What If We Didn't Suppress Wildfires?

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The suppression of lightning ignited wildfires removes one of the most important natural processes from fire dependent ecosystems, yet resource specialists currently have no way of measuring or monitoring the effects of these management actions. Using Yosemite and Sequoia-Kings Canyon National Parks as case studies, we retrospectively and chronologically modeled suppressed lightning ignitions. We use the results of this analysis to illustrate the effects that past fire suppression decisions have had on these study areas.

FARSITE (Finney 1998) was used to determine where lightning ignitions may have spread had they not been suppressed. FARSITE is a fire modeling tool that uses spatial information on topography and fuels, along with weather and wind data to simulate wildfire behavior. Each suppressed lightning ignition that occurred between 1994 and 2004 was chronologically modeled using actual weather conditions. The spatial extent and severity of both modeled and real fires were used to update fuels data after each simulation year. Both the consumption and accumulation of fuel were accounted for using a fuel succession model (Davis et al. 2009). This fuel succession model was also used to determine the changes in fuel loading in the absence of the modeled fires. This resulted in two sets of fuel model data representing pre-fire season 2005 fuels, one for the modeled case and one for the real case.

In addition, two fire atlases were built: one including only the real fires that occurred between 1930 and 2005, and one that also included the modeled fires. These atlases were used to determine Fire Return Interval Departures (FRID) for both study areas. FRID is an index used by both parks to quantify departure from the pre-European settlement fire return interval (Caprio et al. 2002; van Wagtendonk et al. 2002). FRID is determined by calculating how long ago an area last burned divided by the characteristic fire return interval for the underlying vegetation type. For example, if a particular vegetation type has a characteristic FRI of 10 years and the time since last fire is 50 years then the area can be said to have a FRID of five. Lower values of FRID are more desirable than higher values.

Suppressing fire is classically viewed as a means of protecting resources. In the near term these resources can include man-made structures, culturally important areas, sensitive species, public safety, air quality, etc. Available resources for fighting fire and the risk of fire crossing jurisdictional boundaries are also important considerations. More recently, we have begun to realize that there are longer term, unintended consequences in suppressing all fires and that fire restoration, where feasible, can help to alleviate some of these consequences. Negative effects of long term fire exclusion include unnaturally high fuel loadings, impacts on the lifecycle of fire dependent species, such as the Giant Sequoia, and changes in vegetation type and distribution. It is because of these and other unintended consequences that both Yosemite and Sequoia and Kings Canyon National Parks implemented policies in the early 1970s under which naturally ignited fires would be allowed to burn in certain areas within the parks (van Wagtendonk 2007; Kilgore 2007). Unfortunately, even with these policies in place, most lightning-ignited wildfires are still suppressed due to concerns about unnaturally high fuel loadings resulting in uncharacteristically extreme fire behavior and effects, smoke impacts on surrounding communities, and the risk of fire crossing jurisdictional boundaries. The NPS has therefore not been able to restore as much fire to the ground as was seen in historic fire regimes. This may be partly because the risks of negative impacts of a wildfire seem more immediate than the risks associated with suppressing that fire. In addition, the risks of negative impacts have been more extensively studied and are consequently better understood than the benefits of allowing fires to burn.

One of the purposes of retrospective fire modeling is to demonstrate and quantify the benefits lost when fires are suppressed. Our case study on Yosemite and Sequoia and Kings Canyon national parks provided many insights into the benefits of restoring fire to the landscape.

We were able to demonstrate that allowing more fires to burn reduces fuel loading and creates barriers to future wildfires in the form of fuel breaks (Figure 1). Decreased fuel loadings can result in a reduction in uncharacteristically extreme fire behavior in future wildfires. An increase in the number and extent of fuel breaks can be helpful to managers when fighting undesirable fires and increase their ability to allow desirable fires to burn. When it is necessary to suppress future fires, fuel breaks created by past fires can slow or stop fire spread wherever they are encountered. This allows managers to concentrate their efforts on other parts of the fire perimeter. Knowing that there is a fuel break in place between an ignition and a point of value such as an historic cabin can make managers more confident about making the decision to let an ignition burn.

Another implication of the benefits of fuel reduction by fire was discovered through our retrospective analysis. We found that many real fires may never have occurred because their ignition points fell on areas where an earlier modeled fire had left little or no fuel remaining (Figure 1). This can lead to a reduction in the amount of initial attack efforts necessary in the future.

Next, we evaluated the impact of the modeled fires on FRID. We created two fire atlases for the calculation of FRID. The real fire atlas contained only those fires that actually occurred while the modeled fire atlas contained both the real and the modeled fires, minus those fires that were eliminated due to the fact that their ignition points were no longer viable because of the fuel reduction from an earlier modeled fire. We then calculated FRID using the two atlases to determine time-since-last-burn and compared the results. The modeled fires resulted in a dramatic decrease in FRID values across both study areas. This methodology allows managers to quantify the cost of suppressing fire in terms of the impact on FRID.

Of course not all of the suppressed ignitions we modeled could or should have been allowed to burn freely. A number of the modeled fires would have escaped park jurisdictional boundaries, grown to a larger size than is generally acceptable, had too great an impact on the air quality of surrounding communities, etc. Our purpose was not to argue against all

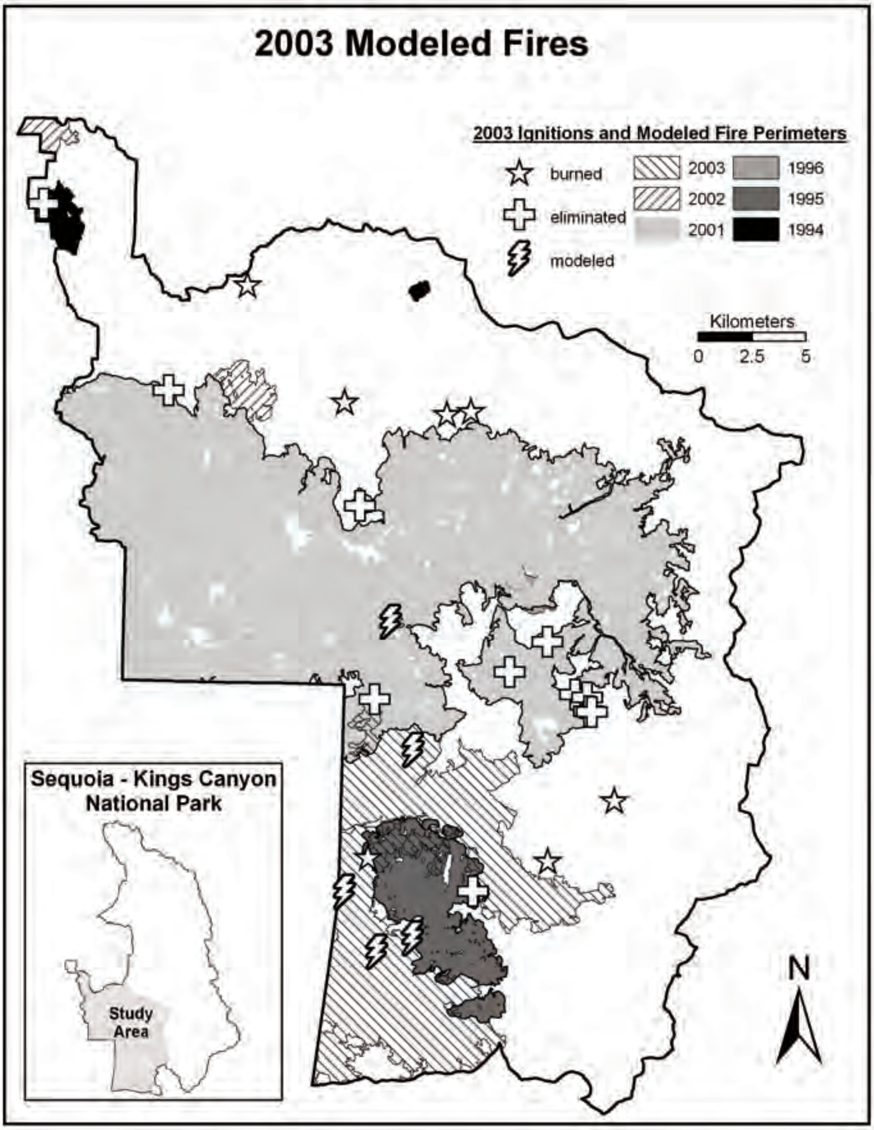

Figure 1. Map of all 2003 ignitions and 1994–2003 modeled fire perimeters. Illustrates the benefits of allowing ignitions to burn including the creation of fuel breaks which can modify future fire spread and reductions in fuel loadings which can eliminate future ignitions.

suppression, but rather to illustrate and quantify some of the benefits lost when fires are suppressed.

Ideally, the decision to suppress or not-to-suppress a fire considers the possible consequences of allowing a fire to burn *as well as* the consequences of suppression. We have demonstrated that as little as 11 years of suppression activities can have a dramatic impact on a landscape. When fires are suppressed, opportunities are foregone to create fuel breaks, reduce fire regime departures and decrease future extreme fire behavior by modifying fuels. An increased number of fuel breaks and/or a reduction in the quantity of available fuels can give managers more tactical options when deciding how to manage a fire. Retrospective modeling is a quantitative method that park managers can use to better understand, measure, and track the cumulative effects of their decisions from year to year. For a more detailed description of this study see Miller and Davis (2009).

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