

Thoughts on the
Wildland-Urban Interface Fire Problem
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The USDA Forest Service along with the National Fire Protection Association generated the National Wildland-Urban Interface Initiative in response to the residential fire destruction during the 1985 fire season. Since 1990, political attention has increased to homes destroyed and communities evacuated during extreme wildland fires. Wildland-urban interface fire spectacles dominated the 2002 U.S. fire season. Federal fire policy and suppression operations reflect the socio-political attention to protecting homes from burning during wildland fires. Supporting policy documents include the Cohesive Strategy, the revised Federal Wildland Fire Management Policy, the 10-Year Comprehensive Strategy, the National Fire Plan, and the Healthy Forests Initiative. The documents, in varying degrees, propose remedial actions for protecting communities from wildland fire as well as actions addressing ecosystem and organizational needs. Although the wildland-urban interface has become an important issue, an appropriate, scientifically based definition of the wildland-urban interface fire problem remains elusive. Proposed management actions are not necessarily based on explicit physical descriptions of how homes ignite related to the characteristics of wildland fires. This suggests that we may be missing significant opportunities for effectively and efficiently preventing residential fire disasters during wildland fires.

My research results indicate that the big flames of high intensity wildland fires do not directly ignite homes at separation distances beyond 100 feet. Because the investigation of extreme fire conditions does not lend itself to statistical inference, I have used three independent approaches to study how homes ignite and burn during extreme wildland-urban fires. I physically describe home ignition potential using modeling. The model uses simplifying assumptions that overestimate the radiation and convection exposures leading to ignition. The question of model reliability has prompted me to evaluate the model using actual fires by conducting home ignition experiments during intense full-scale crown fires (The International Crown Fire Modeling Experiment, 1997-2001, Northwest Territories, Canada). But the crown fire experiments do not represent extreme fire conditions so I use the case studies of others as well as conduct my own investigations on wildland-urban fire disasters. The results of each method generally concur and indicate that the large flames of high intensity fires do not ignite a home's wood exterior at distances greater than 100 feet. This is consistent with our understanding that local wildland fuel reduction can result in significant local fire intensity reduction. The research suggests that if the big flames are not igniting the destroyed homes then relatively low intensity fires contacting or in near contact with a home's flammable materials and/or direct firebrand ignitions must be the ignition sources. Thus, a home's characteristics, its exterior materials and design, in relation to the immediate area around a home within 100 feet principally determine the home ignition potential. I call the home and its immediate surroundings the home ignition zone.

The home ignition zone provides the scientific basis for explicitly defining the problem of residential fire disasters during wildland fires. The home ignition zone indicates that the necessary and sufficient reductions in a home's ignition potential during extreme wildland fires can occur within the home ignition zone. Thus, a home's location does not necessarily determine its vulnerability to wildland fire; the condition of a home's ignition zone determines its vulnerability. Where home ignition zones

overlap property boundaries, the fire dynamics does not change but the social dynamics do. In this case the community must collectively reduce their ignition potential to prevent a wildland-urban fire disaster.

The home ignition zone provides the scientific basis for developing actions that will prevent residential fire disasters. Since the home ignition zone principally determines home ignition potential, communities at risk of burning must be assessed and thereby identified based on the condition of the home ignition zones. For the same reason, mitigating home ignition potential during extreme wildland fires must focus activities within and immediate to the residential area, i.e. the home ignition zone. But the home ignition zone largely corresponds to private property. Thus, with minor exception, the authority for effectively reducing the home ignition potential belongs to homeowners. Public land management agencies can facilitate homeowner mitigations and these agencies may be able to reduce fire intensities and the extent of burning around communities. But these agencies cannot accomplish the necessary and sufficient actions necessary to prevent residential fire disasters during extreme fire conditions by treating beyond the home ignition zone.

As we discuss preventing home ignitions we should recognize that homes are but one of the societal values impacted by wildland fire. Our communities also derive many values from the ecosystems that burn. Fires directly and indirectly impact ecosystems at landscape scales as a complex interaction of biophysical processes over the long-term. In contrast, homes ignite based on meeting the requirements for combustion as determined by the site-specific fire conditions. The home ignition zone physically defines home ignition potential distinct and separate from the impacts of fire in ecosystems and thus allows us to address the risk of burning homes (one community value) separately from landscape fire concerns (multiple community values). This suggests that how we approach fire in our ecosystems and who takes such action should be different from how we prevent residential fire disasters and who must mitigate the home ignition zone. Given that wildland fires will occur under extreme fire conditions and that fire is an ecological process, the home ignition zone indicates that we will have wildland fires and at the same time prevent residential fire disasters.

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