ABoVE: Synthesis of Burned and Unburned Forest Site Data, AK and Canada, 1983-2016

Get Data

Documentation Revision Date: 2022-05-04

Dataset Version: 1

Summary

This dataset is a synthesis of field plot characterization data, derived above-ground and below-ground combusted carbon, and acquired Fire Weather Index (FWI) System components for burned boreal forest sites across Alaska, USA, the Northwest Territories, and Saskatchewan, Canada from 1983-2016. Unburned plot data are also included. Compiled plot-level characterization data include stand age, disturbance history, tree density, and tree biophysical measurements for calculation of the above-ground (ag) and below-ground (bg) biomass/carbon pools, pre-fire and residual post-fire soil organic layer (SOL) depths and estimates of combustion of tree structural classes. The measured slope and aspect for each site and an assigned moisture class based on topography are also provided. Data from 1019 burned and 152 unburned sites are included. From the estimates of combusted ag and bg carbon pools and SOL losses, the total carbon combusted, the proportion of pre-fire carbon combusted, and the proportion of total carbon combusted were calculated for each plot. FWI System components including moisture and drought codes and indices of fire danger were obtained for each plot from existing data sources based on the plot location, year of burn, and a dynamic start-up date (day of burn, DOB) from the global fire weather database. Data for soil characteristics are included in a separate file.

The field studies span six ecoregions in the western North American boreal forest and captures broad gradients in pre-fire conditions of tree productivity, stand age, and ecosystem carbon storage. It also includes meteorological controls represented by DOB and FWI System indices and measurement of post-fire residual soil organic layer depth and reconstructions of burn depth and both above and below carbon combustion.

There are two data files in comma-separated (.csv) format with this dataset.

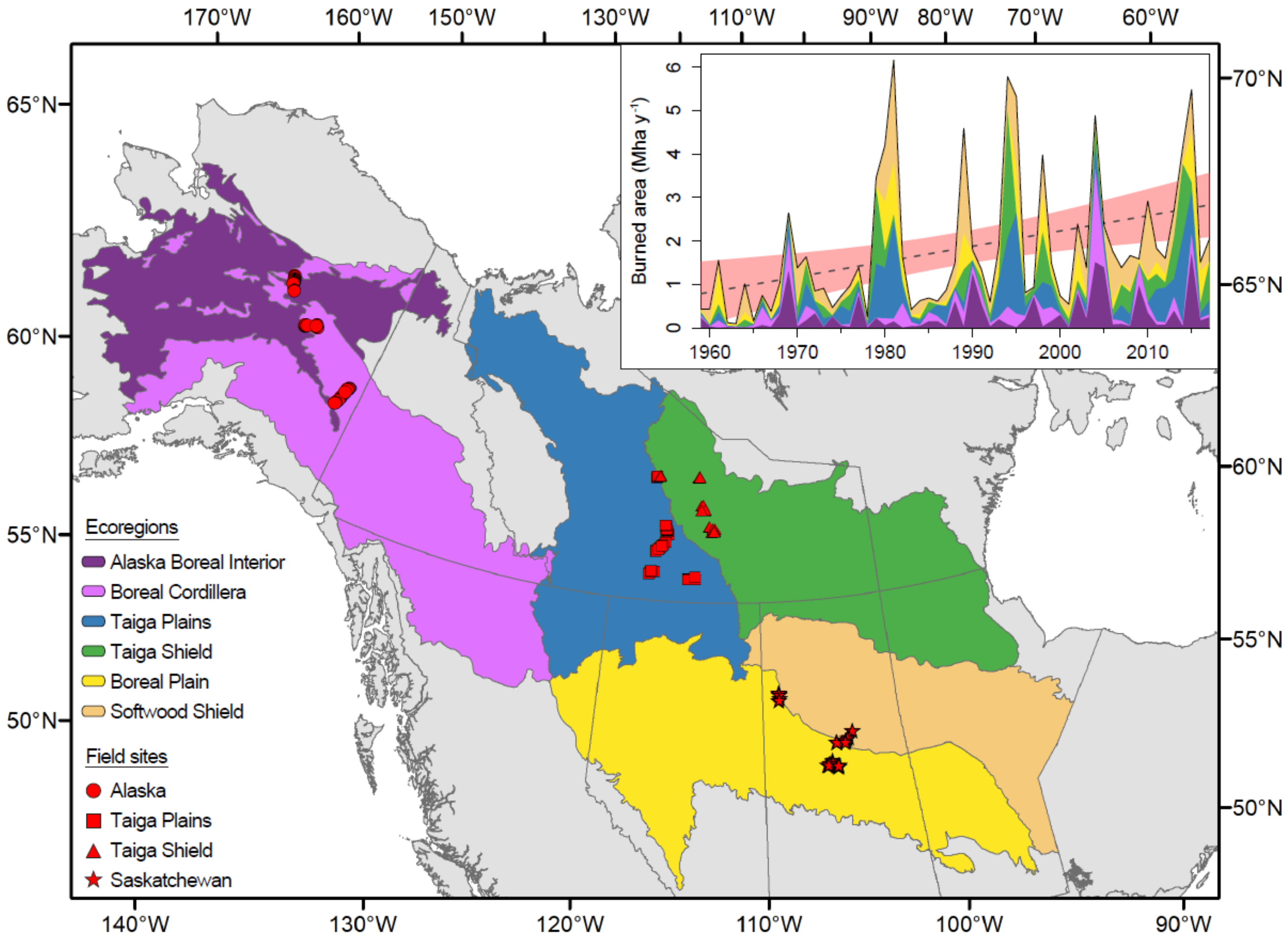

Figure 1. Field sites, ecoregions, and total area burned (millions of hectares; Mha) in each of the ecoregions in the study domain over time. Grey dotted line in the inset represents the simple linear regression, with red shading for the 95% confidence intervals, of burned area for all ecoregions combined. Analyses were completed using the field site groupings, located within the six ecoregions defined by the EPA Level II Ecoregions of North America. Source: Walker et al., 2020.

Citation

Walker, X.J., J.L. Baltzer, L.L. Bourgeau-Chavez, N.J. Day, W.J. De groot, C. Dieleman, E.E. Hoy, J.F. Johnstone, E.S. Kane, M.A. Parisien, S. Potter, B.M. Rogers, M.R. Turetsky, S. Veraverbeke, E. Whitman, and M.C. Mack. 2020. ABoVE: Synthesis of Burned and Unburned Forest Site Data, AK and Canada, 1983-2016. ORNL DAAC, Oak Ridge, Tennessee, USA. https://doi.org/10.3334/ORNLDAAC/1744

Table of Contents

1. Dataset Overview

This dataset is a synthesis of field plot characterization data, derived above-ground and below-ground combusted carbon, and acquired Fire Weather Index (FWI) system components for burned boreal forest sites across Alaska, USA, the Northwest Territories, and Saskatchewan, Canada from 1983-2016. Unburned plot data are also included. The field studies span six ecoregions in the western North American boreal forest and captures broad gradients in pre-fire conditions of tree productivity, stand age, and ecosystem carbon storage. Compiled plot-level characterization data include stand age, disturbance history, tree density, and tree biophysical measurements for calculation of the above-ground (ag) and below-ground (bg) biomass/carbon pools, pre-fire and residual post-fire soil organic layer (SOL) depths and estimates of combustion of tree structural classes. The measured slope and aspect for each site and an assigned moisture class based on topography are also provided. Data from 1019 burned and 152 unburned sites are included. From the estimates of combusted ag and bg carbon pools and SOL losses, the total carbon combusted, the proportion of pre-fire carbon combusted, and the proportion of total carbon combusted were calculated for each plot. FWI system components including moisture and drought codes and indices of fire danger were obtained for each plot from existing data sources based on the plot location, year of burn, and a dynamic start-up date (day of burn, DOB) from the global fire weather database. It also includes meteorological controls represented by DOB and FWI System indices and measurement of post-fire residual soil organic layer depth and reconstructions of burn depth and both above and below carbon combustion. Data for soil characteristics are included in a separate file. In many cases, individual datasets have been published (see related datasets), however this new synthesis dataset contains more information than is provided in the original datasets.

Project: Arctic-Boreal Vulnerability Experiment

The Arctic-Boreal Vulnerability Experiment (ABoVE) is a NASA Terrestrial Ecology Program field campaign based in Alaska and western Canada between 2016 and 2021. Research for ABoVE links field-based, process-level studies with geospatial data products derived from airborne and satellite sensors, providing a foundation for improving the analysis and modeling capabilities needed to understand and predict ecosystem responses and societal implications.

Related Publication

Walker, X.J., Baltzer, J., Bourgeau-Chavez, L., Day, N. J., Dieleman, C., Johnstone, J., Kane, E., Rogers, B. M., Turetsky, M., Veraverbeke, S., and Mack, M. Patterns of ecosystem structure and wildfire carbon emissions across six ecoregions of the North American boreal forest, *in review.*

Walker, X.J., Baltzer, J.L., Barrett, K., Bourgeau-Chavez, L., Day, N. J., de Groot. W.J., Dieleman, C.M., Goetz, S., Hoy, E., Jenkins, L., Johnstone, J., Kane, E.S., Parisien, M.-A., Potter, S., Rogers, B.M., Schuur, E.A.G., Turetsky, M., Veraverbeke, S., Whitman, E., Mack, M.C. Fuel availability not fire weather controls carbon emissions from boreal wildfires, *in review.*

Related Datasets

Walker, X.J., J.L. Baltzer, W. Laurier, S.G. Cumming, N.J. Day, S.J. Goetz, J.F. Johnstone, S. Potter, B.M. Rogers, E.A.G. Schuur, M.R. Turetsky, and M.C. Mack. 2019. ABoVE: Characterization of Carbon Dynamics in Burned Forest Plots, NWT, Canada, 2014. ORNL DAAC, Oak Ridge, Tennessee, USA. https://doi.org/10.3334/ORNLDAAC/1664

Walker, X.J., B.M. Rogers, J.L. Baltzer, S.R. Cummings, N.J. Day, S.J. Goetz, J.F. Johnstone, M.R. Turetsky, and M.C. Mack. 2018. ABoVE: Wildfire Carbon Emissions and Burned Plot Characteristics, NWT, CA, 2014-2016. ORNL DAAC, Oak Ridge, Tennessee, USA. https://doi.org/10.3334/ORNLDAAC/1561

Veraverbeke, S., B.M. Rogers, M.L. Goulden, R. Jandt, C.E. Miller, E.B. Wiggins, and J.T. Randerson. 2017. ABoVE: Ignitions, burned area and emissions of fires in AK, YT, and NWT, 2001-2015. ORNL DAAC, Oak Ridge, Tennessee, USA. https://doi.org/10.3334/ORNLDAAC/1341

Bourgeau-Chavez, L.L., N.H.F. French, S. Endres, L. Jenkins, M. Battaglia, E. Serocki, and M. Billmire. 2016. ABoVE: Burn Severity, Fire Progression, Landcover and Field Data, NWT, Canada, 2014. ORNL DAAC, Oak Ridge, Tennessee, USA. http://dx.doi.org/10.3334/ORNLDAAC/1307

Hoy, E.E., M.R. Turetsky, and E.S. Kasischke. 2016. NACP Soil Organic Matter of Burned Boreal Black Spruce Forests, Alaska, 2009-2011. ORNL DAAC, Oak Ridge, Tennessee, USA. https://doi.org/10.3334/ORNLDAAC/1331

Acknowledgments

This research was performed with support from NASA ABoVE, Grant NNX15AT71A.

2. Data Characteristics

Spatial Coverage: Alaska and Canada

ABoVE Reference Locations:

Domain: Core and Extended

State/territory: Alaska and Canada

Grid cells (108 cells in the ABoVE domain):

Table 1. ABoVE grid cells

Ah1Av1Bh6Bv6Ch41Cv36	Ah1Av1Bh7Bv7Ch42Cv45	Ah1Av0Bh6Bv5Ch36Cv32
Ah1Av0Bh7Bv3Ch44Cv23	Ah1Av0Bh7Bv4Ch42Cv24	Ah1Av0Bh7Bv4Ch43Cv24
Ah1Av0Bh6Bv4Ch40Cv25	Ah1Av0Bh6Bv4Ch41Cv26	Ah1Av0Bh6Bv4Ch40Cv27
Ah1Av0Bh6Bv4Ch40Cv28	Ah1Av0Bh6Bv4Ch41Cv28	Ah1Av0Bh6Bv4Ch38Cv29
Ah1Av0Bh6Bv4Ch40Cv29	Ah1Av0Bh6Bv4Ch41Cv29	Ah1Av0Bh7Bv4Ch45Cv29
Ah1Av0Bh6Bv5Ch39Cv30	Ah1Av0Bh6Bv5Ch40Cv30	Ah1Av0Bh6Bv5Ch41Cv30
Ah1Av0Bh6Bv5Ch40Cv31	Ah1Av0Bh6Bv5Ch38Cv32	Ah1Av0Bh6Bv5Ch39Cv32
Ah1Av0Bh6Bv5Ch40Cv32	Ah1Av0Bh6Bv5Ch41Cv32	Ah1Av0Bh7Bv5Ch42Cv32
Ah1Av0Bh6Bv5Ch40Cv33	Ah1Av0Bh7Bv5Ch43Cv33	Ah1Av0Bh7Bv5Ch44Cv33
Ah1Av0Bh7Bv5Ch45Cv33	Ah1Av0Bh6Bv5Ch40Cv34	Ah1Av0Bh6Bv5Ch41Cv34
Ah1Av0Bh7Bv5Ch42Cv34	Ah1Av0Bh7Bv5Ch45Cv34	Ah1Av1Bh6Bv6Ch40Cv37
Ah1Av1Bh6Bv6Ch40Cv38	Ah1Av1Bh6Bv6Ch41Cv39	Ah1Av1Bh6Bv6Ch41Cv40
Ah1Av1Bh7Bv6Ch42Cv40	Ah1Av1Bh7Bv6Ch46Cv40	Ah1Av1Bh6Bv6Ch41Cv41
Ah1Av1Bh7Bv6Ch43Cv41	Ah1Av1Bh7Bv6Ch44Cv41	Ah1Av1Bh7Bv6Ch45Cv41
Ah1Av1Bh6Bv7Ch41Cv42	Ah1Av1Bh7Bv7Ch42Cv42	Ah1Av1Bh7Bv7Ch43Cv42
Ah1Av1Bh7Bv7Ch42Cv43	Ah1Av1Bh8Bv7Ch49Cv44	Ah1Av1Bh7Bv7Ch43Cv45
Ah1Av1Bh11Bv11Ch70Cv67	Ah1Av1Bh11Bv11Ch71Cv68	Ah2Av1Bh12Bv11Ch75Cv71
Ah2Av1Bh12Bv11Ch76Cv71	Ah2Av1Bh13Bv9Ch79Cv59	Ah2Av1Bh13Bv9Ch80Cv59
Ah2Av1Bh14Bv10Ch84Cv61	Ah2Av1Bh13Bv10Ch83Cv64	Ah2Av1Bh14Bv10Ch84Cv64

Ah2Av1Bh13Bv10Ch79Cv65	Ah2Av1Bh13Bv10Ch83Cv65	Ah2Av1Bh14Bv10Ch84Cv65
Ah2Av1Bh13Bv11Ch78Cv66	Ah2Av1Bh13Bv11Ch79Cv66	Ah2Av1Bh13Bv11Ch83Cv66
Ah2Av1Bh14Bv11Ch84Cv66	Ah2Av1Bh13Bv11Ch78Cv67	Ah2Av1Bh13Bv11Ch79Cv67
Ah2Av1Bh13Bv11Ch83Cv67	Ah2Av1Bh14Bv11Ch84Cv67	Ah2Av1Bh12Bv11Ch77Cv68
Ah2Av1Bh13Bv11Ch78Cv68	Ah2Av1Bh14Bv11Ch84Cv68	Ah2Av1Bh12Bv11Ch73Cv69
Ah2Av1Bh12Bv11Ch76Cv69	Ah2Av1Bh12Bv11Ch74Cv70	Ah2Av1Bh12Bv11Ch75Cv70
Ah2Av1Bh12Bv11Ch76Cv70	Ah2Av1Bh12Bv11Ch77Cv71	Ah2Av2Bh13Bv12Ch79Cv73
Ah2Av2Bh13Bv12Ch80Cv73	Ah2Av2Bh13Bv12Ch80Cv74	Ah2Av2Bh13Bv12Ch80Cv75
Ah2Av2Bh13Bv12Ch81Cv75	Ah2Av2Bh14Bv4Ch87Cv88	Ah2Av2Bh13Bv4Ch82Cv89
Ah2Av2Bh14Bv4Ch87Cv89	Ah2Av2Bh13Bv5Ch82Cv90	Ah2Av2Bh14Bv5Ch87Cv90
Ah2Av2Bh15Bv5Ch95Cv95	Ah2Av2Bh15Bv6Ch94Cv96	Ah2Av2Bh15Bv6Ch92Cv97
Ah2Av2Bh15Bv6Ch93Cv97	Ah2Av2Bh15Bv6Ch94Cv97	Ah2Av2Bh14Bv6Ch88Cv98
Ah2Av2Bh15Bv6Ch91Cv99	Ah2Av2Bh15Bv6Ch91Cv100	Ah2Av2Bh15Bv6Ch92Cv100
Ah2Av2Bh15Bv6Ch91Cv101	Ah2Av2Bh15Bv6Ch92Cv101	Ah2Av2Bh15Bv7Ch92Cv102
Ah2Av2Bh12Bv12Ch75Cv72	Ah2Av2Bh12Bv12Ch77Cv72	Ah2Av2Bh13Bv12Ch78Cv72
Ah3Av2Bh18Bv15Ch108Cv95	Ah3Av2Bh18Bv5Ch109Cv95	Ah3Av2Bh18Bv6Ch109Cv96
Ah3Av2Bh21Bv7Ch128Cv104	Ah3Av2Bh21Bv7Ch129Cv104	Ah3Av2Bh21Bv7Ch129Cv105

Spatial Resolution: multiple points

Temporal Coverage: 1983-01-01 to 2016-08-08

Temporal Resolution: Variable

Study Areas (All latitude and longitude given in decimal degrees)

Site	Westernmost Longitude	Easternmost Longitude	Northernmost Latitude	Southernmost Latitude
Alaska and Canada	-150.902	-88.61199	67.22972	53.19106

Data File Information

There are two data files in comma-separated (.csv) format with this dataset.

AK_CA_Burned_Plot_Data_1983_2016.csv. This file is a compilation of data collected from plots at burned and unburned sites in Alaska and Canada from 1983-2016 as well as data derived from those variables.

AK_CA_Soil_Profile_Synthesis.csv. This file is a compilation of soil data collected from plots at burned and unburned sites.

Table 2. Variables in **AK_CA_Burned_Plot_Data_1983_2016.csv**. Note: An * in the descriptions denotes a variable calculated or assigned by the Investigators. The FWI System's components are calculated from daily weather conditions and include three fuel moisture codes and three fire behavior indices. Refer to Section 5 for additional details.

Variable	Units	Description
project_id		Unique id associated with this project
project_name		Project name
treatment		Burned or control plot
site		Site name/number
burn_name		Name of fire site
burn_year	YYYY	Year of burn
ecoregion_name_l2		US EPA Ecoregion Level 2 (https://www.epa.gov/eco-research/ecoregions)
latitude	decimal degrees	Latitude. GPS. Datum: WSG84 Position format: ddd.ddddd
longitude	decimal degrees	Longitude. GPS. Datum: WSG84 Position format: ddd.ddddd
accuracy_horizontal	meters	Horizontal accuracy
elevation	meters	GPS. Meters above sea level
accuracy_vertical	meters	vertical accuracy
slope	degrees	Slope in degrees

aspect	degrees	Slope aspect in compass degrees (0 to 360) - has not been corrected for declination
moisture	unitless	Ranking of plot moisture potential using the moisture key presented in the successional trajectories workbook (Johnstone). Values range from 1 to 6, where 1=xeric, 2=subxeric, 3=subxeric to mesic, 4=mesic, 5=submesic, 6=subhygric
stand_density	stems/m^2	Estimated density of pre-fire stems per m^2 for the pre-fire stand. All trees and saplings that were alive at the time fires are included
stand_basal_area	cm^2/cm^2	Total measured basal area (cm^2) of pre-fire tree species expressed on a per m^2 basis. Basal area was calculated from stem diameter at breast height (area of each tree=pie(dbh/2)^2)
prop_black_spruce	0-1	Proportion of black spruce trees in a site (range 0-1)
stand_age	year	Age of stand at time of fire - based on tree ring counts
stand_origin		Description of stand origin - e.g. fire, logging, unknown
ag_biomass_prefire	g/m^2	Pre-fire aboveground biomass
ag_c_prefire	g C /m^2	Pre-fire above ground carbon pool
ag_biomass_combusted	g/m^2	Above-ground biomass combusted
ag_c_combusted	g C/m^2	Above-ground carbon pool combusted
prefire_sol	cm	Depth of pre-fire SOL calculated as the sum of the residual SOL and the SOL burn depth
mean_residual_org_layer_depth	cm	Mean of residual organic layer depth
burn_depth	cm	Depth of burn
prop_sol_combusted	0-1	Proportion of the soil organic layer combusted (depth of burn/pre-fire SOL)
residual_sol_c	g C/m^2	Residual SOL C
bg_c_prefire	g C/m^2	Pre-fire belowground carbon pool (g C m^2)
bg_c_combusted	g C/m^2	Below-ground carbon combusted (g C m^2)
prop_sol_c_combusted	0-1	Proportion of the soil organic layer C combusted (bg_c_combusted/bg_c_prefire)
total_c_pool_prefire	g c/m^2	Total pre-fire carbon pool. Sum of above and below ground pre-fire C pools
prop_prefire_bg_c	0-1	Proportion of the total pre-fire C pool attributed to the below-ground component (bg_c_prefire/total_c_pool_prefire)
total_c_combusted	g c/m2	Total carbon combusted. Sum of above and below-ground C combusted *
prop_total_bg_c_combusted	0-1	Proportion of the total C combusted attributed to the below-ground component (bg_c_combusted/total_c_combusted) *
prop_total_prefire_c_combusted	0-1	Proportion of the total pre-fire C pool combusted (total_c_combusted/total_c_pool_prefire) *
dob		Day of Burn
precipitation	mm	Precipitation - obtained from GFWED based on input variables from MERRA 2. MERRA 2 from Field et al. 2015 *
temperature	degree C	Temperature - obtained from GFWED based on input variables from MERRA 2. MERRA 2 from Field et al. 2015 *
relative_humidity	%	Relative Humidity - obtained from GFWED based on input variables from MERRA 2. MERRA 2 from Field et al. 2015 *
wind_speed	m/s	Wind speed obtained from GFWED based on input variables from MERRA 2. MERRA 2 from Field et al. 2015 *
drought_code		Drought Code (DC) - obtained from GFWED based on input variables from MERRA 2. MERRA 2 from Field et al. 2015 *
drought_moisture_code		Drought Moisture Code (DMC) - obtained from GFWED based on input variables from MERRA 2. MERRA 2 from Field et al. 2015 *
fine_fuel_moisture_code		Fine Fuel Moisture Code (FFMC) - obtained from GFWED based on input variables from MERRA 2. MERRA 2 from Field et al. 2015 *
initial_spread_index		Initial Spread Index (ISI) - obtained from GFWED based on input variables from MERRA 2. MERRA 2 from Field et al. 2015 *
buildup_index		Build-up Index (BUI) - obtained from GFWED based on input variables from MERRA 2. MERRA 2 from Field et al. 2015 *

fire_weather_index		Fire Weather Index (FWI) - obtained from GFWED based on input variables from MERRA 2. MERRA 2 from Field et al. 2015 *
daily_severity_rank		Daily Severity Ranking (DSR)- obtained from GFWED based on input variables from MERRA 2. MERRA 2 from Field et al. 2015 *

Table 3. Variables in the file **AK_CA_Soil_Profile_Synthesis.csv**. Refer to Section 5 for additional details.

Variable	Units	Description
site		Study site
project_name		Project name of acquired data
id		ID
project_id		Unique id associated with this project
plot		Plot name
latitude	Decimal degrees	Latitude of site
longitude	Decimal degrees	Longitude of site
treatment		Burned or control (plot)
profile		Soil profiles
min_org		Mineral (min) or organic (org) soil. Mineral soil characteristics were only obtained from Boby et al. 2010 and were not included in any additional analyses
horizon		Soil horizon
raw_depth	cm	Depth in the profile (maximum depth in the profile)
adjusted_depth	cm	SOL profile depth measurements adjusted based on combusted (maximum depth in the profile)
sample_depth	cm	Sample depth
fine_coarse		How the soil was divided into coarse or fine fractions (0=no divide, 1=2mm)
fine_bulk_density	g/cm^3	Fine soil bulk density
coarse_ bulk_density	g/cm^3	Coarse soil bulk density
total_ bulk_density	g/cm^3	Total bulk density
fine_carbon	%	Percent carbon content in fine soil
fine_nitrogen	%	Percent nitrogen content in fine soil
ph		Soil pH
dry_matter	g/m^2	Grams of dry matter per m^2= fine bulk density * sample depth *10 000
carbon	$g\ C/m^2$	Grams of carbon per m^2 = g.dry.matter.m^2 * fine_c

3. Application and Derivation

This dataset was compiled to assess the driver of carbon emissions from fires across the northwestern North American boreal domain.

4. Quality Assessment

Across all studies, calculations largely followed the methods described in Walker et al. 2018.

5. Data Acquisition, Materials, and Methods

Study Areas

Data were obtained from 1,019 burned and 152 control (i.e., no recorded history of fire) sites spanning six different ecoregions in the boreal forest of western North America where area burned has increased in recent decades (Figure 1). Study sites were in the ecoregions of Interior Boreal Alaska, Boreal Cordillera, Taiga Plains, Taiga Shield, Softwood Shield, and Boreal Plains, which differ in their geologic history, soil development and parent materials, and mean annual temperatures and precipitation (Wang et al., 2016). Site selection and sampling methods differed between studies but all provided field-collected data related to pre-fire tree species composition, stand age, topography, and pre- and post-fire above- and below-ground C pools.

Table 4. Data sources for the burned and unburned sites.

Ecoregion	Project/Reference	Burn Years

Ecoregion	Project/Reference	Burn Years
Alaska Boreal Interior	Turetsky, M.R., E.S. Kane, J.W. Harden, R.D. Ottmar, K.L. Manies, E. Hoy, and ES. Kasischke.(2011). Recent acceleration of biomass burning and carbon losses in Alaskan forests and peatlands. *Nature* Geoscience **4**, 27-31. https://doi.org/10.1038/ngeo1027	1983, 1987, 1990, 1991, 1993, 1994, 1999, 2002, 2003, 2004, 2005
	Rogers, B.M., S. Veraverbeke, G. Azzari, C.I. Czimczik, S.R. Holden, G.O. Mouteva, F. Sedano K.K. Treseder, and J.T. Randerson. (2014). Quantifying fire-wide carbon emissions in interior Alaska using field measurements and Landsat imagery. *Journal of Geophysical Research: Biogeosciences* **119**, 2014JG002657. https://doi.org/10.1002/2014JG002657	2010; unburned
	Hoy, E.E., M.R. Turetsky, E.S. Kasischke. (2016). More frequent burning increases vulnerability of Alaskan boreal black spruce forests. *Environmental Research Letters* **11**, 095001. https://doi.org/10.1088/1748-9326/11/9/095001	2005, 2010, 1967, 1969
	Boby LA, Schuur EA, Mack MC, Verbyla D, Johnstone JF. (2010). Quantifying fire severity, carbon, and nitrogen emissions in Alaska's boreal forest. *Ecological Applications* **20**, 1633–1647. https://doi.org/10.1890/08-2295	2004; unburned
Boreal Cordillera	Turetsky, M.R., E.S. Kane, J.W. Harden, R.D. Ottmar, K.L. Manies, E. Hoy, and ES. Kasischke. (2011). Recent acceleration of biomass burning and carbon losses in Alaskan forests and peatlands. *Nature Geoscience* **4**, 27–31. https://doi.org/10.1038/ngeo1027	1990, 1996, 1998, 1999, 2003, 2004
	Rogers, B.M., S. Veraverbeke, G. Azzari, C.I. Czimczik, S.R. Holden, G.O. Mouteva, F. Sedano K.K. Treseder, and J.T. Randerson. (2014). Quantifying fire-wide carbon emissions in interior Alaska using field measurements and Landsat imagery. *Journal of Geophysical Research: Biogeosciences* **119**, 2014JG002657. https://doi.org/10.1002/2014JG002657	unburned
	de Groot W.J., J.M. Pritchard, and T.J. Lynham. (2009). Forest floor fuel consumption and carbon emissions in Canadian boreal forest fires. *Canadian Journal of Forest Research* **39**, 367–382. https://doi.org/10.1139/X08-192	2004
	Hoy, E.E., M.R. Turetsky, E.S. Kasischke. (2016). More frequent burning increases vulnerability of Alaskan boreal black spruce forests. *Environmental Research Letters* **11**, 095001. https://doi.org/10.1088/1748-9326/11/9/095001	1966, 2004
	Boby LA, Schuur EA, Mack MC, Verbyla D, Johnstone JF. (2010). Quantifying fire severity, carbon, and nitrogen emissions in Alaska's boreal forest. *Ecological Applications* **20**, 1633–1647. https://doi.org/10.1890/08-2295	2004; unburned
Taiga Plains	de Groot W.J., J.M. Pritchard, and T.J. Lynham. (2009). Forest floor fuel consumption and carbon emissions in Canadian boreal forest fires. *Canadian Journal of Forest Research* **39**, 367–382. https://doi.org/10.1139/X08-192	2004
	Bourgeau-Chavez, L.L., S. Endres, L. Jenkins, M. Battaglia, E. Serocki, and M. Billmire. Burn Severity and Fire Progression, *in prep*	1994, 1996, 2008, 2014, 2015
	Walker, X.J., B.M. Rogers, J.L. Baltzer, S.G. Cumming, N.J. Day, S. Goetz, J.J. Johnstone, E.A.G. Schuur, M. Turetsky, and M.C. Mack. Cross-scale controls on carbon emissions from boreal forest megafires. *Glob. Change Biol.* **24**, 4251–4265. (2018). https://doi.org/10.1111/gcb.14287 Data archived at the ORNL DAAC: Walker, X.J., B.M. Rogers, J.L. Baltzer, S.R. Cummings, N.J. Day, S.J. Goetz, J.F. Johnstone, M.R. Turetsky, and M.C. Mack. 2018. ABoVE: Wildfire Carbon Emissions and Burned Plot Characteristics, NWT, CA, 2014-2016. ORNL DAAC, Oak Ridge, Tennessee, USA. https://doi.org/10.3334/ORNLDAAC/1561	1969, 1971, 1972, 1980, 2011, 2013, 2014, unburned
Taiga Shield	Bourgeau-Chavez, L.L., S. Endres, L. Jenkins, M. Battaglia, E. Serocki, and M. Billmire. Burn Severity and Fire Progression, *in prep*	2014, 2015
	Walker, X.J., B.M. Rogers, J.L. Baltzer, S.G. Cumming, N.J. Day, S. Goetz, J.J. Johnstone, E.A.G. Schuur, M. Turetsky, and M.C. Mack. Cross-scale controls on carbon emissions from boreal forest megafires. *Glob. Change Biol.* **24**, 4251–4265. (2018). https://doi.org/10.1111/gcb.14287 Data archived at the ORNL DAAC: Walker, X.J., B.M. Rogers, J.L. Baltzer, S.R. Cummings, N.J. Day, S.J. Goetz, J.F. Johnstone, M.R. Turetsky, and M.C. Mack. 2018. ABoVE: Wildfire Carbon Emissions and Burned Plot Characteristics, NWT, CA, 2014-2016. ORNL DAAC, Oak Ridge, Tennessee, USA. https://doi.org/10.3334/ORNLDAAC/1561	2014; unburned

Ecoregion	Project/Reference	Burn Years
Boreal Plains	de Groot W.J., J.M. Pritchard, and T.J. Lynham. (2009). Forest floor fuel consumption and carbon emissions in Canadian boreal forest fires. *Canadian Journal of Forest Research* **39**, 367–382. https://doi.org/10.1139/X08-192	2003
	Bourgeau-Chavez, L.L., S. Endres, L. Jenkins, M. Battaglia, E. Serocki, and M. Billmire. Burn Severity and Fire Progression, *in prep*	2016
	Dieleman, C., B.M. Rogers, S. Veraverbeke, J. Johnstone, J. Laflamme, L. Gelhorn, K. Solvik, X.J. Walker, M. Mack, M. Turetsky. Drivers of carbon stocks and combustion in response to wildfire events in the southern boreal forest. *in review Global Change Biology*	2015; unburned
Softwood Shield	de Groot W.J., J.M. Pritchard, and T.J. Lynham. (2009). Forest floor fuel consumption and carbon emissions in Canadian boreal forest fires. *Canadian Journal of Forest Research* **39**, 367–382. https://doi.org/10.1139/X08-192	2003
	Dieleman, C., B.M. Rogers, S. Veraverbeke, J. Johnstone, J. Laflamme, L. Gelhorn, K. Solvik, X.J. Walker, M. Mack, M. Turetsky. Drivers of carbon stocks and combustion in response to wildfire events in the southern boreal forest. *in review Global Change Biology*	2015; unburned

Data Synthesis

Compiled Field Site Observations

Each site was assigned a moisture class based on topography controlled drainage and adjusted for soil texture and presence of permafrost, on a six-point scale, ranging from xeric to subhygric (Johnstone et al., 2008). Stand age, or time since establishment from previous disturbance was based on tree ring counts from five to ten dominant trees per site using standard dendro-chronology techniques. All stems within a plot, including snags (i.e., coarse woody debris), were counted, and a diameter at breast height measurement along with study- and species-specific allometric equations were used to calculate tree density (number stems m^{-2}), basal area (m^2 ha^{-1}), above-ground biomass (g dry matter m^{-2}), and above-ground C content (g C m^{-2}). Tree combustion estimates of either total percent burned or combustion of structural classes (i.e., foliage, fine branches, large branches, bark) were then used to quantify the amount of above-ground C combusted. Residual SOL depth was measured at five to twenty points per site and a site-level burn depth was estimated based on the height of adventitious roots above the residual SOL or by moisture class-specific comparisons with control sites. Pre-fire SOL depth was calculated as the sum of the residual SOL and the SOL burn depth. Site-level estimates were compiled of residual SOL C, pre-fire SOL C, and below-ground C combusted.

Estimates of Carbon Combustion

Using these variables, total C combustion (g C m^{-2}) as the sum of above and below-ground C emissions, the proportion of pre-fire C combusted as total C combusted divided by the total pre-fire C, and proportional of total C combusted attributed to the below-ground C pool as below-ground C combustion divided by total C combusted was calculated (Walker et al., 2020).

Fire Weather Index (FWI) System Components

FWI System components were obtained for each site based on the plot location, year of burn, and a dynamic start-up date from the global fire weather database (GFWED) using input variables from the Modern-Era Retrospective Analysis for Research and Application version 2 (MERRA-2) (Field et al., 2015). Day of Burn (DOB; local solar time) for each of the study sites was extracted from the MODIS Global Monthly Fire Location Product (MCD14ML). Using the DOB daily weather conditions were obtained for air temperature (°C), wind speed (m/s), relative humidity (%), and 24-hour accumulated precipitation (mm) from GFWED. The FWI System's components are calculated from these daily weather conditions and include three fuel moisture codes and three fire behavior indices. The three codes, the Fine Fuel Moisture Code (FFMC), Duff Moisture Code (DMC), and Drought Code (DC) represent the fuel moisture of surface, intermediate, and deep soil layers, respectively. The Initial Spread Index (ISI) is a wind-based indicator of fire danger, whereas the Buildup Index (BUI) is chiefly drought based. The Fire Weather Index (FWI) is an integrated indicator of overall fire danger computed from the ISI and BUI. The daily severity ranking (DSR) was also obtained which represents the expected difficulty of controlling a fire (Walker et al., 2020).

Compiled Soil Characteristics Data

Depth-wise measurements of both mineral (n=744) and organic (n=3794) soil characteristics were also acquired. Mineral soil characteristics were only obtained from Boby et al. 2010. Organic soil characteristics were obtained from 167 of the original 417 sites used in the ecoregion analyses (Walker et al., 2020), plus an additional 110 sites (27 burned, 83 unburned) nested within six ecoregions (Table 5). Five to ten SOL profiles were available per site and bulk density (g cm^{-3}), C content (%), and C stock (g C m^{-2}) were assessed from either pre-determined depth increments (e.g. 5 cm) or depth measurements of horizons (e.g. brown moss, fibric, humic). To ensure that all measurements were acquired from organic soil, we excluded all depth-wise SOL samples with bulk density >0.75 g cm^{-3} and C content < 20 %. This resulted in 2,596 measurements from 1,041 SOL profiles nested within 277 sites (Table 5).

Table 5. Compiled soil data within Ecoregions. (Walker et al., 2020)

			Soil Sample Characteristics			
Ecoregion	**Reference (see Table 4)**	**Burn Year**	**# fires/ecoregion**	**# sites**	**# soil profiles**	**# soil sub-samples**
Alaska Boreal Interior	Rogers et al. 2014	2010	1	21	73	115
		unburned	1	6	36	85
	Boby et al. 2010	2004	1	5	19	42
		unburned	1	7	56	177
Boreal	Rogers et al. 2014	unburned	1	2	12	33
		2004	3	24	81	152

Cordillera	Boby et al. 2010		Soil Sample Characteristics			
		unburned	0	0	0	0
Boreal Plains	Dieleman et al. in press	2015	3	27	106	167
		unburned	1	21	78	186
Softwood Shield	Dieleman et al. in press	2015	2	14	43	49
		unburned	1	11	55	146
Taiga Plains	Bourgeau-Chavez in prep	2014	0	0	0	0
		2015	0	0	0	0
	Walker et al. 2018	2014	4	65	205	578
		unburned	2	18	85	249
Taiga Shield	Bourgeau-Chavez in prep	2014	0	0	0	0
		2015	0	0	0	0
	Walker et al. 2018	2014	3	38	109	409
		unburned	1	18	83	208
Total		**unburned**	**8**	**83**	**405**	**1084**
		burned	**17**	**194**	**636**	**1512**

6. Data Access

These data are available through the Oak Ridge National Laboratory (ORNL) Distributed Active Archive Center (DAAC).

ABoVE: Synthesis of Burned and Unburned Forest Site Data, AK and Canada, 1983-2016

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