California Building Resilience Against Climate Effects (CalBRACE) Project

Short Title: Current wildfire risk
Full Title: Percent of population currently living in very high wildfire risk areas

CalBRACE Domain: Environmental Exposures

Why is this important to health*?*

Wildfire activity in California has greatly increased in recent years.[1] The increase has been attributed to warmer spring and summer temperatures, reduced precipitation associated with warmer temperatures, reduced snow pack and earlier snowmelts, and longer, drier summer seasons in some middle and upper elevation forests.[2] These trends are expected to continue under plausible climate change scenarios.[1] Wildfires can lead to injuries and deaths from burns, smoke inhalation, and displacement.[3] In addition to fire-related injuries, local and regional transport of smoke, ash, and fine particles increases respiratory and cardiovascular risks beyond the area directly impacted by the fire.[3] Wildfire smoke is composed of thousands of microscopic chemical compounds. Smoke and ash particles can travel many miles from the original fire location. These very small particles can penetrate deep into the lungs and can cause changes in lung function.[4] Further health impacts include psychological reactions to an extreme event, such as displacement and evacuation, and increased pressures on local resources.[3] Water and soil pollution can cause longer term threats to population and ecosystem health after a wildfire.[3] Populations most vulnerable to the health impacts of wildfires include the following: people who live in the vicinity of fires and downwind from wildfire smoke, elderly, young children, pregnant women, populations of low socioeconomic status, smokers, people with pre-existing diseases (especially cardiac and respiratory), people with decrease access to information about risk mitigation, communities without adequate emergency preparedness (including the presence of an early warning system), firefighters, and agricultural and outdoor workers.[3] Persons with chronic health conditions may face challenges in accessing health services and other public resources, which may be under increased pressure during wildfires.[3]

Summary of Evidence for Climate and Health

A comprehensive literature review of international evidence regarding wildfire related health effects was conducted in 2012 which showed that human health can be severely affected by wildfires.[3] Increased levels of bushfire air pollution have been associated with an increase of all respiratory hospital admissions, particularly COPD and adult asthma.[4] Air pollution from wildfires affects eye and respiratory conditions such as asthma, chronic obstructive pulmonary disease, and other cardiovascular and respiratory diseases.[3, 4] Chemical residues from burning vegetation may contaminate land, soil, or watersheds through sediment run-off from landslides or mudslides and particulate matter deposition; these affects may lead to longer term threats to human and ecosystem health.[3]

Key References:

1. Westerling AL, Bryant BP. Climate change and wildfire in California. *Climate Change.* 2008; 87:

231-249.
2. Westerling AL, Hidalgo HG, Cayan DR, et al. Warming and earlier spring increase western U.S. forest wildfire activity. *Science.* 2006; 313(940-943).
3. Finlay SE, Moffat A, Gazzard R, et al. Health Impacts of Wildfires. *PLoS.* 2012; 1(4).
4. M Dennekamp, MJ Abramson. The effects of bushfire smoke on respiratory health. *Respirology.* 2011; 16: 198-209.

What is the indicator?

Detailed Definition

- Indicator (percent) = % Population living in very high fire hazard severity zone
- Stratification: 8 race/ethnicity strata (African American, American Indian/Native Alaskan, Asian, Latino, Multiple, Native Hawaiian and Other Pacific Islander, White, Total).
- Interpretation: Vulnerable communities will have higher percentage of population living in high risk fire zone

Data Description and Methodology

- Data were downloaded from the California Department of Forestry and Fire Protection (CAL FIRE) Fire Hazard Severity Zone Map Update Project, State Responsibility Area (SRA) and Local Responsibility Area (LRA) (http://www.fire.ca.gov/fire_prevention/fire_prevention_wildland_statewide.php).
  - Years available: 2007
  - Geographies available: California
- Population of 2010 U.S. Census blocks, U.S. Census Bureau Redistricting File for California (http://www2.census.gov/census_2010/01-Redistricting_File--PL_94-171/California/).
  - Years available: 2010
  - Geographies available: Census block, census tract, city, county, county division, region (derived), state

Fire Hazard Severity Zone (FHSZ) shapefiles for the State Responsibility Areas (SRA) and Local Responsibility Areas (LRA) in the State of California were obtained from the California Department of Forestry and Fire Protection (CAL FIRE) website. Percent of census block area within "Very High" FHSZ was calculated in ArcGIS. Data was exported into SAS to calculate population-weighted percent of population living in high-risk FHSZ within each census block using proportional allocation method. Total population living in high-risk FHSZ was summed up at higher geographic aggregations and divided by total population within each geographic unit (e.g., census tract, county subdivision, county, region, and state). Regions in the CalBRACE project are based on county aggregations in the *Adaptation Planning Guide Understanding Regional Characteristics*. Decile rankings for places and census tracts as well as relative risk were calculated.

Limitations

Fire Hazard Severity Zones (FHSZ) were measured using a comprehensive GIS-based model that produced 3-class maps of hazard zones for the entire state of California. Proportional allocation method was applied to estimate the proportion of population living within "Very High" fire hazard severity zones. This method assumes homogenous distribution of risk and

population within each census block. Since the main public health concern relates to wildfire smoke and smoke dispersion rather than the specific location of wildfires, this method is appropriate to estimate risk to human populations.

Acknowledgement and Disclaimer

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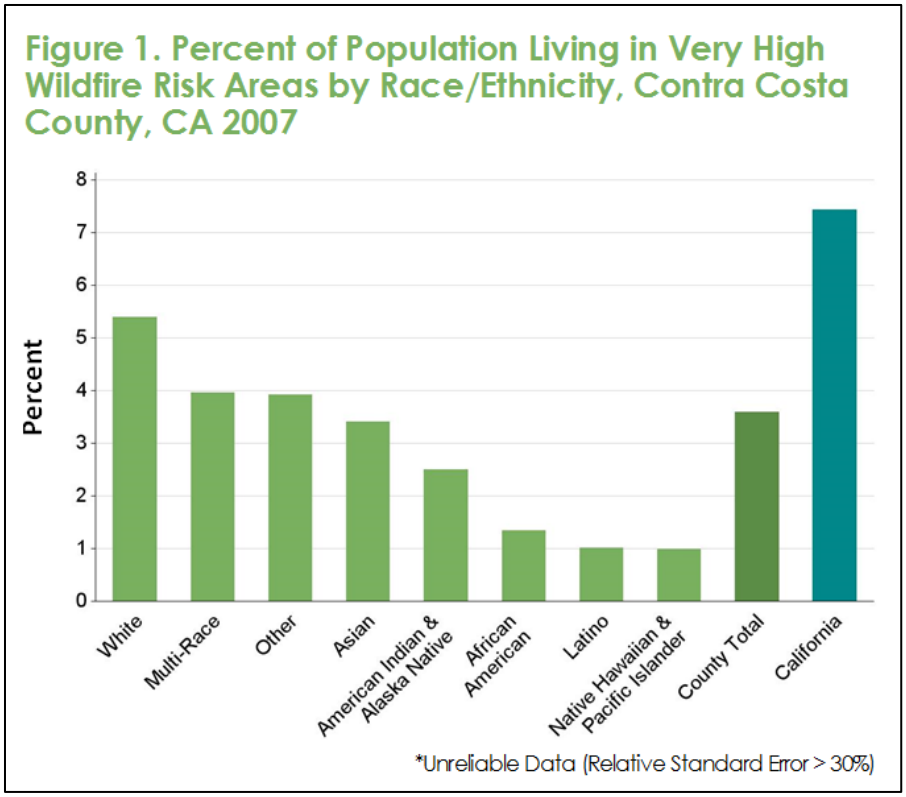
Examples of Maps, Figures, and Tables:



Source: CAL FIRE, 2007; U.S. Census 2010. Analysis done by UC Davis and CDPH.

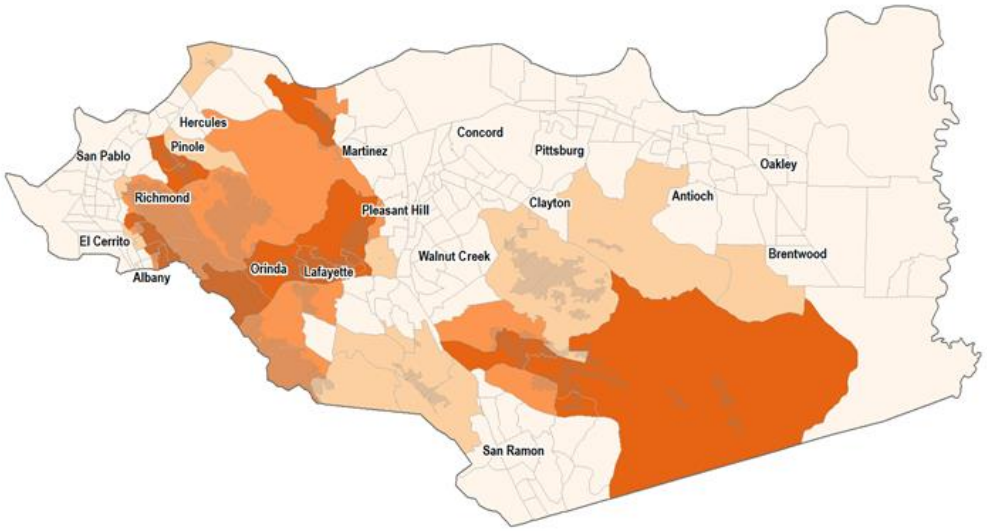
Table 1. Cities and Towns (>1,000 Population) with Highest Percent of Population Living in Very High Wildfire Risk Areas, Contra Costa County, California, 2007

Location	Percent at Risk	Population at Risk	Total Population
Kensington	99%	5,026	5,077
Diablo	67%	776	1,158
Blackhawk	33%	3,087	9,354
Contra Costa County	4%	**37,728**	**1,049,025**
California	7%	2,770,269	37,253,956

Source: CAL FIRE, 2007; U.S. Census 2010. Analysis done by UC Davis and CDPH.

Figure 10. Population living in very high wildfire risk areas* by census tracts, Contra Costa County, California, 2007

*CAL FIRE defines very high wildfire risk areas (also referred to as very high fire hazard severity zones) to be areas with wildlands supporting high to extreme fire behavior. Factors taken into account include vegetation, topography, weather, crown fire potential, and ember production and movement. Risk of exposure to wildfire smoke and smoke dispersion is not included in this analysis which limits the ability to assess the broader health impacts of wildfires.



0
1 - 63
64 - 888
889 - 4,150
Very High Wildfire Risk Zone
Census Tract Boundaries

0 2.5 5 10 Miles

Source: California Department of Forestry and Fire (CAL FIRE), 2007; U.S. Census 2010. Analysis by UC Davis and CDPH.

Only cities with population greater than 1,000 were labeled.