Marina Stever

Introduction

Climate change that results in drier, warmer climates has the potential to increase fire occurrence and intensify fire behavior, thus altering the distribution of fire-dependent, -sensitive, and -influenced ecosystems. (Liu et al., 2010). Between 2007 to 2017, there was an average of 67,000 wildfires annually and an average of 7.0 million acres burned annually in the United States (Hoover, 2019). In 2018 alone, there were 58,083 wildfires that burned 8.8 million acres across the United States (NIFC, 2018). As the frequency and intensity of wildfires increase, the issue of fire management and human development in the wildland-urban interface (WUI) continues to capture the attention of fire planners, land managers, social scientists, and government bodies. The wildland-urban interface is an area where homes are built adjacent to or within vast tracts of flammable vegetation. In 2007, the state of California developed state maps and suggested local maps for cities to adopt as fire zones which have implications for further development and defensive behavior within the zone, as well as disclosure during the sale of homes. This paper analyzes the potential impact that risk-mitigating policies associated with the zone recommendations have on fire frequency in the Local Responsibility Areas.

California Fire Hazard Zone Background

We analyze LRAs that fall within incorporated city boundaries. Fire protection in LRAs is typically provided by city fire departments, fire protection districts, counties, and CAL FIRE under contract to local governments. Government Code Section 51175 calls for the CAL FIRE director to evaluate fire hazard severity in the Local Responsibility Area (California, Department of Forestry and Fire Protection). Additionally, the CAL FIRE director makes recommendations

to the local jurisdiction where Very High Fire Hazard Severity Zones exist and the local jurisdiction that can choose whether or not to adopt these recommendations. If the local jurisdiction chooses to adopt, then the Government Code provides direction for the local jurisdiction to take to meet new California Building Code standards.

In California, wildland fire protection is the responsibility of either the state, local, or federal government. The Local Responsibility Areas encompass incorporated cities, cultivated agriculture lands, and portions of the desert. In September 2007, CAL FIRE began distributing drafts that updated Very High Fire Hazard Severity Zones (FHSZ) for local agencies. The drafts were followed up by official recommendations that began distribution in June 2008, with some counties receiving their updated recommendations as late as May 2012. Once the local governments received the recommendations, the zones would then be up for adoption by ordinance. It is important to note that cities and counties that had Very High Fire Hazard Severity Zones were not required to adopt these zones or to inform CAL FIRE on their decision. To evaluate the fire hazard ratings in the Local Responsibility Area, CAL FIRE used an extension of the state responsibility area Fire Hazard Severity Zone model. This model evaluates areas using characteristics that impact the probability of the area burning and potential fire behavior. The model includes factors like fire history, existing and potential fuel, flame length, blowing embers, terrain, weather, and the probability of buildings catching on fire. The hazard rating reflects flame and ember entry from adjacent wildlands and from flammable vegetation in the urban area. The fire hazard ratings also include an urban fuel model developed by scientists at the U. C. Berkeley Center for Fire Research and Outreach. Local agencies may use the maps to identify areas where ignition resistant building standards will be required for any new construction, to identify properties requiring defensible space maintenance, and for sellers to

disclose natural hazards during a property sale (California Department of Forestry and Fire Protection, 2007).

Data

There are a total of 181 cities in 30 counties that received recommendations from CAL FIRE for Very High Fire Hazard Severity Zones within Local Responsibility Areas following the 2007 map drafts. Since the cities were not required to announce their choice or time of adoption to CAL FIRE, we attempted to contact representatives or search through municipal codes of each city that contained Very High Fire Hazard Severity Zones. Ten cities were dropped due to a lack of LRA zone data and an additional 74 did not respond to our inquiry and no online indication of the decision was located. Of the remaining 97 cities, 86 chose to adopt the recommendations and 11 chose not to adopt. Historical fire perimeter data was collected using the CAL FIRE Wildfire Perimeters and Prescribed Burns (1950+) map. For our analysis, fire perimeters included were those of wildfires that burned an area 50 acres or larger, between 2007-2018, and that fell within any of our city or county borders. If a fire occurred in multiple cities or counties, then it was counted for each of those areas. With these parameters, 1138 unique fires took place between 2007-2018, and a total of 1231 fire observations were recorded for the data set. 130 unique fires took place within the borders of a VHFHSZ LRA city, with a total of 176 city fires being observed. Total city and county fire counts were calculated by month and year. Mendocino County had the highest number of fires for a given month and year at 24 fires during June 2008.

Results

We attempt to break down the zone recommendations' impact in two ways. First, we examine the average number of county acres burned during and outside of peak California fire

season from 2007 to 2018. The peak California fire reason typically occurs between early August and late April, when the Santa Ana winds are most prevalent. Looking at *Figure 1,* we can see an overall decrease in the average acres burned following the receival of the zone recommendations. However, after 2016 we begin to see a sharp increase in the size of fires. These results suggest that the zone suggestions have an immediate and effective impact, but are not permanent. This is an important finding because it entails that the zones, and the associated protective policies, need to be updated routinely and more quickly. These results provide insight into important policy implications that are impacted by risk perceptions in the context of risk associated with wildfires and other natural hazards. Such zoning policies can impact but are not limited to, building codes, insurance premiums, and overall survivability in the presence of a hazard. Second, we average the number of county fires that occurred during and outside of the fire season. Interestingly, the zone policies did not seem to have much of an impact on the average number of fires that occurred between 2007 and 2018.

Fig 1.

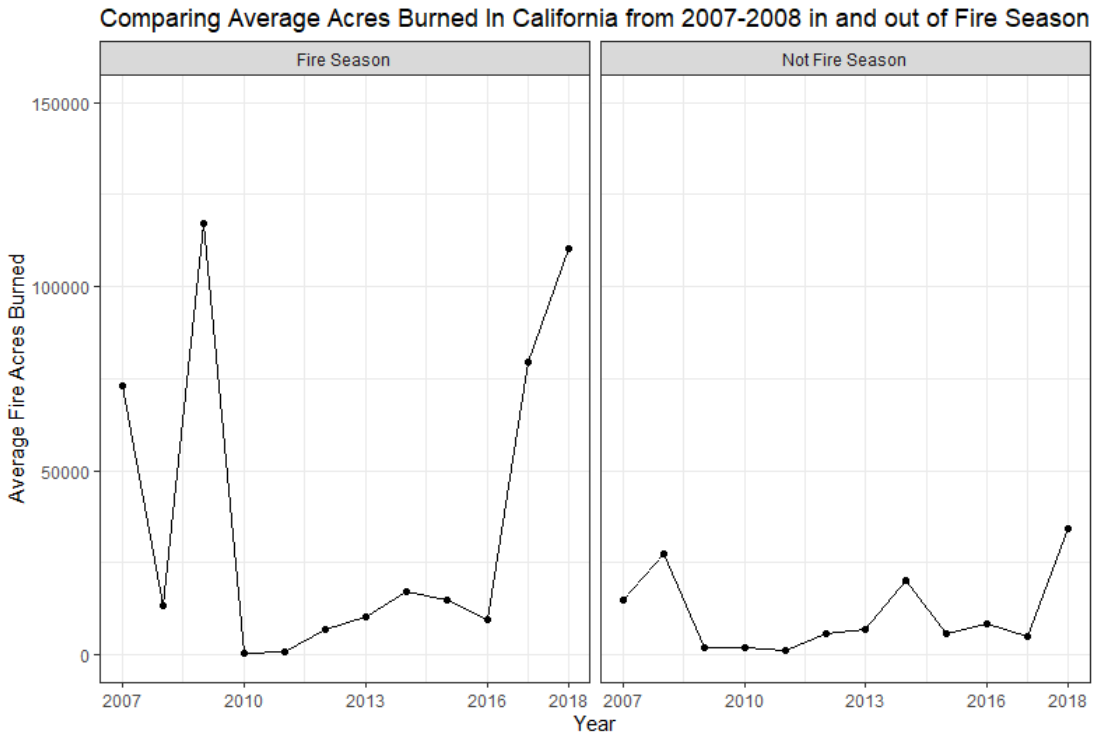
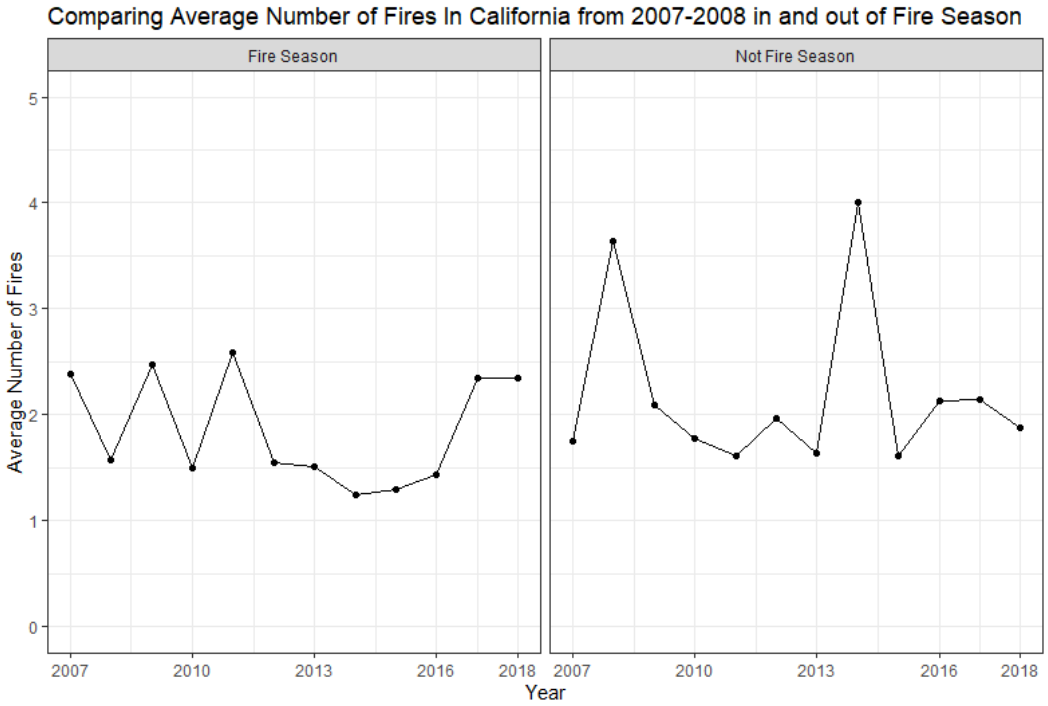


Fig 2.



References

California, Department of Forestry and Fire Protection. *Fire Hazard Severity Zoning and New Building Codes for California's Wildland-Urban Interface.* May, 2007.

Hoover, Katie and Laura A. Hanson. 2018. "Wildfire Statistics." *Congressional Research Service* 2.

Liu, Yongqiang, John Stanturf, and Scott Goodrick. 2010. "Trends in Global Wildfire Potential in a Changing Climate." *Forest Ecology and Management* 259(4):685–97.

National Interagency Fire Center. 2018. "National Report of Wildland Fires and Acres Burned by State Figures from the Fire and Aviation Management Web Applications Program." 64–75.