RESEARCH BRIEF

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Stanford WOODS INSTITUTE for the ENVIRONMENT

California Wildfire Risk: Historical Frequency Can Lead to Inequities

As high-hazard communities continue to expand across California, a better understanding of fire vulnerability and impacts can enable more effective wildfire risk management and lessen inequities.

Background

Increased housing development and forest management practices, combined with climate change-driven wildfires, pose a growing threat to communities around the world. Record-setting losses have spurred the need for adaptation initiatives, especially in California, where 15 of the 20 most destructive fires on record have occurred since 2015, and climate change is projected to exacerbate wildfire risk. Understanding the relationships between fire hazard, exposure and vulnerability of households and communities is critical for developing and targeting response and adaptation strategies.

In California, fire hazard severity zone (FHSZ) maps are the primary tools for tracking, communicating, and mitigating fire risk and along with other indicators, can be used to evaluate the distribution of fire risk. These maps assign local hazard levels based on "fuels, fire history, terrain influences, housing density, and occurrence of severe fire weather" and are used in multiple regulatory and decision-making applications including zoning. Across the western United States, properties valued in the top ten percent are more likely to

POINTS FOR POLICYMAKERS

▶ **Communities with high levels of fire experience, on average, have lower incomes and lower property values than communities with high hazard levels.** Communities identified as high-hazard average higher incomes than low- and no-hazard communities; conversely, communities with high fire experience — or number of incidents — average lower incomes than those with little to no experience. Home values have grown more slowly in communities with high fire experience, translating to decreased total appreciation of $165-$630 million per year.

▶ **There is added value in considering the full spectrum of historical fire events, their impacts, and their overlap with dimensions of social vulnerability.** A single fire, even a damaging one, does not have a big impact on income or real-estate appreciation. In contrast, repeated fire exposure may become internalized as a permanent characteristic of a community, leading to long-term demographic or economic responses, such as migration and declines in property values.

▶ **Considering fire experiences in prioritizing fire prevention and suppression investments can potentially contribute to a more equitable distribution of public resources.** Investments in fire prevention and/or suppression can be unequal. It is important to avoid a situation where wealthier communities are better protected. On the other hand, repeated fire experiences may be not so much a cause, but a symptom, indicating lower levels or effectiveness of investment in prevention or suppression.

▶ **Focusing on hazard maps and catastrophic events may miss the consequences of more frequent, smaller events.** The strong patterns linked to fire experience highlight the benefits of considering multiple dimensions of risk in delineating need for fire-related assistance and adaptation. Information about fire history, including relatively smaller, less-damaging fires, adds information that strongly distinguishes between communities with similar levels of fire hazard. Repetitive exposure to fires, even when those fires do not cause widespread structural damage, may have cumulative harmful effects to communities through indirect impacts on resident health or disruptions to local economic activity.

be located in high-hazard areas than median value properties. Yet, frequent, small fires in lower-hazard areas may be disproportionately affecting communities through a variety of mechanisms, including loss of natural resources, long-term health impacts or changes in economic opportunities.

To broaden the lens on understanding wildfire risk and to help guide risk management efforts, Stanford-affiliated researchers explored the implications of three metrics that capture different aspects of fire risk: hazard as defined by FHSZs, fire damage from the most severe historical fire, and fire experience or number of incidents. The researchers also evaluated the relationships between those metrics and community-level social and economic characteristics as well as property value appreciation over time.

They found that communities with higher numbers of historical fires, on average, have lower incomes and lower property values than communities with high hazard levels based on FHSZ maps. The relationship between income and fire experiences may reflect cumulative impacts of repeated fires, or it could point to a relationship between income and the success of fire prevention or suppression. While none of these metrics fully encompasses fire risk, each offers a different window on the issue, especially concerning who bears the burden of wildfires in California. The use of all three metrics in combination could help support efforts to equitably target risk management resources.

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This brief is based on the paper **"Fire frequency and vulnerability in California"** published in the journal *PLOS Climate*.

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FOR MORE INFORMATION

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