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Publication Brief

# The Built Environment Is More Influential Than Fuel Breaks in Exposure to Wind-Driven Chaparral Fire

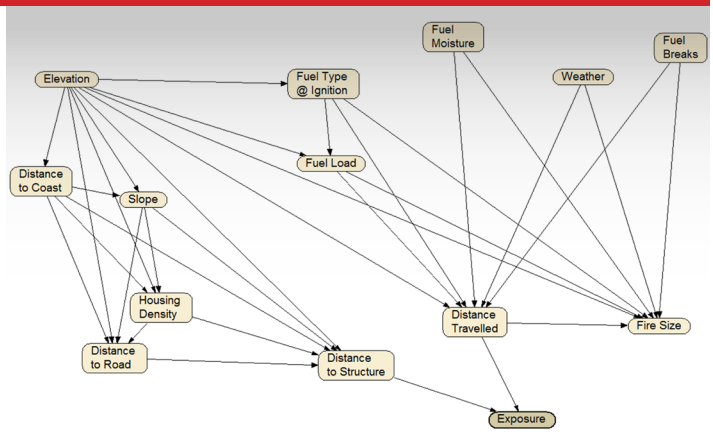
In San Diego County, California, approximately 5,000 homes have been destroyed by fire since 2000. Although billions of dollars have been spent on fuels treatments to reduce fire losses, it has not been demonstrated that fuel breaks reduce the exposure of lives and property to southern California wildfires.

Fuel breaks are designed to physically stop fires as well as to facilitate fire suppression actions. While research has shown fire breaks can be useful in certain conditions, such as backfire operations, there is a lack of landscape-scale evidence to support their effectiveness at reducing the risk of wildfire exposure to lives and property. To examine this question, Australian and U.S. researchers used a Bayesian Network model to evaluate the relative importance of fuel and fuel treatments compared to weather and variables of the built and natural environment on wildfire risk at the wildland-urban interface (WUI) in San Diego County. The final conceptual model was agreed upon by 12 fire experts during three USGS workshops over three years.

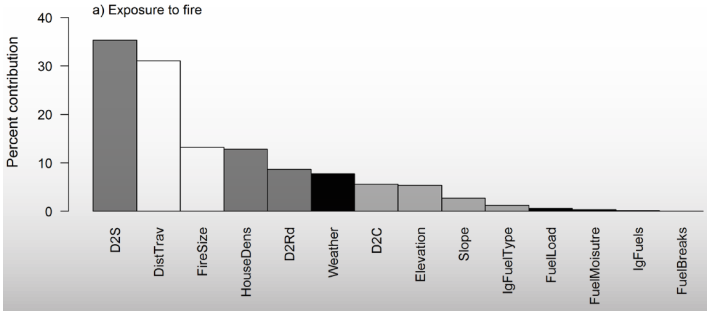
Conditional probabilities used in the model were calculated by a combination of empirical data and 11,944 Fire Area Simulator (FARSITE) fire simulations which examined all combinations of fire weather (low, high and Santa Ana), live fuel moisture (LMF 60% and 90%), fuel loading (low and high) and the presence or absence of maintained fuel breaks. The analyses found several significant relationships: 1) fire size and distance traveled were most sensitive to fire weather, 2) fuel breaks did not alter the risk of exposure under any weather scenario, and 3) housing exposure was most influenced by fire size, distance travelled, and the nature of the built environment, i.e. distance to structure, housing density and distance to road.

The findings suggest that weather determines the risk of exposure for assets in the landscape. Under extreme weather, where the risk of fire is greatest, landscape fuel treatments are unlikely to have a significant influence on risk. These results suggest that managing the occurrence of fire and the spatial distribution of the built environment across the landscape is likely to be the best way to alter the risk profile. Further research is needed to examine the cost tradeoffs of each of these approaches.

**This Brief Refers To:**
Penman, TD, L Collins, AD Syphard, JE Keeley, RA Bradstock. 2014. **Influence of fuels, weather and the built environment on the exposure of property to wildfire.** *PLOS ONE* 9(10): e111414. doi: 10.1371/journal.pone.0111414
http://www.werc.usgs.gov/ProductDetails.aspx?ID=5136




Influence diagrams for the Bayesian Network Model. Figure 2 from Penman et al. 2014.




Sensitivity analysis for exposure to fire. White=fire variables, dark grey=built environment variables; light grey=natural environment variables; black=simulation model variables. Figure 5 from Penman et al. 2014.

## MANAGEMENT IMPLICATIONS

- Bayesian risk modeling shows that fuel breaks did not alter the risk of fire exposure to homes in southern California wildfires, under any weather scenario.
- Managing for fire prevention and managing for the spatial distribution of the built environment across the landscape are likely more effective ways to alter the fire risk profile.

## RESEARCH CONTACT

**Jon E. Keeley**
Sequoia and Kings Canyon Field Station
jon_keeley@usgs.gov
www.werc.usgs.gov/keeley
www.werc.usgs.gov/socalfirerisk