

The New Normal: Identifying the Highest Priority Regions in California for Wildfire Management

BACKGROUND

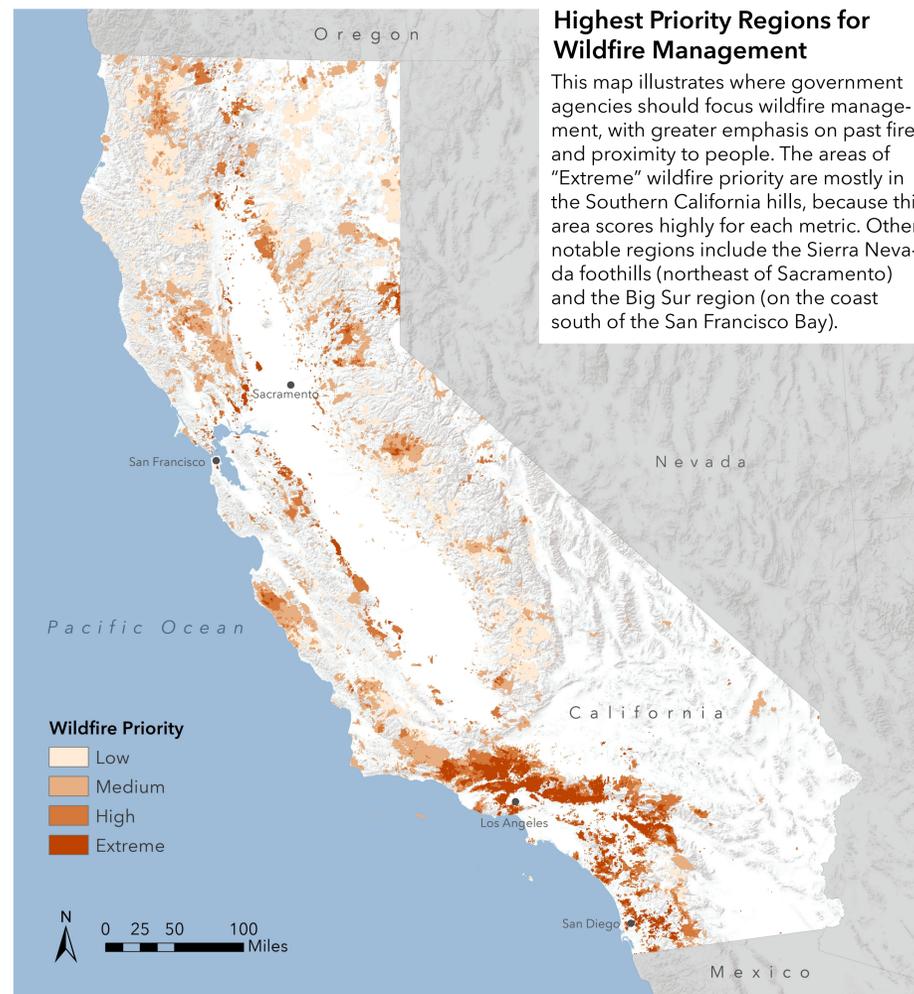
As climate change progresses, California will face more extreme droughts and more devastating wildfires, presenting management and public health challenges to all levels of government (Boxall, 2019). Parts of the state are predicted to see increases in wildfire activity of up to 400% due to climate change (Westerling, 2011). Forest management is not the only method to address the threat of wildfires, but it is a crucial piece in protecting the health of both the people and the land in California. This project aims to determine where fires have (1) overlapped repeatedly in the historical record, (2) occurred without fire facilities nearby, (3) occurred close to population centers, and (4) occurred near major roads (interstates). With these results, forest management agencies can better visualize where they should prioritize wildfire management.

METHODOLOGY

This project relied upon raster tools and analysis to determine the highest-priority regions for wildfire management. I used four metrics to form the result: number of fire overlaps, distance to the nearest fire facility, distance to the nearest urban area, and distance to the nearest interstate. I created a raster for each of these layers, with raster values ranging from 1 to 5 (number of fire overlaps) or 1 to 4 (all others), with lower numbers indicating lower wildfire priority. In the final raster calculation (result directly on right), I added up each of the four rasters, giving them equal weight except for the number of fire overlaps, which I gave double weight. Finally, I reclassified the resulting raster values into the 4 categories seen on the right: low, medium, high, and extreme. My results can be compared to the California Department of Forestry and Fire Protection threat map, displayed above the Results & Conclusions section.

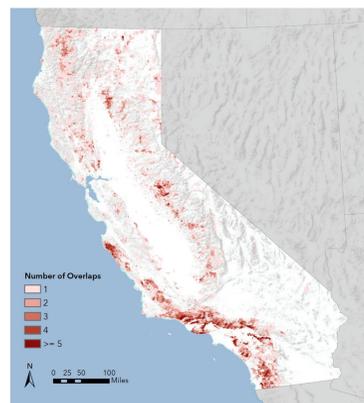
Highest Priority Regions for Wildfire Management

This map illustrates where government agencies should focus wildfire management, with greater emphasis on past fires and proximity to people. The areas of "Extreme" wildfire priority are mostly in the Southern California hills, because this area scores highly for each metric. Other notable regions include the Sierra Nevada foothills (northeast of Sacramento) and the Big Sur region (on the coast south of the San Francisco Bay).

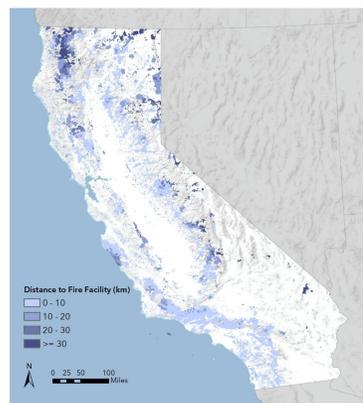


Department of Forestry and Fire Protection Fire Threat

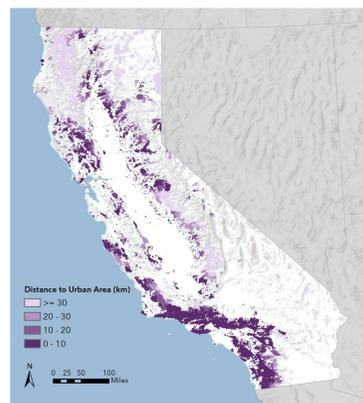
This map displays the California Department of Forestry and Fire Protection (CAL FIRE) official fire threat ratings. The scores range from -1 (no fire threat, such as on a body of water) to 4 (extreme fire threat). Their ratings are based on (1) fire frequency, i.e., the likelihood of an area burning, and (2) potential fire behavior, i.e., fire hazard. In order to have a fire threat for every part of the state, they interpolated their results.



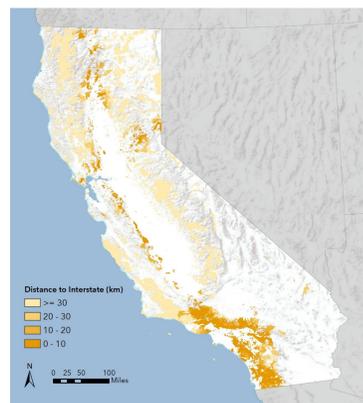
Number of Fire Overlaps
This raster layer illustrates the number of fires that have overlapped the same piece of land from 1878 to 2017. The number of overlaps in some areas was as high as 13; however anywhere with more than 5 is considered extreme.



Distance to Fire Facility
This raster layer illustrates the distance from a fire to the nearest fire facility, as the crow flies. Fires occurring in remote areas may have a higher potential to grow out of control. This poses a challenge to fire suppression agencies.



Distance to Urban Area
This raster layer illustrates the distance from a fire to the nearest urban area, as the crow flies. Fires close to people are a direct threat to human safety, and therefore should be considered when planning wildfire management.



Distance to Major Road
This raster layer illustrates the distance from a fire to the nearest interstate, as the crow flies. Fires occurring close to interstates can make evacuation and transportation of critical supplies dangerous or impossible.

RESULTS & CONCLUSIONS

Areas rated as "Extreme" in my results align closely with areas rated 4 by CAL FIRE. This can be observed especially in the Southern California hills, as well as Big Sur (due south of the San Francisco Bay). My results differ from the CAL FIRE's for northeastern California and the southern Sierra Nevada foothills. My system is based on priority, while the CAL FIRE system is based on the likelihood of a fire and fire hazard. As a result, my map does not rank sparsely populated areas as high priority, even if a fire occurring there is likely.

The main limitation of my analysis is that my results are heavily dependent on distance calculations, and all of the distance calculations are as the crow flies. In reality, wildfires travel differently based on the terrain, e.g., canyons increase fire speed, whereas a water body may act as a natural fire break. Including variables relating to topographic features could provide a more accurate assessment of wildfire priority; however, this initial analysis serves as a good starting point for forest management officials.

SOURCES

Boxall, B. (Jan 12, 2019). More wildfires, drought and climate change bring devastating damage to California's wildlands. *Los Angeles Times*. Retrieved from <https://www.latimes.com/local/lanow/la-me-fire-los-padres-20190111-htmlstory.html>
Westerling, A. L., Bryant, B. P., Preisler, et al. (2011). Climate change and growth scenarios for California wildfire. *Climatic Change*, 109(Suppl 1), pp. 445-463. <https://doi.org/10.1007/s10584-011-0329-9>
[Photo] "Wildfire in Yosemite National Park", Kip Evans, Alamy Stock Photo (2009)

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Projection: California Teale Albers
Data Sources: CAL FIRE, CAL DOT