Title

Data and scripts associated with a manuscript on a meta-analysis synthesizing stream biogeochemical response to wildfires across space and time

Summary

This data package is associated with the publication "Catchment characteristics modulate the influence of wildfires on nitrate and dissolved organic carbon across space and time: A meta-analysis." submitted to *Global Change Biology* (Cavaiani et al. 2024., in preparation). This study uses meta-analytical techniques to evaluate the effect of wildfire on in-stream responses in burned and unburned watersheds. The study aims to provide additional insight into the range of responses and net influences that wildfires have on hydro-biogeochemistry across broad spatial scales, burn extents, and the persistence of water-quality change. This study compiles data and metadata from 18 total publications that includes 1) surface water geochemistry data (dissolved organic carbon; nitrate), 2) climate classifications, 3) year of the wildfire, 4) the time lag between when the fire occurred and when the sampling occurred, and 5) study design of the publication. In total, this meta-analysis draws data that spans 8 climate guilds, 3 biomes, 62 watersheds, and 20 unique wildfires. See Sites_meta_data.csv for citations of the papers used in this meta-analysis. All R scripts and the associated data can also be found on GitHub at https://github.com/river-corridors-sfa/rc_sfa-rc-3-wenas-meta.

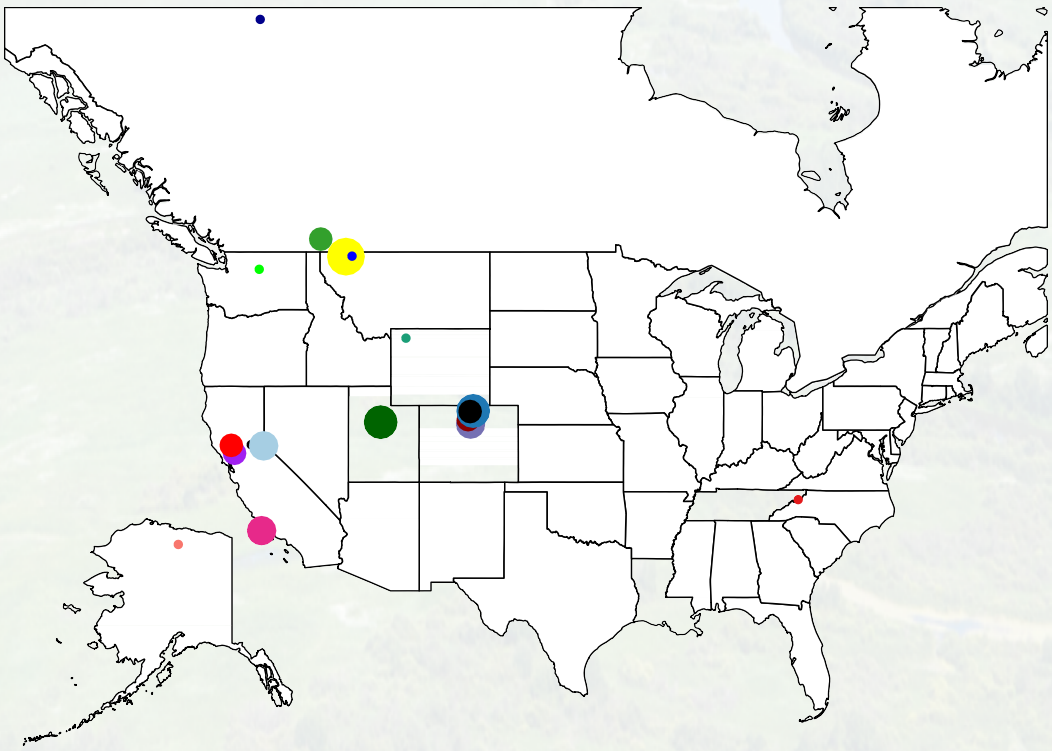
Brief Overview of Methods

We performed a systematic literature search in September 2023 on Scopus and Web of Science to generate a list of peer-reviewed publications reporting the effects of fire on dissolved organic carbon and nitrate in burned versus unburned watersheds. The following keywords were used: "wildfire" OR "fire" AND "dissolved organic carbon" OR "nitrate" AND "concentration" AND "export" OR "discharge" OR "stream" OR "river" OR "creek" OR "watershed". From the initial list of publications, we only retained studies matching all five of the following criteria: (1) the burn was a wildfire; (2) paired watershed study design encompassed both burned and unburned reference sites; (3) data included either DOC or nitrate; 4) data were reported as time-series allowing us to interpret seasonal variability in concentrations, and 5) located within North America.

To prepare the data for meta-analysis, we created a summary file ("effect_size_geospatial_fire_lat_long.csv") that consists of site level metadata, climate characteristics, and the effect size calculated for each site included in the study. Due to the lack of accessible data across publications, we generated a pseudo yield metric to facilitate intercomparisons across watersheds of different sizes. To analyze the proportional difference between burned and unburned in-stream solute concentrations, we calculated the effect size statistical metric. Effect sizes were converted to percent differences. Mixed-effects models were used to determine the significance of climate, time-since-fire, and burn extent response to fire.

Critical Details

1 – Map of North America with each point representing a unique fire that was studied. The size represents the number of monitored watersheds associated with each wildfire. The color represents the unique fire monitored. In total, 62 watersheds are represented across the 18 publications.



2 – Table containing a list of each publication that was included and the characteristics of the selected sites. Full citations can be found in the Acknowledgements & Citations section below.

Reference	Analyte	Koppen Geiger	Lat/Long	Wildfire name	Fire year	Time since fire	Analysis type
Abbott *et al.* 2021	DOC	Dwc	69.16, -150.75	Anaktuvuk River wildfire	2007	10 years	TSF
Burd *et al.* 2018	DOC	Dfc	61.4, -121.43	Northwest Territories fire	2013	3 years	Climate/TSF
Coombs & Melack, 2013	NO_3^-	BSk	34.47, -120.18	Gaviota Fire	2004	0-1 years	Climate/TSF/BP
Crandall *et al.*, 2021	DOC & NO_3^-	Csa	40.13, -111.77	Pole Creek Fire Complex	2018	0 years	Climate/TSF/BP
Gerla & Galloway, 1998	NO_3^-	Dfc	44.51, -109.98	Clover-Mist Wildfire	1988	1-5 years	Climate/TSF/BP
Gluns & Toews, 1989	NO_3^-	Dfc	49.70, -116.11	Matt Fire	1985	0-3 years	Climate/TSF
Hauer & Spencer, 1998	NO_3^-	Dfc	48.81, -114.39	Red Bench Fire	1988	1-5 years	Climate/TSF/BP
Hickenbottom et al. 2023	DOC & NO_3^-	Csb	38.88, -119.97	Caldor Fire/Mosquito Fire	2021/2022	0-2 years	Climate/TSF
Mast & Clow, 2008	DOC & NO_3^-	Dfc	48.41, -113.69	Rampage Fire	2003	1-4 years	Climate/TSF/BP
Murphy *et al.*, 2015	DOC & NO_3^-	Cfb	40.03, -105.39	Fourmile Canyon Fire	2010	0-3 years	Climate/TSF/BP
Murphy *et al.*, 2018	DOC & NO_3^-	Cfb	40.03, -105.39	Fourmile Canyon Fire	2010	0-5 years	Climate/TSF/BP
Neary & Currier, 1982	NO_3^-	Cfa	34.93, -83.09	Jumping Branch Wildfire	1978	0-1 years	Climate/TSF
Oliver *et al.*, 2021	NO_3^-	Csb	38.86, -120.06	Angora Fire	2007	1-2 years	Climate/TSF/BP
Rhea *et al.*, 2021	DOC & NO_3^-	Dfc	40.26, -105.59	Hayman Fire/High Park Fire	2002/2012	5 &15 years	TSF
Tiedemann, 1973	NO_3^-	Dsb	48.03, -120.29	Safety Harbor Fire	1970	0-2 years	Climate/TSF
Uzun *et al.*, 2020	DOC & NO_3^-	Csa	38.45, -122.05	Rocky Fire/Wragg Fire	2015	1-2 years	Climate/TSF/BP
Wagner *et al.*, 2015	DOC	Dfb	40.69, -105.54	High Park Fire	2012	0-1 years	Climate/TSF/BP
Writer *et al.*, 2014	DOC& NO_3^-	Dfb	40.69, -105.54	Hewlett Gulch/High Park Fire	2012	0 – 1 years	Climate/TSF/BP

3 – Catchment characteristics were extracted using the code found at https://doi.org/10.5281/zenodo.8140272 (Willi and Ross; 2023)

Data Package Structure

This data package contains five primary folders that include the following: (1) inputs; (2) output for analysis; (3) initial plots; (4) R scripts; and (5) GIS data. The data package also contains a data dictionary (dd) that provides column header definitions and a file-level metadata (flmd) file that describes every file. The "inputs" folder contains a list of all publications identified during the formal web search and an indication of whether each publication was included in the final analysis. Additionally, it includes site-level metadata, catchment characteristics, and GIS data for all publications included in the final analysis. The "Output_for_analysis" folder contains all data frames and figures generated from each R script used for additional data analysis. The "initial_plots" folder includes all exploratory figures that will be included in a supplemental and figures that will be submitted with the manuscript for publication. The "R_scripts" folder contains the scripts that perform all the data manipulations, statistical analyses, and plots. The "gis_data" folder includes shape files for each fire included in this meta-analysis. This data package contains the following file types: csv, pdf, jpeg, cpg, dbf, prj, shp, shp.ea.iso.xml, shp.iso.xml, shx.

Acknowledgements and Citations

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Cite this data package with the appropriate DOI. Cite the associated manuscript in any work that that uses analyses or conclusions presented in the manuscript. To cite the paper: Cavaiani, J., Regier, P., Roebuck Jr, J. A., Barnes, M., Garayburu-Caruso, V. A., Gillespie, X., McKever, S., Renteria, L., & Myers-Pigg, A. N., (2024, in preparation). Catchment characteristics modulate the influence of wildfires on nitrate and dissolved organic carbon across space and time: A meta-analysis.

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Change History

Data Package Version	Changes
Version 1 *March 2024*	Original data package publication