



**CALIFORNIA
ENERGY COMMISSION**



Energy Research and Development Division

Comprehensive Open Source Development of Next Generation Wildfire Models for Grid Resiliency:

Near Term Fire Risk Forecast Data Archive and Dataset

**Gavin Newsom, Governor
January 2020**

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CHAPTER 1:

Introduction

The purpose of the Near-term Fire Risk Forecast Data Archive and Dataset (hereafter, “data archive”) is to establish a centralized repository for disseminating native format geospatial data related to real-time fire spread and risk forecasting. Datasets that are currently included, or planned for inclusion, in the data archive include:

- Fuel and topography rasters for all static inputs required by current-generation fire spread models.
- 5-day fire weather forecasts, refreshed every 6 hours, that provide hourly meteorological inputs and fuel moisture content values necessary to drive real-time fire spread/risk forecasts.
- 16-day forecasts of conventional National Fire Danger Rating System (NFDRS) indices.
- Structure density raster.
- National Agriculture Imagery Program (NAIP) orthoimagery.
- Real-time National Weather Service (NWS) red flag warning and fire weather watch polygons.
- Real-time locations of ongoing large fires identified by the National Interagency Fire Center (NIFC).
- Near real time fire progression mapping data from the National Infrared Operations (NIROPS) and GeoMAC (Geospatial Multi-Agency Coordination).
- Near real time satellite-based fire detection data from Terra/Aqua Moderate Resolution Imaging Spectroradiometer (MODIS) and Suomi National Polar-orbiting Partnership (NPP) Visible Infrared Imaging Radiometer Suite (VIIRS).
- Fire progression data for selected recent fires of historical significance in California.
- Archived weather forecast or analysis data for the above fires of historical significance.
- Publicly accessible maps of electricity assets and damage to electricity assets from wildfire.

The data archive will be updated over time as appropriate.

CHAPTER 2:

Data Archive Access

The data archive is modeled after the National Atmospheric and Oceanic Associations' (NOAA's) Operational Model Archive and Distribution System (NOMADS¹) which is used to distribute large amounts of geospatial data generated by weather and climate models. NOMADS is a simple web server with file/directory listing enabled, thereby allowing users to obtain data by making http requests from a web browser or script using command-line tools such as wget or curl. This simplicity and flexibility afford users the ability to transfer large amounts of data from NOMADS to their local ecosystem using automated scripts.

The data archive that is the subject of the current deliverable is hosted on a dedicated server configured similarly to NOMADS. It can be accessed at the following URL:

<http://californiafireforecast.com:8080>

No authentication is required because all data hosted in the data archive are in the public domain. Note that the data archive is intended only to serve underlying native format geospatial data. It does not include a visualization portal or web map, although much of the geospatial data contained in the data archive will be made available later in this project via a web map. The data archive uses port 8080 so that a web map can be configured on port 80 (http) and 443 (https) of californiafireforecast.com.

¹ <https://nomads.ncep.noaa.gov/pub/data/nccf/>

CHAPTER 3:

Data Dictionary

A “data dictionary” is provided at:

http://californiafireforecast.com:8080/data_dictionary.pdf.

The data dictionary provides a “key” to all files and contained in the data archive and will be updated as the data archive evolves. Contents of the current data dictionary are excerpted on the following pages:

Fire weather forecast & meteorological inputs for fire modelling

Root directory: ./fire_weather_forecast

Description: CONUS 5-day hybrid forecast derived from 3 operational weather models created by ELMFIRE's weather analytics pipeline. Native forecast outputs are used to calculate live and dead fuel moisture values needed for fire modeling. Stacked GeoTiff rasters contain hourly outputs where band 1 corresponds to forecast hour zero, band 2 is forecast hour 1, and so on. A new 5-day forecast is generated every 6 hours.

Forecast is derived from operational weather models as follows:

- Forecast hour 0 – 36: Average values from High Resolution Rapid Refresh (HRRR) and North American Mesoscale Forecast System (NAM) at 3 km resolution
- Forecast hour 37 – 60: Values from NAM forecast at 3 km resolution
- Forecast hour 61 – 120: Values from Global Forecast System (~13 km resolution resampled to same projection, resolution, and extents as the HRRR/NAM).

Filenames and units:

The convention for timestamps in subdirectories and filenames is YYYYMMDD_CC where:

- YYYY = 4 digit year
- MM = 2 digit month
- DD = 2 digit day
- CC = 2 digit forecast cycle (00, 06, 12, or 18)

All times are in UTC. Within each subdirectory is a series of GeoTiff files with filenames that begin with the above timestamp (shown as “*” in the table below):

Filename	Units	Description
*apcp01.tif	kg/m ²	Precipitation accumulated in previous hour
*erc.tif	0.04 × Btu/ft ²	Energy release component (NFD RS fuel model G)
*fmc.tif	%	Foliar moisture content
*m1.tif	%	1-hour dead fuel moisture
*m10.tif	%	10-hour dead fuel moisture
*m100.tif	%	100-hour dead fuel moisture
*m1000.tif	%	1000-hour dead fuel moisture
*mlh.tif	%	Live herbaceous fuel moisture
*mlw.tif	%	Live woody fuel moisture
*netrad.tif	W/m ²	Net radiation flux at ground or water surface
*rh.tif	%	2 m relative humidity
*tmpf.tif	°F	2 m temperature
*wd.tif	degrees	20 ft wind direction, meteorological convention
*ws.tif	mph	20 ft wind speed

Fuels and Topography

Root directory: ./fuels_and_topography

Description: CONUS static fuels and topography inputs for use in fire modelling generated by ELMFIRE. Where available, LANDFIRE Remap (LF 2.0.0) is used and LANDFIRE 2014 (LF 1.4.0) is used elsewhere.

Filenames and units:

Filename	Units	Description
asp.tif	Degrees	Topographical aspect
cbd.tif	$100 \times \text{kg/m}^3$	Canopy bulk density
cbh.tif	$10 \times \text{m}$	Canopy base height
cc.tif	%	Canopy cover
ch.tif	$10 \times \text{m}$	Canopy height
dem.tif	m	Elevation
fbfm13	Categorical	Fuel model (Anderson 13 system)
fbfm40	Categorical	Fuel model (Scott/Burgan 40 system)
slp.tif	Degrees	Topographical slope

Structure Density

Root directory: ./structure_density

Description: CONUS structure density derived from most recent census (2010) generated by ELMFIRE. Will be updated to 2020 census data when available.

Filenames and units:

Filename	Units	Description
structure_density.tif	Structures / sq mi	Structure density

Orthoimagery

Root directory: ./orthoimagery

Description: 2016 NAIP orthoimagery mosaic for California. Resampled to 6 m resolution. 2018 NAIP orthoimagery will be added later.

Filenames:

Filename	Units	Description
ca_naip_2016.tif	-	CA NAIP orthoimagery mosaic

NIFC Large Fires

Root directory: ./nifc_large_fires

Description: Location of large fires tracked by the National Interagency Fire Center (NIFC), updated in real-time by ELMFIRE's fire detection and mapping pipeline.

Filenames: Every time a fire is added or removed from this list, a new shapefile is generated and archived in a .zip file named nifc_large_fires_YYYYMMDD_hhmmss.zip where:

- YYYY = 4 digit year
- MM = 2 digit month
- DD = 2 digit day
- hh = 2 digit hour
- mm = 2 digit minute
- ss = 2 digit second

Real Time Fire Progression Data

Root directory: ./real_time_fire_progression

Description: Real-time fire progression GIS data collated together by ELMFIRE's fire detection and mapping pipeline from three different sources:

1. GeoMAC perimeters
2. Terra/Aqua MODIS detections
3. Suomi NPP VIIRS detections

Directory and File Names:

GIS data for each separate fire are contained in a directory named as state-firename. Within each directory are shapefiles named as timestamps of the form YYYY-MM-DD_hh_mm.shp. All times are in UTC.