Ramped pyrolysis oxidation (RPO) temperature and carbon dioxide evolved values of soils collected in 2014-2015 within Plum Island Ecosystems LTER

Website: https://www.bco-dmo.org/dataset/827427
Data Type: Other Field Results
Version: 1
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Project
» Eutrophication Effects on Sediment Metabolism and Benthic Algal-bacterial Coupling: An Application of Novel Techniques in a LTER Estuary (Benthic_PP_at_TIDE)

Contributors	Affiliation	Role
Spivak, Amanda	Woods Hole Oceanographic Institution (WHOI)	Principal Investigator
Luk, Sheron	Woods Hole Oceanographic Institution (WHOI)	Contact
Rauch, Shannon	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
Ramped pyrolysis oxidation (RPO) temperature and carbon dioxide evolved values of soils at Plum Island Ecosystems - LTER. Data were collected 2014-2015.

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Coverage

Spatial Extent: **N**:42.741354 **E**:-70.83000142 **S**:42.73739991 **W**:-70.84720027
Temporal Extent: 2014-07 - 2015-12

Dataset Description

Bulk soil and elemental properties of marsh and infilled pond soils within Plum Island Ecosystems - LTER. Bulk soil properties of the soils are complemented with Fourier Transform Infrared Spectroscopy and ramped pyrolysis oxidation measurements of the soils. Data were collected during 2014-2015.

Methods & Sampling

Soil cores were collected from three sites within the Plum Island Ecosystems - Long Term Ecological Research (PIE-LTER) domain (MA, USA; 42.74° N, -70.85° W). A core liner was fitted with a gasketed piston and placed on the sediment surface and pushed down into the marsh subsurface, ensuring that the soil column did not compact during collection.

The sites had similar elevations (1.41 - 1.51 m North American Vertical Datum of 1988 [NAVD88]) and salt

marsh grass communities, dominated by *Spartina patens, S. alterniflora*, and *Distichlis spicata*. Permanently inundated ponds within each site had comparable depths (0.24 - 0.30 m) but varied in size (643 - 7,149 m²) and age (40 - 53 years) (Spivak et al., 2017; Spivak et al., 2018).

Soil cores were split lengthwise and sectioned into 1, 2, or 5 cm sections, with higher resolution in the top 30 cm. Soil water content (%) and bulk density (g/cm³) were determined gravimetrically after drying to constant mass (60°C). Samples were sieved (1 mm) to remove root material and homogenized with a Retsch Mixer Mill 200.

The thermal reactivity of SOC was characterized through ramped pyrolysis oxidation (RPO). Homogenized soil samples (~6 mg) were exposed to a constant flow of ultra-high purity oxygen and helium gas mixture within a reactor, where temperatures ramped to 1000°C at a constant rate (20°C per min) (Rosenheim et al., 2008). The evolved carbon dioxide (CO2) was measured by a flow-through infrared gas analyzer and thermograms were constructed by plotting gas concentrations over time. Thermograms were normalized to the expected milligram of carbon evolved per gram of dry soil sample (mg C / g soil). Samples were not acidified as inorganic carbon content was 0.02% - 0.04% of TOC. Analyses were conducted at the National Ocean Sciences Accelerator Mass Spectrometry Facility (NOSAMS, Woods Hole, MA). We further analyzed the δ13C and Fm composition of CO2 evolved from marsh and pond soils at one representative site. Refer to Hemmingway et al. (2017) for a description of the NOSAMS RPO set up.

Data Processing Description

BCO-DMO Processing:
- replaced NaN with nd as the missing data identifier;
- renamed fields to conform with BCO-DMO naming conventions (no spaces or special characters).

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Data Files

File
RPO_fast.csv (Comma Separated Values (.csv), 2.83 MB) MD5:6aae8d6820e27305d1c5cdd8cfb1b1f7 Primary data file for dataset ID 827427

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Related Publications

Hemingway, J. D., Galy, V. V., Gagnon, A. R., Grant, K. E., Rosengard, S. Z., Soulet, G., … McNichol, A. P. (2017). Assessing the Blank Carbon Contribution, Isotope Mass Balance, and Kinetic Isotope Fractionation of the Ramped Pyrolysis/Oxidation Instrument at NOSAMS. Radiocarbon, 59(1), 179–193. doi:10.1017/rdc.2017.3 https://doi.org/10.1017/RDC.2017.3
Methods

Spivak, A. C., Gosselin, K. M., & Sylva, S. P. (2018). Shallow ponds are biogeochemically distinct habitats in salt marsh ecosystems. Limnology and Oceanography. doi:10.1002/lno.10797
Methods

Spivak, A. C., Gosselin, K., Howard, E., Mariotti, G., Forbrich, I., Stanley, R., & Sylva, S. P. (2017). Shallow ponds are heterogeneous habitats within a temperate salt marsh ecosystem. Journal of Geophysical Research: Biogeosciences, 122(6), 1371–1384. doi:10.1002/2017jg003780 https://doi.org/10.1002/2017JG003780
Methods

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Parameters

Parameter	Description	Units
Site	Site number (1, 2, or 3); three high marsh sites were cored in PIE-LTER	unitless
Core	Core identifier (1 or 2); the two marsh cores were labeled 1 and 2	unitless
Location	Location within each site (MARSH or POND); at each of the three sites, two high marsh cores and one inundated pond core were collected	unitless
Depth_Into_Core	Depth of horizon relative to surface of the marsh	centimeters (cm)
Time	Time during ramped pyrolysis oxidation experiment; format: hh:mm:ss AM/PM	unitless
Temperature	Temperature of oven during ramped pyrolysis oxidation	degrees Celsius
CO2	Carbon dioxide evolved	per mil

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Instruments

Dataset-specific Instrument Name	infrared gas analyzer
Generic Instrument Name	Gas Analyzer
Dataset-specific Description	The evolved carbon dioxide (CO2) was measured by a flow-through infrared gas analyzer.
Generic Instrument Description	Gas Analyzers - Instruments for determining the qualitative and quantitative composition of gas mixtures.

Dataset-specific Instrument Name	Retsch Mixer Mill 200
Generic Instrument Name	Homogenizer
Dataset-specific Description	Retsch Mixer Mill 200 was used for homogenization.
Generic Instrument Description	A homogenizer is a piece of laboratory equipment used for the homogenization of various types of material, such as tissue, plant, food, soil, and many others.

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Project Information

Eutrophication Effects on Sediment Metabolism and Benthic Algal-bacterial Coupling: An Application of Novel Techniques in a LTER Estuary (Benthic_PP_at_TIDE)

Coverage: Plum Island Estuary, Rowley Massachusetts

Extracted from the NSF award abstract:
This project will address how rates of benthic microalgal production respond to eutrophication and geomorphological changes in human-impacted tidal creeks. Excess nutrient loading increases benthic algal biomass and likely stimulates production rates but the magnitude of nutrient and geomorphological effects on rates of production is unknown. Will changes in benthic algal productivity affect algal-bacterial coupling? Furthermore, how is algal-bacterial coupling affected by geomorphological changes, which may be exacerbated

by excess nutrient loading but can also occur in pristine marshes?

This project will take advantage of the infrastructure of the TIDE project, a long-term saltmarsh eutrophication experiment at the Plum Island Ecosystem - Long Term Ecological Research site in Northeastern Massachusetts. Specifically, the PIs will measure benthic metabolism and examine algal- bacterial coupling in fertilized and ambient nutrient tidal creeks in the first field season. The following field season, they will compare sediment metabolism and carbon dynamics on slumped tidal creek walls (i.e. areas where low marsh has collapsed into the tidal creek) to that on the bottom of tidal creeks. In both years, gross and net production will be determined using an innovative triple oxygen isotope technique and traditional dissolved oxygen and inorganic carbon flux measurements. Comparisons between these methods will be useful in informing studies of sediment metabolism. Lipid biomarkers will be used to characterize the sources of organic matter to creek sediments, and stable isotope analysis of bacterial specific biomarkers to identify the sources of organic carbon utilized by sediment bacteria. The biomarkers will reveal whether sediment bacteria use organic matter substrates, such as benthic microalgal carbon, selectively or in proportion to availability. Overall, results from the proposed study will provide important information about how sediment carbon dynamics in shallow tidal creeks respond to long term eutrophication. Furthermore, findings will enhance understanding of the role of tidal creeks in coastal biogeochemistry.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1233678

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