

CALIFORNIA FIRE SCIENCE CONSORTIUM



Research Brief for Resource Managers

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Forecasting Fire Regime Changes By Mapping Driver Changes Across California

Syphard, Alexandra D. and Jon E. Keeley. 2020. Mapping fire regime ecoregions in California. International Journal of Wildland Fire: 1-7. <u>10.1071/WF19136.</u>

The fire regime is a central framing concept in wildfire science and describes how wildfire characteristics vary geographically over time. Most fire regime classifications are based on historical fire patterns, such as fire frequency, size, and severity. This approach can result in fire regime classes that encompass regions with similar fire characteristics but wide differences in ecosystem types and is not well-suited to regions where historical data are lacking.

In a new publication, Syphard and Keeley (2020) aim to devise a fire regime classification that better aligns with ecosystem types. In this new approach, fire regimes are defined by the biophysical and anthropogenic attributes that shape fire activity rather than historical fire outcomes. The authors suggest that evaluating the long-term driving variables of a given fire regime may allow for better management of fire prone regions.

In demonstration, they offer a digital **California Fire Regime Ecoregion** map and methodology for use in fire research and management planning. The authors developed the map by assembling a database of topographic, climatic, vegetation, and anthropogenic variables that have been significantly associated with geographical variation in California fire regimes (Table 1;

Management Implications

- This **California Fire Regime Ecoregion** classification map (i.e., using clustered driver variability layers) may be a more robust tool for predicting future fire regime variability than the traditional practice of using past fire regime variability.
- This methodology could be useful in any fire prone region, especially where historical fire data is scarce or absent and where the fire drivers are changing.

Fig.1a). These data were normalized and mapped to a 270 m resolution grid overlaid on the state of California. A classification algorithm was then used to sort the grid cells into clusters based on the biophysical and anthropogenic variables, creating a series of fire regime ecoregions. Finally, the mapped ecoregions were evaluated against traditional, historical fire regime outcome data (Fig.1b, c).

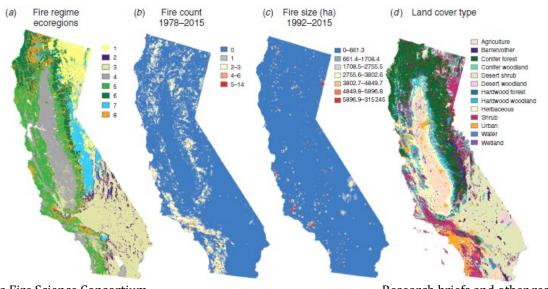
Overall, the Fire Regime Ecoregion map (Fig.1a) corresponds well with the major land cover types for California (Fig.1d) as well as with historical fire size and frequency, suggesting that this approach may be applied to any fire prone location. The authors conclude that by focusing on fire driver variability, managers may be better able to predict fire variability, especially where

historical fire data are scarce and the drivers are changing.

Fire	Historical frequency	Mean count of fires in each cell, averaged across all cells within fire regime ecoregion 1978–2015	http://frap.fire.ca.gov/data/frapgisdata-sw- fireperimeters_download	
	Severity	Historical severity class (i.e. effect on landcover) for wildfire disturbance 2006–2016. Classes ranked numerically (1–4) for unburned/low, low, medium and high severity and averaged per fire regime ecoregion within disturbance footprints	https://www.landfire.gov/hdist.php	
	Size	FPA-FOD, 1992–2015, inverse distance weighted spatial interpolation based on fire size attribute (ha)	https://www.fs.usda.gov/rds/archive/Prod- uct/RDS-2013-0009.4/	
Terrain	Elevation	Height above sea level (m)	https://www.landfire.gov/elevation.php	Х
	Topographic heterogeneity	Range of elevation values within 810-m radius from centre cell (0–1)	Nature Serve (https://databasin.org/datasets/ 1f86100938b544a3b6361eee6ac05945)	Х
Climate	Annual precipitation	Mean sum over calendar year (mm), 1981-2010	http://climate.calcommons.org/dataset/2014- CA-BCM	Х
	Summer precipitation	Mean sum over June, July, August (mm), 1981-2010	http://climate.calcommons.org/dataset/2014- CA-BCM	Х
	Annual minimum temperature	Mean minimum temperature of December, January, February (°C), 1981–2010	http://climate.calcommons.org/dataset/2014- CA-BCM	Х
	Annual maximum temperature	Mean maximum temperature over June, July, August (°C), 1981–2010	http://climate.calcommons.org/dataset/2014- CA-BCM	х
	Actual evapotranspiration	Total annual water evaporated from surface and transpired by plants (mm), 1981–2010	http://climate.calcommons.org/dataset/2014- CA-BCM	X
	Climatic water deficit	Annual evaporative demand exceeding water availability (mm), 1981–2010	http://climate.calcommons.org/dataset/2014- CA-BCM	х
	Snow water equivalent	Amount of water contained within snowpack (mm), 1981–2010	http://climate.calcommons.org/dataset/2014- CA-BCM	Х
Vegetation	NDVI annual minimum	30-year means of annual minimum NDVI, Landsat TM, 1984–2010 $(-1-1)$	http://climateengine.org/data	Х
	NDVI annual maximum	30-year means of annual maximum NDVI, Landsat TM, 1984–2010 $(-1-1)$	http://climateengine.org/data	Х
	Vegetation type	Habitat and land cover types spanning 1990-2014	https://frap.fire.ca.gov/mapping/gis-data/	
Land use	Housing density	Derived from US Department of Commerce, US Census Bureau partial block groups, 2000, units per square km	http://silvis.forest.wisc.edu/data/housing- block-change/	Х
	Distance to roads	Derived Euclidean distance to TIGER line files 2015, US Department of Commerce, US Census Bureau (m)	https://www.census.gov/geo/maps-data/data/ tiger-line.html	Х

Table 1. Variables used in the classification and evaluation of fire regime ecoregions in California FPA-FOD, fire program analysis fire-occurrence database; NDVI, normalised difference vegetation index

Figure. 1. Maps showing (*a*) fire regime ecoregions with variables correlated at *r* # 0.7; (*b*) historical fire count, (*c*) historical fire size and (*d*) land cover type in California



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