Appendix(ces)

documentation of the data used in this project

Specification Table

Subject	Geography, Environmental Science, Remote Sensing, Computer Science, Climate studies
Specific subject area	Tree Carbon in boreal forests, Remote Sensing modelling, Environmental Science climate processing
Type of data	Raster data (Tif file type) Excel data (CSV) Code files (html)
Method of data acquisition	Predictor and Explana tory data were acquired online Field combustion data was acquired: The ABoVE Fire Emissions Database USGS Earth Explorer: Landsat 8 band 1-9 GEE Climate variables: Precipitation, humidity, minimum and maximum temperature. ASTER DEM: Digital elevation
Data format	Processed
Description of data acquisition	Field combustion dataset were acquired from the above fire emissions derived from Potter et al. 2023 [^1^].
For prediction of Carbon emissions, we used different covariate layers:	• Time-series 2014 and 2015 : USGS Landsat bands [^7^], Optical vegetation indices, GEE Climate variables (Humidity, precipitation, mean, min. and max. air temperature, ASTER DEM
Location of data source	Landsat bands: [^2^] GEE climate dataset: [^3^] ASTER DEM: [^4^]
Accessibility of data	The predicted carbon emission dataset will be found at 30 m resolution in the following repository [^5^] : Repository name: Chinyereruth Data identification number: Still in progress Direct URL to data: Still in progress Detailed code associated with the data analysis is available from the Github repository [^5^]

VALUE OF DATA

• The map provides the amount of carbon emission from trees from Canada's boreal forests, using statistical methods such as regression and machine learning. • The map will support research on Carbon emission models, and climate change assessment and can be used to inform climate and fire scientists on carbon accounting and reporting, and also recommend measures to reduce carbon emission footprints. It can also be used to compare carbon emissions from other boreal forest zones. • The methods that will be outlined and code that will be provided can also be replicated in other locations and zones to derive carbon emission maps.

Data Description

Predictors will be provided within the domain of the boreal forest in a folder called the "carbon-emission-modelling-2023.zip". Carbon emitted from each province will be named according to its geographic location (i.e. 059E_14N corresponds to 59E to 60E, 14N to 15N). The "pronvince_carbon_emission_2023.Tif"file will

contain carbon emissions for each province within Canada and the "Canada_Carbon_emission_2023.tif"file contains the final carbon emission map for the entire Canada . The detailed code associated with this project will be found in the Github repository (https: //github.com/Chinyereruth/carbon-emission), allowing for the prediction applied here to be replicated. In addition, the code used for this folder will be found in "carbon-emission-Canada-2023- code. Rmd" which will be located in the main GitHub repository folder.

Table 1 Files used in the study for wildfire carbon emission modelling in Canada for the year 2023

File description	File name
Predicted Carbon emitted for Canada 2023	Carbon-emiss-Can_ JanDec_2023-30m.tif
Minimum temperature for Canada 2023	Min-temp-Can_ JanDec_2023-30m.tif
Maximum temperature for Canada 2023	Max-temp-Can_ JanDec_2023-30m.tif
Soil data for Canada 2023	Soil-Can_ JanDec_2023-30m.tif
NDVI data for Canada 2023	NDVI-Can_ JanDec_2023-30m.tif
Tree cover for Canada 2023	Treecov-Can_ JanDec_2023-30m.tif
DEM for Canada 2023	ASTER-dem-Can_JanDec-2023-30m.tif

Experimental Design, Materials and Methods

Training data

I used a compilation of field carbon combustion data obtained from the ABoVE Fire Emissions Database (n=500). This field combustion data that were collected across Alberta, Saskatchewan, Manitoba and North Western Territories.

Covariate layers

Combustion measurements that were obtained from ABoVE fire database were related to covariates of remotely sensed variables for fire severity, elevation, soil and climate.

Climate variables

Climate data for minimum and maximum temperature were obtained from Climate ClimateNA using the GEE climate hub portal for the year 2023. The climate data used here provided the climate point estimate in degrees Celsius which was imported in the spatial environment. The data upscaled to a 30 m grid. This helped to capture the climate impact on vegetation, fuel loads, and fuel moisture, which affect combustion losses.

Environmental variables

I used a variety of environmental variables. This includes soils, topography and vegetation category. The soil data was gotten at 250 m resolution but this was upscaled. Topographic variables that will be derived include aspect in degrees, elevation (m),

and slope at a 30 m pixel size.

Remotely sensed variables

Here, I derived various remotely sensed vegetation indices from Landsat, and this includes NDVI, the normalized difference infrared index (NDII) and the dNBR. All images used were atmospherically and geometrically corrected using the correction and geometric tool in R.

Model training

For the model training, remotely sensed variables, climate and environmental variables were used. Areas of clouds, cloud shadows, and snow were extracted out using an extraction function in R.

Spatial carbon modelling

The results from this research are still in progress. Preliminary results are displayed here.

Ethic statement

This study did not use human subjects, experiments carried out on animals, and did not also acquire any data from social media platforms.

Data availability

Carbon emission modelling from wildfire disturbances in Canada at 30 m resolution for the year 2023 will be available at Github/ChinyereRuth/carbon-emission.

Insert content for additional tables here.

Appendix B: additional figures

Insert content for additional figures here.

Appendix C: code