration in Pacific Northwest estuarine wetlands

This document provides detailed information about 11 datasets that were generated through a four year collaborative research project titled *Land Use and Environmental Effects on Greenhouse Gas Emissions and Carbon Sequestration in Pacific Northwest Tidal Wetlands*. 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/project/Cornu20>

Grant Type: Collaborative Research

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

Keyword(s): blue carbon, methane, wetland

Reserve(s): Padilla Bay, WA; South Slough, OR

Project Duration: October 2020 - September 2024

Grant Amount: \$600,000.00

Project Contacts:

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Project Description

Blue carbon refers to the carbon sequestered and stored in tidal wetlands such as tidal swamps, salt marshes, and seagrass meadows (and mangrove forests at tropical and subtropical latitudes). Blue carbon ecosystems are especially effective at capturing and storing carbon, often storing disproportionately large amounts of carbon on a per acre basis. However, tidal wetlands can also emit varying amounts of greenhouse gases (GHGs)—including carbon dioxide, methane, and nitrous oxide—which can reduce or offset their net climate benefit.

To fill regional data gaps associated with GHG emissions and carbon accumulation rates in Pacific Northwest (PNW) tidal wetlands and investigate how net ecosystem carbon balance differs among wetland types and land uses, a project team of PNW Blue Carbon Working Group members partnered with two National Estuarine Research Reserves and other collaborators to plan and implement this project. This project was built on partnerships developed through

previous Science Collaborative efforts and addressed key data gaps and research priorities identified in those earlier projects (see: [2016 Collaborative Research](#) and [2018 Catalyst Project](#)).

Through new data collection across five estuaries and continued engagement with partners, the project team examined how net ecosystem carbon balance differs among wetland types and land uses, quantified blue carbon-ecosystem driver relationships, expanded the regional blue carbon database, and provided new data to the Smithsonian's Coastal Carbon Research Coordination Network working group to help validate a national methane emissions model.

Significant findings included:

- Most project sites with salinity >2–3 ppt showed reduced methane fluxes
- Highest methane emissions occurred in wet pastures and restored marshes, especially those with low salinity and high water table
- Carbon accumulation rates were highest in restored marshes, somewhat lower in least-disturbed marshes and swamps, and lowest in diked pastures
- Carbon accumulation rates varied within wetland categories, primarily due to local differences in growing season water table level.

The project along with the PNW Blue Carbon Working Group (Working Group) has played a pivotal role in advancing blue carbon science and facilitating the development of natural climate solutions policy, generating both direct and indirect impacts on climate mitigation efforts focused on the US Pacific Northwest. Through collaborative research, policy integration, tool development, and regional coordination, the Working Group has significantly influenced how scientists and policymakers incorporate coastal ecosystems into natural climate solutions strategies.

Overview of Datasets

Eleven related datasets are described in this document:

- 1. Site-level metadata:** this dataset been archived with Figshare at the Smithsonian Environmental Research Center and can be accessed here:
<https://doi.org/10.25573/serc.27161883.v1>
- 2. Soil temperature:** this dataset been archived with Figshare at the Smithsonian Environmental Research Center and can be accessed here:
<https://doi.org/10.25573/serc.27161883.v1>
- 3. Groundwater level, salinity, and temperature:** this dataset been archived with Figshare at the Smithsonian Environmental Research Center and can be accessed here:
<https://doi.org/10.25573/serc.27161883.v1>
- 4. General wetland elevation:** This dataset will be made publicly available within two years of project completion or upon publication of the associated manuscript, whichever is sooner. Data will be archived in the interim with the NERRS Centralized Data Management Office (CDMO).
- 5. General plant species composition:** This dataset will be made publicly available within two years of project completion or upon publication of the associated manuscript, whichever is sooner. Data will be archived in the interim with the NERRS Centralized Data Management Office (CDMO).
- 6. Greenhouse gas fluxes - CO₂, CH₄, N₂O:** This dataset been archived with Figshare at the Smithsonian Environmental Research Center and can be accessed here:
<https://doi.org/10.25573/serc.27161883.v1>
- 7. Blue carbon core profiles:** This dataset been archived with archived at the Coastal Carbon Atlas for the Smithsonian Environmental Research Center and can be accessed here:
https://smithsonian.figshare.com/articles/dataset/Dataset_Soil_carbon_stocks_and_long-term_accretion_rates_in_tidal_marshes_tidal_swamps_and_former_tidal_wetlands_in_eight_estuaries_in_the_Pacific_Northwest_USA/27156465
- 8. Time series of light flux:** This dataset will be made publicly available within two years of project completion or upon publication of the associated manuscript, whichever is sooner. Data will be archived in the interim with the NERRS Centralized Data Management Office (CDMO).
- 9. Wetland short-term accretion and surface elevation change:** This dataset will be made publicly available within two years of project completion or upon publication of the associated manuscript, whichever is sooner. Data will be archived in the interim with the NERRS Centralized Data Management Office (CDMO).

- 10. GHG chamber location and wetland surface elevation:** This dataset been archived with Figshare at the Smithsonian Environmental Research Center and can be accessed here: <https://doi.org/10.25573/serc.27161883.v1>
- 11. Plant species composition in greenhouse gas chambers:** This dataset been archived with Figshare at the Smithsonian Environmental Research Center and can be accessed here: <https://doi.org/10.25573/serc.27161883.v1>

Questions about these datasets can be directed to:

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About the Project Datasets

Detailed descriptions are provided for each dataset below.

Dataset 1: Site-level metadata

Description of data:

This Phase 2 study was built on the Working Group's earlier research efforts to fill greenhouse gas (GHG) emissions and carbon accumulation rate data gaps for major PNW tidal wetland classes and land uses, examine BC-ecosystem driver relationships, expand the regional BC database, and provide new data to the Smithsonian's Coastal Carbon Research Coordination Network to help validate a national methane emissions model. The data described in this document were collected from each of the 34 sites in our Phase 2 blue carbon project and the sites associated with a companion GHG emissions project funded by NOAA-NCCOS-ESLR.

We quantified carbon accumulation rates and GHG emissions in former tidal wetlands historically converted to agricultural (ag) lands, restored and least-disturbed tidal emergent marshes, and forested tidal wetlands in sites of varying salinity in five PNW estuaries: Padilla Bay, Skagit and Grays Harbor estuaries, WA, Lower Columbia Estuary, WA/OR, and the Coos Estuary, OR

Site-level data collected at each site include the geographic location of sites (typified by the location of their groundwater wells) and the elevation of the wetland surface at the groundwater well.

Search keywords:

Blue carbon; carbon accumulation rate; greenhouse gas emissions; Pacific Northwest; tidal marsh; tidal swamp; tidal wetlands

Data collection period:

2020-2021

Geographic extent:

Study site	Code	Estuary	Type	Yr Restored	Age	Latitude	Longitude
Wasson Creek Pasture (dry)	WAS-PA	COO	PA-D	NA	NA	43.27173	-124.32409

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Wasson Creek Pasture (wet)	WAS2-PA	COO	PA-W	NA	NA	43.27067	-124.32174
Winchester Creek Swamp	WIN-TS	COO	FO	NA	NA	43.26943	-124.32101
Fredrickson South Marsh	FSM-HM	COO	EM	NA	NA	43.27239	-124.31885
Fredrickson Restored	FRE-RM	COO	EM	1998	23	43.27481	-124.32033
Kunz Marsh (high cell)	KZH-RM	COO	EM	1996	25	43.28057	-124.31885
Kunz Marsh (low cell)	KZL-RM	COO	EM	1996	25	43.28171	-124.31957
Danger Pt Marsh	DAN-HM	COO	EM	NA	NA	43.28335	-124.32342
Metcalf Marsh	MET-HM	COO	EM	NA	NA	43.33526	-124.32829
Millicoma Marsh	MIL-HM	COO	EM	NA	NA	43.36810	-124.18532
Millicoma Restored Marsh	MIL-RM	COO	EM	Unknown	NA	43.36734	-124.18500
Sause Pasture	SAU-PA	COO	PA-D	NA	NA	43.36835	-124.18409
Secret River Marsh	SEC-HM	COL	EM	NA	NA	46.30497	-123.69242
Secret River Swamp	SEC-TS	COL	FO	NA	NA	46.30766	-123.68992

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Alder Rd Pasture	ALD-PA	COL	PA-W	NA	NA	46.31446	-123.68349
Kandoll Farm Marsh	KAN-RS	COL	EM	2012	9	46.32616	-123.65401
Seal Slough Swamp	SES-TS	COL	FO/S S	NA	NA	46.32647	-123.65992
Mth Lewis Clark Riv Marsh	MLC-HM	COL	EM	NA	NA	46.15775	-123.86157
South Clatsop Slough Marsh	SCS-RM	COL	EM	2007	14	46.12910	-123.87931
Johns River Polyhaline Marsh	JRP-HM	GRA	EM	NA	NA	46.90081	-123.99240
Johns River Mesohaline Marsh	JRM-HM	GRA	EM	NA	NA	46.89158	-123.98729
Johns River S Pasture (wet)	JRW-PA	GRA	PA	NA	NA	46.89342	-123.98842
Johns River N Pasture (dry)	JRD-PA	GRA	PA	NA	NA	46.89867	-123.98821
Johns River Oligohaline Marsh	JRO-HM	GRA	EM	NA	NA	46.88344	-123.96458
Johns River Restored Marsh	JRR-RM	GRA	EM	2011	10	46.90513	-123.99071
Johns River Swamp	JRS-TS	GRA	FO	NA	NA	46.88292	-123.96576

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Milltown Isl Oligohaline Marsh	MIO-HM	SKA	EM	NA	NA	48.30145	-122.35995
Milltown Isl Restored Marsh	MIR-RM	SKA	EM	1999	22	48.31730	-122.34848
Milltown Isl Swamp	MIS-TS	SKA	FO	NA	NA	48.31744	-122.34747
Fir Island Marsh	FIR-HM	SKA	EM	NA	NA	48.33332	-122.41500
Fir Island Restored Marsh	FRR-RM	SKA	EM	2015	6	48.33520	-122.41038
Padilla Bay Ag field	PBD-PA	PAD	PA-D	NA	NA	48.46369	-122.46956
Padilla Bay Wet Pasture	PBW-PA	PAD	PA-W	NA	NA	48.45705	-122.46960
Big Indian Slough Marsh	BIS-HM	PAD	EM	NA	NA	48.45392	-122.47308

File format:

CSV

File name(s):

Janousek_et_al_2025_site_level.csv

Data access and archival:

This dataset been archived with Figshare at the Smithsonian Environmental Research Center and can be accessed here: <https://doi.org/10.25573/serc.27161883.v1>

Maps and schematics for data collection



Figure 1. Project sites.

Dataset 2: Soil temperature

Description of data:

Data consist of a time series of soil temperature at about 5-8 cm below the soil surface near the main groundwater station at each site in the study. Data collected with Hobo UA-001 data loggers. Data include the date and time stamp for each measurement and the temperature value in Celsius.

Search keywords:

soil temperature; Pacific Northwest; tidal wetlands

Data collection period:

October 2020 to June 2022, although most sites have shorter time periods

Geographic extent:

Coordinates for each site are in file "Site-level metadata"

File format:

CSV

File name(s):

Janousek_et_al_2025_soil_temperature.csv

Data access and archival:

This dataset been archived with Figshare at the Smithsonian Environmental Research Center and can be accessed here: <https://doi.org/10.25573/serc.27161883.v1>

Dataset 3: Groundwater level, salinity, and temperature

Description of data:

Data consist of a time series of groundwater level, groundwater salinity, and groundwater temperature in shallow groundwater wells at each site in the two projects. Data include the date and time stamp for each measurement and the temperature (in Celsius), salinity (in ppt), and groundwater level (in m below the wetland surface).

Search keywords:

groundwater; Pacific Northwest; tidal wetlands; salinity; temperature

Data collection period:

October 2020 to June 2022, although most sites have shorter time periods

Geographic extent:

Coordinates for each site are in file "Site-level metadata"

File format:

CSV

File name(s):

Janousek_et_al_2025_porewater_level.csv

Data access and archival:

This dataset been archived with Figshare at the Smithsonian Environmental Research Center and can be accessed here: <https://doi.org/10.25573/serc.27161883.v1>

Dataset 4: General wetland elevation

Description of data:

Data consist of wetland elevation measurements conducted along transects at each of the sites. Elevation data are in meters relative to NAVD88 and were obtained by RTK-GNSS and leveling. Data include the point name, geographic location, and elevation.

Search keywords:

elevation; Pacific Northwest; RTK-GNSS

Data collection period:

October 2020 to June 2022, although most sites have shorter time periods

Geographic extent:

Coordinates for each site are in file "Site-level metadata"

File format:

CSV

Data access and archival:

This dataset will be made publicly available within two years of project completion or upon publication of the associated manuscript, whichever is sooner. Data will be archived in the interim with the NERRS Centralized Data Management Office (CDMO).

Dataset 5: General plant species composition

Description of data:

Data consist of the species identity and percent cover of vegetation at up to eight randomly selected vegetation plots per site. Plots did not coincide with GHG chambers but were close by and characteristic of each site in the study. Data include the site, vegetation plot name, geographic coordinates of the plot, elevation, species code and percent cover of the species.

Search keywords:

vegetation; Pacific Northwest; plant composition

Data collection period:

Summer 2021

Geographic extent:

Coordinates for each site are in file "Site-level metadata"

File format:

CSV

Data access and archival:

This dataset will be made publicly available within two years of project completion or upon publication of the associated manuscript, whichever is sooner. Data will be archived in the interim with the NERRS Centralized Data Management Office (CDMO).

Dataset 6: Greenhouse gas fluxes - CO₂, CH₄, N₂O

Description of data:

Data consist of greenhouse gas flux data (carbon dioxide, methane, nitrous oxide) for each sampling time point in each chamber at each of 34 sites in the two studies. Data include the site, chamber ID, date, light or dark measurement and calculated greenhouse gas flux rate.

Search keywords:

greenhouse gas emissions; Pacific Northwest; blue carbon; tidal wetlands

Data collection period:

2021-2022

Geographic extent:

Coordinates for each site are in file "Site-level metadata"

File format:

CSV

File name(s):

Janousek_et_al_2025_chamber_timseseries.csv

Data access and archival:

This dataset been archived with Figshare at the Smithsonian Environmental Research Center and can be accessed here: <https://doi.org/10.25573/serc.27161883.v1>

Dataset 7: Blue carbon core profiles

Description of data:

Data consist of tidal wetland soil core vertical profiles of bulk density, carbon and nitrogen (or organic matter) content, and radiometric (e.g., ²¹⁰Pb activity) measurements.

More about the data:

Data include the site, core ID, depth interval and measurements of soil characteristics.

Search keywords:

tidal wetlands; soils; Pacific Northwest; blue carbon; tidal wetlands

Data collection period:

2017-2024

Geographic extent:

Coordinates for each site are in file "Site-level metadata"

File format:

File format = .csv

File name(s):

poppe_et_al_2024_methods.csv

poppe_et_al_2024_cores.csv

poppe_et_al_2024_depthseries.csv

poppe_et_al_2024_species.csv

Data access and archival:

This dataset been archived with archived at the Coastal Carbon Atlas for the Smithsonian Environmental Research Center and can be accessed

here:https://smithsonian.figshare.com/articles/dataset/Dataset_Soil_carbon_stocks_and_long-term_accretion_rates_in_tidal_marshes_tidal_swamps_and_former_tidal_wetlands_in_eight_estuaries_in_the_Pacific_Northwest_USA/27156465

Dataset 8: Time series of light flux

Description of data:

Data consist of time series of light flux (lux) to five emergent marshes in the study. Data include the site, day and time stamp, air temperature, and light flux.

Search keywords:

tidal wetlands; PAR; Pacific Northwest; blue carbon; tidal marsh

Data collection period:

2021-2022

Geographic extent:

Coordinates for each site are in file "Site-level metadata"

File format:

CSV

Data access and archival:

This dataset will be made publicly available within two years of project completion or upon publication of the associated manuscript, whichever is sooner. Data will be archived in the interim with the NERRS Centralized Data Management Office (CDMO).

Dataset 9: Wetland short-term accretion and surface elevation change

Description of data:

Data consist of short-term sediment accretion in feldspar marker horizon plots and net surface elevation change in surface elevation tables (SETs). Data include vertical accretion rates and net surface elevation change.

Search keywords:

tidal wetlands; Pacific Northwest; accretion; SET; surface elevation change

Data collection period:

2021-2022

Geographic extent:

Coordinates for each site are in file "Site-level metadata"

File format:

CSV

Data access and archival:

This dataset will be made publicly available within two years of project completion or upon publication of the associated manuscript, whichever is sooner. Data will be archived in the interim with the NERRS Centralized Data Management Office (CDMO).

Dataset 10: GHG chamber location and wetland surface elevation

Description of data:

Data consist of the geographic coordinates and wetland surface elevation of chambers where GHG emissions were determined by RTK-GPS.

More about the data:

Geographic coordinates are in latitude and longitude; elevation is NAVD88 and tide-scaled z*.

Search keywords:

elevation; Pacific Northwest; tidal wetlands

Data collection period:

October 2020 to June 2022, although most sites have shorter time periods

Geographic extent:

Coordinates for each site are in file “Site-level metadata”

File format:

CSV

File name(s):

Janousek_et_al_2025_chamber_level.csv

Data access and archival:

This dataset been archived with Figshare at the Smithsonian Environmental Research Center and can be accessed here: <https://doi.org/10.25573/serc.27161883.v1>

Dataset 11: Plant species composition in greenhouse gas chambers

Description of data:

Data consist of plant species cover (and other cover classes) within chambers used to assess GHG emissions. Data indicate the year, month and day that species cover was assessed.

Search keywords:

plant cover; Pacific Northwest; tidal wetlands

Data collection period:

2021.

Geographic extent:

Coordinates for each site are in file "Site-level metadata"

File format:

CSV

File name(s):

Janousek_et_al_2025_chamber_species.csv

Data access and archival:

This dataset been archived with Figshare at the Smithsonian Environmental Research Center and can be accessed here: <https://doi.org/10.25573/serc.27161883.v1>