Fourier Transform Infrared Spectroscopy raw spectra of soils collected in 2014-2015 within Plum Island Ecosystems LTER

Website: https://www.bco-dmo.org/dataset/827452
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
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. This dataset includes the Fourier Transform Infrared Spectroscopy raw spectra.

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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.

Samples were run on a Bruker Vertex 70 Fourier Transform-Infrared Spectrometer (Bruker Optics Inc., Billerica, MA) outfitted with a Pike AutoDiff diffuse reflectance Accessory (PIke Technologies, Madison, WI) and data were obtained in diffuse reflectance mode at a 2cm-1 resolution. Raw spectra were transformed using a calculated two-point linear tangential baseline using Unscrambler X (Camo Software, version 10.1, Woodbridge, NJ) (Bulseco, 2019).

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Data Files

File
FTIR Spectra filename: FTIR_Spectra.csv (Comma Separated Values (.csv), 8.32 MB) MD5:d2829eee293a09df6bf8fbb1d465fb57 Fourier Transform Infrared Spectroscopy raw spectra from soil samples collected at Plum Island Ecosystems - LTER in 2014-2015 as part of the project "Eutrophication Effects on Sediment Metabolism and Benthic Algal-bacterial Coupling: An Application of Novel Techniques in a LTER Estuary". Column descriptions: Site: Three high marsh sites were cored in PIE-LTER, unitless. Location: At each of the three sites, two high marsh cores and one inundated pond core were collected, unitless. Core ID: The two marsh cores were labelled 1 and 2, unitless. Depth: Depth of horizon relative to surface of the marsh, cm. 5996 - 181.3: Absorbance spectra wave number, cm-1. missing data identifier (no data): NA

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Related Publications

Bulseco, A. N., Giblin, A. E., Tucker, J., Murphy, A. E., Sanderman, J., Hiller-Bittrolff, K., & Bowen, J. L. (2019). Nitrate addition stimulates microbial decomposition of organic matter in salt marsh sediments. Global Change Biology, 25(10), 3224–3241. doi:10.1111/gcb.14726
Methods

Sanderman, J., Krull, E., Kuhn, T., Hancock, G., McGowan, J., Maddern, T., … Steven, A. (2015). Deciphering sedimentary organic matter sources: Insights from radiocarbon measurements and NMR spectroscopy. Limnology and Oceanography, 60(3), 739–753. doi:10.1002/lno.10064
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

Parameters for this dataset have not yet been identified

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Instruments

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.

Dataset-specific Instrument Name	Bruker Vertex 70 Fourier Transform-Infrared Spectrometer
Generic Instrument Name	Spectrometer
Generic Instrument Description	A spectrometer is an optical instrument used to measure properties of light over a specific portion of the electromagnetic spectrum.

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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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