Trends in wildfire burn severity across Canada, 1985 to 2015

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Supplementary Material 1

SM 1. Correcting the error in fire year attribution within the *CanLaD* database

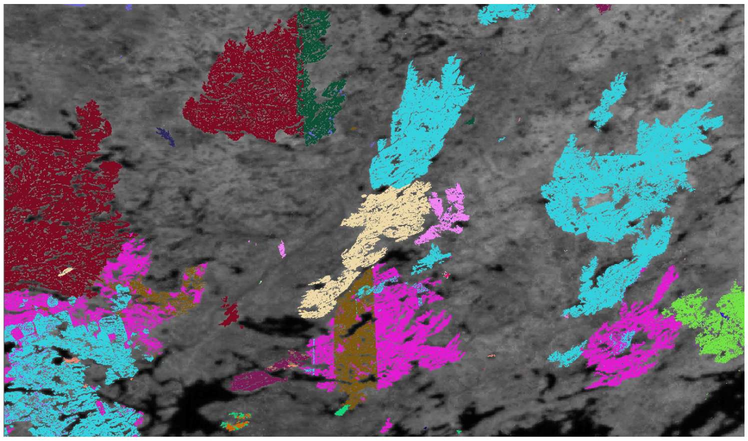
We corrected the errors in the attribution of fire year within the *CanLaD* database (Guindon et al. 2017, 2018) using a GIS-based spatial intersection between *CanLaD* fires and those from five fire reference databases vetted as reliable sources:

1. The National Burned Area Composite database (NBAC, now covering 1986-2018: yearly fire perimeter polygons, 2004 to 2015 were used (Canadian Forest Service 2019a, https://cwfis.cfs.nrcan.gc.ca/datamart/metadata/nbac);
2. The Canadian National Fire Database (CNFDB):
    - fire perimeter polygons from provincial and territorial agencies with various starting years. Polygons from 1985 to 2015 were used (Canadian Forest Service 2019b,) https://cwfis.cfs.nrcan.gc.ca/datamart/metadata/nfdbpoly);
    - fire location points for burned area ≥ 200 ha, points from 1985 to 2015 from previous Large Fire Database (LFDB) were used (Stocks et al. 20002, http://cwfis.cfs.nrcan.gc.ca/ha/nfdb);
3. The Quebec fire database: yearly fire perimeter polygons, 1984 to 2015 (https://www.donneesquebec.ca/recherche/fr/dataset/feux-de-foret/resource/49f5ca33-f7b7-42a5-9fb9-d8bc708f3f0c);
4. The SPOT-VGT database: yearly fire perimeter polygons from 1 km resolution imagery, 1994 to 2015 (Fraser and Cihlar 2000);
5. The AVHRR database: yearly fire perimeter polygons from 1-km resolution imagery, 1989 to 2000. (https://daac.ornl.gov/ABOVE/guides/AVHRR_Fire_Products.html, Pu et al. 2018)

We processed these databases, performed the spatial intersection and corrected the fire year of *CanLaD* burned pixel error as follows. Fire polygons from the five reference databases were rasterized to rasters with 30 m pixel size matching the resolution of the *CanLaD* raster product. In parallel, the fire point data from CNFBD database were spatially expanded to approximate the fire perimeter using a circular buffer according to provided burned area. We then spatially intersected all six resulting fire geospatial layers with *CanLaD* fires. When the intersection revealed a mismatch in fire year, we assigned to each erroneous *CanLaD* fire the year provided by the fire reference layers. For some few cases, when fire year occasionally disagreed among reference layers, we tasked an analyst to assign the most probable fire year based on the visual interpretation of Landsat image time series, including the search for smoke plumes providing unambiguous fire year.

We found cases of fire year mismatch for 31% of burned forest pixels within *CanLaD* database. We resolved 90% of them through the basic intersection of all five 30-m fire raster layers. We resolved an additional 4% of cases using buffered point data with spatial connectivity criteria, mostly for years prior to 2000 for which we often only had coarser 1-km resolution or less reliable fire reference data, and an additional 2% of the cases using visual interpretation of Landsat time series. These last cases were mostly pre-2000 fires in the sparsely vegetated Hudson Plains ecozone and in the frequently cloudy regions of Northern Québec where large fires were occasionally absent from all reference databases. Finally, we rejected the remaining 4% of *CanLaD* burned pixels with erroneous fire years due to the lack of reliable fire year information or possibility due to misclassified *CanLaD* fires confused with other severe disturbances (for example, severe insect defoliation due to Hemlock Looper (*Lambdina fiscellaria*) in Québec or slash burning in British-Columbia and Ontario). See figure S1 for an example.

A)



B)

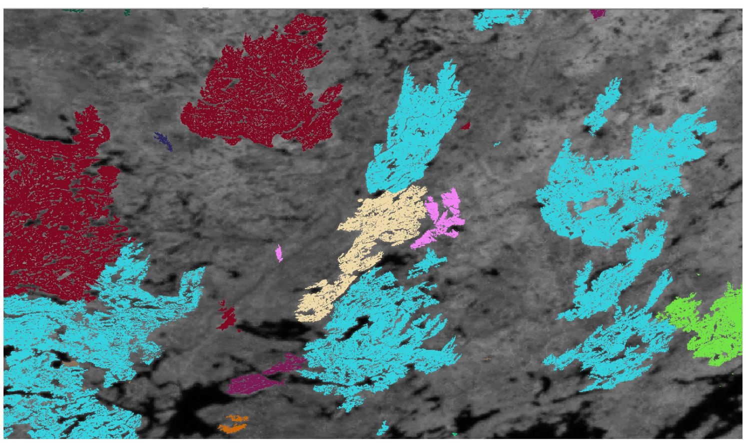


Figure S1.1 Local example of detection of fire year A) as in the original *CanLaD* database where fire could be detected one year later and more and B) after the application of fire year latency correction. Each color represent a different year.

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