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Human Influence on California Fire Regimes

California has one of the worst fire hazard problems in the United States due to the very complex wildland-urban interface/intermix (WUI), high human ignitions, and annually some of the most severe fire weather in the country. In a recent study published in the July edition of *Ecological Applications*, researchers at the University of Wisconsin-Madison, Oregon State University, Forest Service Northern Research Station, and USGS have studied the human influence on fire regimes at the WUI using California Department of Forestry and Fire Protection (CDF) data from a majority of counties in the state, coupled with associated housing and other human infrastructure data.

Management Implications:

- Ignition loads originating at the WUI are an important reason for land use planners to consider the benefits of minimizing sprawling development patterns.
- Fire risk is greatest at intermediate levels of development, and appears to be affected by the spatial arrangement of housing development.

The study reports that humans and their spatial distribution explain a large proportion of the variability in number of fires, but that area burned is more a function

Scripps Ranch, San Diego County after the 2003 Cedar Fire. This is an example of WUI *interface,* where development abuts wildland vegetation. Photo: J. Keeley, USGS.

of vegetation type. The statistical models from this study underscore the importance of using anthropogenic factors as well as biophysical factors in fire risk assessments and mapping. The models also help to delineate which indicators of human activity are most strongly associated with fire. In addition to the strong influence of human presence, ecoregion and vegetation types were also highly significant in the final models, suggesting that the particular level of human activity that was most influential in explaining fire activity was also context dependent.

Human impacts on fire changed through time. Housing development patterns explained the majority of increase in number of fires from 1960–1980, but those relationships changed in subsequent years. Between 1980–2000, there was a slight downward trend in number of fires concurrent with an increase in area burned. In addition to anthropogenic factors, these trends are likely influenced by broad-scale factors such as climate and fuel patterns. Because fire both constrains and is constrained by the fuel patterns it creates, there is an autocorrelation of cycles of fire activity and temporal patterns in area burned.

For number of fires, the proportion of WUI *intermix* (development intermingles with wildland vegetation, as individual houses surrounded by wildlands) rather than WUI *interface* (development abuts wildland vegetation) explained more variation than any other variable except for population density, suggesting that the spatial pattern of housing development and fuel are important risk factors for fire starts. Maximum fire frequency occurred at intermediate levels of human development; and when human activity was either lower or higher, fire activity was lower. Initial increases in fire occurrence with increasing population are expected since humans are responsible for most ignitions. However, it appears that when human population density and development reach a certain threshold density, ignitions decline, and this is likely the result of diminished and fragmented open space containing insufficient fuels to sustain fire. In addition, above a certain population threshold, fire suppression resources are likely to be more concentrated in the WUI. Ultimately, as more low-density housing development (i.e., intermix WUI) spreads into undeveloped wildland, the greater the risk that more fires will ignite and that fire hazard will increase. Thus, there is a need for land use planning to discourage dispersed development patterns.

Area burned was more a function of vegetation type in the WUI than housing density and increased with shrubland fires. Distance to roads was the only anthropogenic variable associated with area burned, which may reflect the difficulty of fire suppression access contributing to fire size.

Syphard, A.D., V.C. Radeloff, J.E. Keeley, T.J. Hawbaker, M.K. Clayton, S.I. Stewart, and R.B. Hammer. 2007. Human influence on California fire regimes. Ecological Applications 17:1388–1402.