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Supplementary Material

Wildland fire evacuations in Canada from 1980 to 2021

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Supplementary Material

Description of the Canadian Wildland Fire Evacuation Database (CWFED)

After the creation of the Canadian Wildland Fire Evacuation Database (CWFED) and analysis by Beverly and Bothwell (2011), updates to the database were made over the course of a decade (2012–2021) to create the version of the database we refer to as *CWFED2021*. New records were added using federal, provincial, and territorial records, the "Canadian News, Business and Current Affairs" database (ProQuest), "Canadian Newsstream" database (ProQuest), google searches, and social media posts. In recent years, provincial and federal agency situation reports have improved and agencies have extensive records of some evacuations. In cases where aggregated evacuation numbers were provided (for example, a regional district may only report a total number of evacuees), media records were used to help disaggregate the number of evacuees by community. Media records were also searched to verify the accuracy of agency records. Within Proquest, a multi-database access tool, search terms included "forest fire*", "evacu *", "*fire evacu*", "wildfire" and "Canada". French media were also reviewed separately to ensure wildland fire evacuations in dominantly French-speaking areas of the country were represented, using search terms like "feu de forêt*", "évacu*", "incendies", and "Québec". *CWFED2021* contains the variables described in Table S1. Because of the variable data quality, data input involves numerous assumptions that are detailed in the database standards to ensure consistent data input for annual updates.

Recent work to expand and improve the database included adding information about the wildland fire that caused an evacuation wherever it was possible to make the link. This information had not typically been included in the database, as it is often not mentioned in evacuation records or reports. The information added includes geospatial coordinates of the fire, agency-assigned name, and fire identification number. Wildland fire details were obtained from the National Fire Database polygon data (NFDB; primary source), the National Burned Area Composite (NBAC, secondary source), NFDB point data, and lastly provincial and territorial wildland fire databases (if no fire was found in the national datasets). Agency data, followed by media reports, were the preferred sources for linking wildland fires to evacuation

events. These event references were verified against the fire databases to ensure that the cited wildland fire aligned with the evacuation location and dates. When this information was not available from either source, or appeared to be incorrect (e.g., the fire mentioned in the media report happened after the date of the evacuation), the closest reasonable fire that occurred across the evacuation date range was presumed to be the source fire when an evacuation was due to wildland fire threat. A fire was considered reasonable based on several factors including feasibility of size and location to cause threat, listed cause (i.e., human, lightning, or unknown) matching media reports if available, and evidence of fire growth at the time of evacuation order. When evacuations were due to health or smoke concerns, no assumption about the source fire were made and a fire was only linked to the event if it was explicitly mentioned in evacuation event reporting. If multiple fires were listed as responsible for triggering an evacuation, whether due to threat or smoke, the largest nearby fire is listed as the source event, with contributing fires listed in the event comments. Following these standards, we linked specific wildland fires to 1140 of the 1393 evacuation events (82%) in the database, which provides many other opportunities for further detailed research using fire databases.

Significant changes were made to the CWFED due to the mislabelling of many Indigenous communities in previous database versions. For example, the name of a First Nation was frequently input as an evacuation location. This is incorrect, particularly as one First Nation may be associated with multiple locations or communities. In addition, previous occurrences where the CWFED missed or mislabeled the type of Indigenous communities have been corrected and the categories now include First Nations reserves and Métis settlements. We also added columns to the CWFED including ‘associated First Nation’ and ‘band number’. A yes/no column for population >50% Indigenous was added and this field was populated using data from the census closest to the year the evacuation occurred. This approach was chosen instead of estimating the exact % of the Indigenous population because of the unreliability of census data on Indigenous communities. The intent is to capture the full extent of evacuations of Indigenous communities, including those that may not have official designation as a reserve or settlement.

We also worked with Indigenous Services Canada to share and crosscheck information they have collected during the wildfire evacuations of First Nations' reserves.

Every event in the database (1980–2020) went through a secondary fact-checking process in 2020–2021. We aimed to fill in missing information as much as possible. Some entries were removed when found to only be an evacuation alert, with no order or actual evacuation occurring. Entries were also removed if they were listed as a voluntary evacuations and the information was not supported by agency data or significant media coverage. Additionally, by sharing the database results during public research presentations, local knowledge holders came forward to suggest additions to the database that were previously missed. An overview of the wildfire evacuation project was presented at the Assembly of First Nations – Emergency Services Chiefs Committee on Emergency Management – Strategic Planning Session on the Care and Control of First Nations Emergency Management in March 2021. Several presentations were made to representatives from the Assembly of First Nations about the database in February to May 2022, as well as to a team of Prince Albert Grand Council researchers in August 2022. These were generally small evacuation events that lasted less than a day and were often outside of areas managed by wildland fire management agencies (i.e., farmland). As a result of these cumulative efforts, 566 evacuation events are now reported from 1980–2007, which is 19 more than were reported in Beverly and Bothwell (2011). A description of the information included in the *CWFED2021* can be found in Table S1.

During this review, the research team assigned each evacuation event record a confidence rating on a scale of 1 (low) to 3 (high) for evacuee number, geospatial location, and overall confidence in the record. The specific criteria for each confidence rating are detailed in Table S2. Notes were made for each evacuation event as to why the confidence ratings were applied. For number of evacuees, 75 events were ranked 1 (low confidence), 301 events were ranked 2 (moderate confidence), and 1 017 events were ranked 3 (high confidence). For location of evacuation, 35 events were ranked 1 (low confidence), 226 events were ranked 2 (moderate confidence), and 1 132 events were ranked 3 (high confidence). For

overall confidence, 73 events were ranked 1 (low confidence), 328 events were ranked 2 (moderate confidence), and 992 events were ranked 3 (high confidence).

Table S1. Description and details of the variables from the CWFED2021 analyzed in this paper.

Category	Description	Details
Temporal	Year	Year the evacuation began
	Start Date	Date of the onset of evacuation activity
	End Date	Date when most evacuees returned
	Duration of event	Number of days from start date to end date
Spatial	Latitude, longitude	Coordinates of centre of the structure/populated area impacted by the evacuation; or, for dispersed (e.g., rural) areas affected by evacuation, coordinates of either the center of the area, or in middle of largest density of homes
	Location name	Name of the community or location evacuated (e.g., name of community, First Nation reserve, area, census subdivision, regional district etc.)
	Province/Territory	Of the evacuation location (BC/AB/SK/MB/ON/QC/NB/NS/NL/PE/NT/ YK)
	Associated Indigenous group	If applicable, name of the First Nation band, Metis group, or Inuit group associated with the location

	First Nation band number	First Nation band registration number from Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC)
Community	Community type	E.g., city, town, village, First Nation reserve, municipal district
	>50% Indigenous population	Census-derived Indigenous population (First Nations, Métis, and Inuit combined; Yes/No/Unknown)
	Population of community	Population of the entire community (from census and/or other sources; not necessarily equivalent to number of evacuees)
	Notes on source of population numbers	E.g., census data and year used
Evacuation	Number of evacuees	Number of people evacuated obtained from reports of evacuation; if no number is provided, community population is used as an estimate; if only a description is provided, we estimate: family/home/several people (3 evacuees), some (9), group of people/a number of homes or camps (20), dozens (36), residential subdivision (90)
	Evacuation size	Classification of 'number of evacuees' field: very small (1 to 100), small (101 to 1000), medium (1001 to 5000), large (5001 to 20000), very large (>20,001)
	Evacuation type	Order vs. voluntary (note: voluntary evacuations only recorded if they had agency support or significant media coverage)

	Evacuation cause	Direct proximity threat - when a wildland fire is not under control and there is potential for embers or the fire front to enter a community; smoke - when air quality was deemed hazardous enough to warrant evacuation or that smoke could obstruct a future evacuation (no risk of a wildland fire threat; oftentimes the fire was tens or hundreds of kilometres away from the evacuated community); other (e.g., loss of access, precautionary evacuation of hospital/long term care or those vulnerable to smoke impacts, tactical evacuations to make space for fire camps)
	Evacuee type	Main category of people evacuated (e.g., permanent residents, vulnerable members of the population, seasonal residents, employees etc.)
	Evacuation transport method	Method of transportation used to evacuate the community (e.g., road, air, boat etc.)
	General notes on the evacuation from official records or media	Notes on data sources, additional relevant information on the evacuation, etc.
	Documentation of sources for media articles and other documentation	Links/references to media reports, fire agency reports, and other documentation relevant to the event
Ancillary Data	Number of direct evacuee fatalities	Fatalities that occurred directly due to the fire that caused the evacuation; fatalities from traffic accidents and other indirect causes are not included; only evacuee fatalities are included
	Number of structural losses	In the case where structural losses are incurred from the same fire that caused an evacuation, losses of homes, seasonal/recreational, outbuilding/other, and business/industry structures is recorded

Fire Information	Cause of fire	If stated in any reports of the evacuation/fire, or in fire databases in cases where the event is linked to a specific fire, fire cause is recorded as human, lightning, or unknown
	Fire name, number, and location that caused the evacuation	Fire name and unique fire agency fire number from evacuation/fire reports or from fire databases in cases where the event is linked to a specific fire
	Fire data source	Notes on fire information; sources include the National Fire Database polygon data (NFDB), the National Burned Area Composite (NBAC), NFDB point data, and fire management agency wildfire databases

Table S2. Confidence ratings for the database by variables of evacuee number, location, and overall confidence

Variable	Confidence Rating	Description	CWFED2021 % of records
Evacuee Number	1	Low: The evacuation number could not be located/estimated or is inconsistent with other evacuation details.	5.4%
	2	Moderate: Evacuation number is available but is estimated or only verified by one media source of moderate integrity.	21.6%
	3	High: Evacuation number is available, appears valid, and has been verified by at least two unique media sources or at least one agency source. Evacuations confirmed only by Indigenous Services Canada may be rated as high if the record appears sound.	73.0%
Location	1	Low: Location is incorrect, or likely incorrect, and there is insufficient information available to correct it.	2.5%
	2	Moderate: Location is in the correct general area of the evacuation based on available information, but precise location cannot be verified (i.e., point is in centred of an unorganized region that was evacuated but there is no identifiable populated area).	16.2%
	3	High: Location is correctly located in a populated region that is accurately associated with this evacuation record.	81.3%
Overall record	1	Low: Location (name and coordinates), number of evacuees, and/or evacuation start date are incomplete, incorrect, or have low confidence ratings OR there is missing data or apparent inconsistencies in >3 of the following fields: community type, evacuation size, evacuation type,	5.2%

	evacuation cause.	
2	Moderate: Location (name and coordinates), number of evacuees, and evacuation start date are all complete and appear consistent with size of community in aerial imagery or other data sources but there is missing data or apparent inconsistencies in 1–3 of the following fields: community type, evacuation size, evacuation type, evacuation cause.	23.5%
3	High: Location (name and coordinates), number of evacuees, and evacuation start date are all complete and appear correct and community type, evacuation size, evacuation type, and evacuation cause are all populated with no obvious errors	71.2%