Joint Fire Science Program
Fire Science First Look
RESEARCH SUPPORTING SOUND DECISIONS
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Southern California Chaparral Fires: A Unique Multi-century Reconstruction

Management Implications

- Research will supply land managers with baseline information about the historical variation of fire regimes of two ecotypes of significant value and concern, on a multi-century time scale.
- The roles of extreme weather events, climate patterns and human intervention will be clarified with regard to their influence on fire regimes in these landscapes.
- Development of a new network of fire scar chronologies of bigcone Douglas-fir will supplement similar efforts taking place on national and global scales.

The chaparral communities of southern California are among the most fire prone landscapes in the nation, and represent one of the most dominant vegetation types in the state. Unique climate patterns, geography, and extreme weather events are natural components that contribute to these hazardous conditions. Human contributions include decades of fire suppression and a rapidly expanding wildland urban interface. This combination of factors raises a common fire management question: Are large-scale, stand-replacing fires the result of natural process, human activity or both?

There is broad consensuses that stand replacing fires in southern California chaparral communities are a natural phenomenon, but debate remains regarding the causes of changes in patterns and frequency of fire, and the roles that human activity and climate variability play. Some argue that fire suppression and fuel loading have altered the structure of these communities in a way that promotes large, severe fires. Others have countered that human population growth, geographic variables, weather and climate are the primary drivers; particularly the Santa Ana winds and drought.

It's impossible to unravel the answers without more information about the long term patterns and drivers of fire before human influences became a factor. Despite recent advances in chaparral ecology and fire history reconstruction, little is known about the long term ecological variability of this system. Most research thus far has relied on fire atlases and photographic surveys, evidence that is only relevant to the last century. These methods can't produce information about the causes, frequency or patterns of fire over multiple centuries. Studies of charcoal in sediments have provided long term perspectives on fire and climate in this region, but they lack spatial information on fire extent and seasonality. In other regions of the West, fire scar dating and tree ring analysis have been used successfully to study long term changes. But chaparral doesn't lend itself to this approach because fire scars aren't generally formed on shrub stems, and complicated tree ring structure makes them difficult to discern or cross date. In addition, few plants survive the stand-replacing fires, so the only information carried by survivors is the date of the most recent fire.

University of Arizona researchers Dr. Tom Swetnam, Keith Lombardo and Christopher Baisan, along with Dr. Mark Borchert of the U.S Forest Service, are taking a unique approach to reconstructing the historical fire history of this region. In an effort to gather multi-century information they're examining two potential indicators beyond the chaparral itself:

- Weather patterns that generate the Santa Ana winds, particularly high pressure in the Great Basin
- Fire-scarred stands of bigcone Douglas-fir trees imbedded in the chaparral matrix.

2003 Smoke Plumes
Photo Credit: NASA

Fire scars bigcone Douglas-fir

Intense chaparral fires tend to run up to stands of bigcone Douglas-fir and then settle down into surface fires. Many of these thick bark trees survive -- with resulting fire scars. If fire scars from separate islands of bigcone, scattered among expanses of chaparral, demonstrate that they were burned simultaneously by the same fires, it may be a reasonable inference that the intervening chaparral also burned during these events. This fire spread concept will be tested against independent data from modern fire atlases. If this approach works, it may be possible to use bigcone fire scars to estimate the extent, frequency, and seasonality of chaparral fires that took place as long as 500-700 years ago.

This information will be supplemented by examination of the influence of the Santa Ana winds. This strong seasonal wind pattern occurs late in the fall when conditions are at their driest and humidity can be close to zero. Generated by high pressure over the Great Basin, the winds funnel down slope through the east-west mountain ranges of the region, which includes the Angeles, Cleveland, San Bernardino and Los Padres National Forests. This extreme weather event further dries out vegetation, pushing and intensifying any fire in its path. Using tree rings and modern weather maps as calibration tools, researchers will reconstruct the weather patterns that generate the Santa Ana winds. They hypothesize that years in which large fires occurred will coincide with years of strong high pressure in the Great Basin.

Examination of these weather patterns, combined with information gleaned from bigcone Douglas-fir fire scars, will generate much needed answers for fire managers in this region of high resource value and concern.

For More information contact:

Keith Lombardo – lombardo@email.arizona.edu

Tom Swetnam – tswetnam@ltrr.arizona.edu

On the web at: http://www.ltrr.arizona.edu/~tswetnam/