

FigShare Dataset Name: **Dataset: Oxygen priming induced by elevated CO₂ reduces carbon accumulation and methane emissions in coastal wetlands**

Citation: Genevieve L. Noyce, Alexander J. Smith, Matthew L. Kirwan, Roy L. Rich, and J. Patrick Megonigal. 2023. Oxygen priming induced by elevated CO₂ reduces carbon accumulation and methane emissions in coastal wetlands. *Nature Geosciences*.

The dataset is composed of 8 files providing the data used in the paper Noyce et al. (2023) in *Nature Geoscience*:

1. **Read Me (2022-10-03).pdf**: This document explains the contents of the dataset.
2. **SMARTX fine roots_2017-2020.csv**: This file contains fine root biomass for all plots in all years.
3. **SMARTX automated redox_Apr-Dec 2020.csv**: This file contains automated redox data for the warmed plots in 2020.
4. **SMARTX AccretionRatePBP.csv**: This file contains soil accretion rates for all plots.
5. **SMARTX CH₄ fluxes_2017-2020.csv**: This file contains CH₄ fluxes for all plots in all years.
6. **SMARTX Schoenoplectus density_2017-2020.csv**: This file contains the *Schoenoplectus americanus* stem density for all plots in all years.
7. **SMARTX automated redox_Apr-Jun 2022.csv**: This file contains automated redox data for all plots in spring 2022.
8. **SMARTX porewater CH₄_2017-2020.csv**: This file contains porewater CH₄ data for all plots in all years.

This Read Me file has two details that describe the dataset (Table 1) and the variables in the data files (Table 2).

Table 1. Description of the dataset.	
1. Name	Genevieve Noyce
2. Dataset File Name	Dataset: Oxygen priming induced by elevated CO ₂ reduces carbon accumulation and methane emissions in coastal wetlands
3. Dataset Version	Version 1
4. Lead Investigators	Noyce, Genevieve; Megonigal, Patrick
5. Other Investigators	Matthew Kirwan, Roy Rich, Alex Smith
6. Contact	Genevieve Noyce, noyceg@si.edu, 443-482-2351 Pat Megonigal, megonigalp@si.edu, 443-482-2346
7. Start Date	2016
8. End Date	2020
9. Location	38°55' N, 76°33' W; Smithsonian Global Change Research Wetland, Smithsonian Environmental Research Center, Edgewater, MD 21037.
10. Taxa	NA

11. Keywords	warming, elevated CO ₂ , global change, methane, carbon sequestration, priming, root oxygen loss
12. Abstract	<p>Warming temperatures and elevated CO₂ are inextricably linked global change phenomena, but are rarely manipulated together in field experiments. As a result, ecosystem-level responses to these interacting facets of global change remain poorly understood. Here we report on a 4-year field manipulation of warming and elevated CO₂ in a coastal wetland. Contrary to our expectations, elevated CO₂ combined with warming reduced the rate of carbon accumulation due to increases in plant-mediated oxygen flux that stimulated aerobic decomposition via oxygen priming. Evidence supporting this interpretation includes an increase in soil redox potential and a decrease in the nominal oxidation state of the dissolved organic carbon pool. While warming alone stimulated methane (CH₄) emissions, we found that elevated CO₂ combined with warming reduced net CH₄ flux due to plant-microbe feedbacks. Together, these results demonstrate that ecosystem responses to interacting facets of global change are mediated by plant traits that regulate the redox state of the soil environment. Thus, plant responses are critical for predicting future ecosystem survival and climate feedbacks.</p>
13. Related Materials	None
14. Related Links	https://serc.si.edu/gcrew/warming
15. Related Datasets	None
16. Research Topic	Carbon cycling response to elevated CO ₂ and warming.
17. Study Type	Biogeochemistry.

Table 2. Description of variables in the data files.

File Name	Variable Name	Variable Description	Units	Codes
SMARTX fine roots_2017-2020.csv	Year	year of data collection	none	none
	Plot	3-digit plot ID	none	none
	Temperature Treatment	target temperature differential for whole-ecosystem warming	°C	0 = Ambient; 1.7 = +1.7 °C above ambient; 3.4 = +3.4 °C above ambient; 5.1 = +5.1 °C above ambient
	CO2 Treatment	ambient or elevated CO2 treatment	none	Amb = ambient; Elev = elevated
	Core ID	individual ID for each of the 3 cores in each plot	none	none
	Fine Roots (g/m2)	total fine root biomass per core	g m ⁻²	none
SMARTX automated redox_Apr-Dec 2020.csv	Date	date of data collection	none	none
	Plot	3-digit plot ID	none	none
	Temperature Treatment	target temperature differential for whole-ecosystem warming	°C	0 = Ambient; 1.7 = +1.7 °C above ambient; 3.4 = +3.4 °C above ambient; 5.1 = +5.1 °C above ambient
	CO2 Treatment	ambient or elevated CO2 treatment	none	Amb = ambient; Elev = elevated
	Depth	depth of redox measurement	cm	none
	Redox potential (mV)	mean daily soil redox potential	mV	none
SMARTX AccretionRatePBP.csv	Pin Number	ID of SET pins in each plot	none	none
	C3 Amb	SET pin heights for ambient temperature, ambient CO2 plots	mm/yr	none
	Amb + CO2	SET pin heights for ambient temperature, elevated CO2 plots	mm/yr	none

	5.1	SET pin heights for +5.1 °C, ambient CO2 plots	mm/yr	none
	5.1 and CO2	SET pin heights for +5.1 °C temperature, elevated CO2 plots	mm/yr	none
SMARTX CH4 fluxes_2017-2020.csv	Year	year of data collection	none	none
	Day of Year	Julian day of data collection	none	none
	Plot	3-digit plot ID	none	none
	Temperature Treatment	target temperature differential for whole-ecosystem warming	°C	0 = Ambient; 1.7 = +1.7 °C above ambient; 3.4 = +3.4 °C above ambient; 5.1 = +5.1 °C above ambient
	CO2 Treatment	ambient or elevated CO2 treatment	none	Amb = ambient; Elev = elevated
	CH4 flux (umol CH4/m2/day)	methane flux measured using static chambers	μmol CH ₄ m ² day ⁻¹	none
SMARTX Schoenoplectus density_2017-2020.csv	Year	year of data collection	none	none
	Temperature Treatment	target temperature differential for whole-ecosystem warming	°C	0 = Ambient; 1.7 = +1.7 °C above ambient; 3.4 = +3.4 °C above ambient; 5.1 = +5.1 °C above ambient
	CO2 Treatment	ambient or elevated CO2 treatment	none	Amb = ambient; Elev = elevated
	Stem density (#/m2)	mean # of Schoenoplectus stems per plot	# m ⁻²	none
SMARTX automated redox_Apr-Jun 2022.csv	Date	date of data collection	none	none
	Plot	3-digit plot ID	none	none
	Temperature Treatment	target temperature differential for whole-ecosystem warming	°C	0 = Ambient; 1.7 = +1.7 °C above ambient; 3.4 = +3.4 °C above ambient; 5.1 = +5.1 °C above ambient
	CO2 Treatment	ambient or elevated CO2 treatment	none	Amb = ambient; Elev = elevated
	Depth	depth of redox measurement	cm	none

	Redox potential (mV)	mean daily soil redox potential	mV	none
SMARTX porewater CH4_2017-2020.csv	Year	year of data collection	none	none
	Month	month of data collection	none	none
	Plot	3-digit plot ID	none	none
	Temperature Treatment	target temperature differential for whole-ecosystem warming	°C	0 = Ambient; 1.7 = +1.7 °C above ambient; 3.4 = +3.4 °C above ambient; 5.1 = +5.1 °C above ambient
	CO2 Treatment	ambient or elevated CO2 treatment	none	Amb = ambient; Elev = elevated
	Depth (cm)	depth of sample collection	cm	none
	CH4 (umol CH4/L)	concentration of methane in porewater sample	$\mu\text{mol CH}_4 \text{ L}^{-1}$	none