CALIFORNIA FIRE SCIENCE CONSORTIUM

JOINT FIRE SCIENCE PROGRAM

Research Brief for Resource Managers

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Wildfire trends in northwestern California forests

Miller, J.D., C.N. Skinner, H.D. Safford, E.E. Knapp, and C.M. Ramirez. 2012. Trends and causes of severity, size, and number of fires in northwestern California, USA. Ecological Applications, 22: 184-203.
http://www.fs.fed.us/psw/publications/skinner/psw_2012_skinner001.pdf

Recent research and local experience suggest that wildfire size and annual area burned are increasing across the western United States. These trends are thought to be driven by climate and forest changes from fire suppression and other human activities. However, though fire size and area burned are important, they do not necessarily speak to the ecological influence of wildfire on the landscape, nor do they address changes in vegetation that result from different fire severities.

This study assessed trends in fire size and area burned in northwestern California from 1910 to 2008, yet it also analyzed fire severity patterns in the same region, using available data for the period between 1987 and 2008.

The authors used spatial analyses to describe major wildfire patterns across a 5.8 million acre area of northwestern California. Some of their results are intuitive, pointing to increasing fire size and annual area burned since the beginning of the 20th century; however, fire severity results are somewhat surprising, suggesting no clear trends in fire severity over time and highlighting new understandings of the relationships between climate, humans, and fire.

Management Implications

- Managed wildfire may become an increasingly important land management tool, given the relatively stable, low to moderate fire severity trends observed in northwestern California over the last two decades and projections of future fire frequency and extent
- Climate-fire relationships are strengthening, and fire management and planning efforts should consider and incorporate future climate scenarios.

Fire occurrence and fire area, 1910 - 2008

As in much of central and northern California, fire size and annual area burned have increased in the study region over the last century.However, the fire-climate relationship has changed in that time period; early in the 20th century, the number of fires, fire size, and area burned all had strong relationships with drought severity, but later in the study period, those attributes were more strongly related to fire-season precipitation patterns.

Interestingly, lightning fires have become more important in the study region over the last century; lightning accounted for only 42% of area burned in the early 20th century, but by the end of that century, lightning was responsible for 87% of area burned. However, because major lightning storms are often accompanied by summer rain, the biggest lightning-caused fires tend to result from the few, drier lightning events.

Fire rotation

Fires burned approximately one third of the study area between 1910 and 2008. During this time, there were distinct temporal patterns in the region's fire rotation, or the length of time that it takes for fire to cover a given area. Early in the 20th century, the fire rotation was 267 years; however, largely as a result of fire suppression, this value peaked in 1984 at a fire rotation of 974 years. The 1987 fire season brought the rotation back down to 256 years, and by the end of 2008, the value had dropped to a study period low of 95 years.

Fire severity, 1987 - 2008

Though the four biggest fire years of the last century occurred between 1987 and 2008, the authors of this study found no clear trends in fire severity during that time period. In other words, fire severity did not significantly increase or decrease in those 21 years – it stayed about the same.

This finding may seem counterintuitive, given widely held beliefs about the increasingly severe effects of wildfire in the western United States. However, a number of factors explain why fire severity has remained fairly constant in the study region. For one, in years when large areas burn, like 1987 and 2008, burning takes place over an extended time period – often months – and the fire season can stretch late into the fall. As a result, much of the area burns at low to moderate severity. Secondly, the strong relationship between complex topography and temperature inversions can inhibit fire behavior in northwestern California. For example, the 1987 and 2008 fire years featured very strong inversion effects, resulting in relatively low proportions of high severity fire.

Though no clear temporal fire severity trends emerged from this study, there were a number of notable stand- and vegetation-type trends in fire severity. Severity was lower in stands dominated by medium and large trees, and higher in stands dominated by small trees. Likewise, severity patterns differed by forest type and fire history. For example, severities in mixed conifer and high elevation fir were higher in areas that had not burned since before 1910 than in areas that had.

Intriguingly, the study also showed that fire severity was greater in human-ignited fires than lightning-ignited fires. This is probably because human-ignited fires are isolated incidents that escape under more severe conditions and occur close to population centers, allowing swift and effective suppression and precluding the long, drawn-out, lower-severity events that are more typical of lightning-ignited wildfires.

Conclusions

This study highlights the complex and dynamic relationships between humans, fire, and climate in northwestern California. Like other recent studies in central and northern California, it demonstrates increases in fire size and annual area burned. However, the study also reveals surprisingly stable fire severity patterns in the region, contrasting with results of previous studies and providing fresh perspective on fire's influence on the ecology and vegetation of the area.

The authors point out the increasingly important role of climate in shaping fire in northwestern California, and they predict that fire may become more prevalent under future climate scenarios. However, given the low to moderate severity patterns they've documented for the past two decades, and the critical ecological role of mixed-severity fire in the region, the authors are optimistic that wildfire may be increasingly used to fulfill management objectives.

Suggestions for further reading

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