The Science Behind Fire Management

Sequoia & Kings Canyon National Parks have long taken pride in embracing the best available science to direct its fire management program. Here are some highlights of current research underway as well as some practical examples of how the science is applied at the field level.

Dendrochronology: This science studies tree rings. For fire management, scientists can determine the frequency of fires in a forest type (sequoia groves, lodgepole, and others.) Was it an early or late season fire or during a drought year? By studying multiple trees in a sample area, scientist can determine how large a single fire grew. The long life of sequoia trees have provided 3,000 years of information about fires in these mountains. The most extensive dendrochronology work in the United States has been completed in these parks and informs fire managers about the natural fire cycle (frequency, timing, intensity, etc.).

This sequoia "cookie" from Redwood Mountain in Kings Canyon National Park demonstrates that fire was a frequent occurrence (about every 10 years) in the mixed-conifer forest.

NPS Photo

Sediment Coring: Researchers took sediment core samples at Oriole Lake in 2007 and Round Meadow in 2009. Researchers hope to determine when a fire occurred based on the presence of black carbon and other fire-charred material. The dating of the fire is based on the location of the black carbon in the core sample. It promises to look further in the past in geological records beyond tree ring scars. A longer record could give a better estimate of how fire varied in the past relative to climate shifts.

Core samples taken at Oriole Lake. This project is a partnership between the parks and the University of Rhode Island.

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Fuels Analysis: By using dendrochronology research, fire managers can determine how frequently fires happened and also how many natural fire cycles have been missed. For example, fires occurred naturally every 5- 15 years in the conifer/ sequoia grove forest. If there have been no fires in that forest for 100 years, approximately10 natural fire cycles have been missed. Areas that deviate far from the natural fire cycle are given high priority for mechanical or prescribed fire treatments. Values that need protection (property) and natural areas that benefit from regular fire (sequoia groves) are also prioritized for treatments. By mapping these areas, fire managers can create treatment plans for both the short and long-term.

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Project Locations for 2011

The parks are planning 9 projects this year totaling up to 3,843 acres. They are designed to improve protection of communities and restore or maintain forest health. Remember, the ultimate timing and completion of burns depends on funding, air quality, local and national fire activity, fuel moistures, and weather.

1 Hole-in-the-Wall
(52 acres)
Summer prescribed fire

2 North Boundary
(248 acres)
Fall prescribed fire

3 Swale East
(101 acres)
Fall prescribed fire

4 Redwood Mountain
(626 acres)
Summer prescribed fire

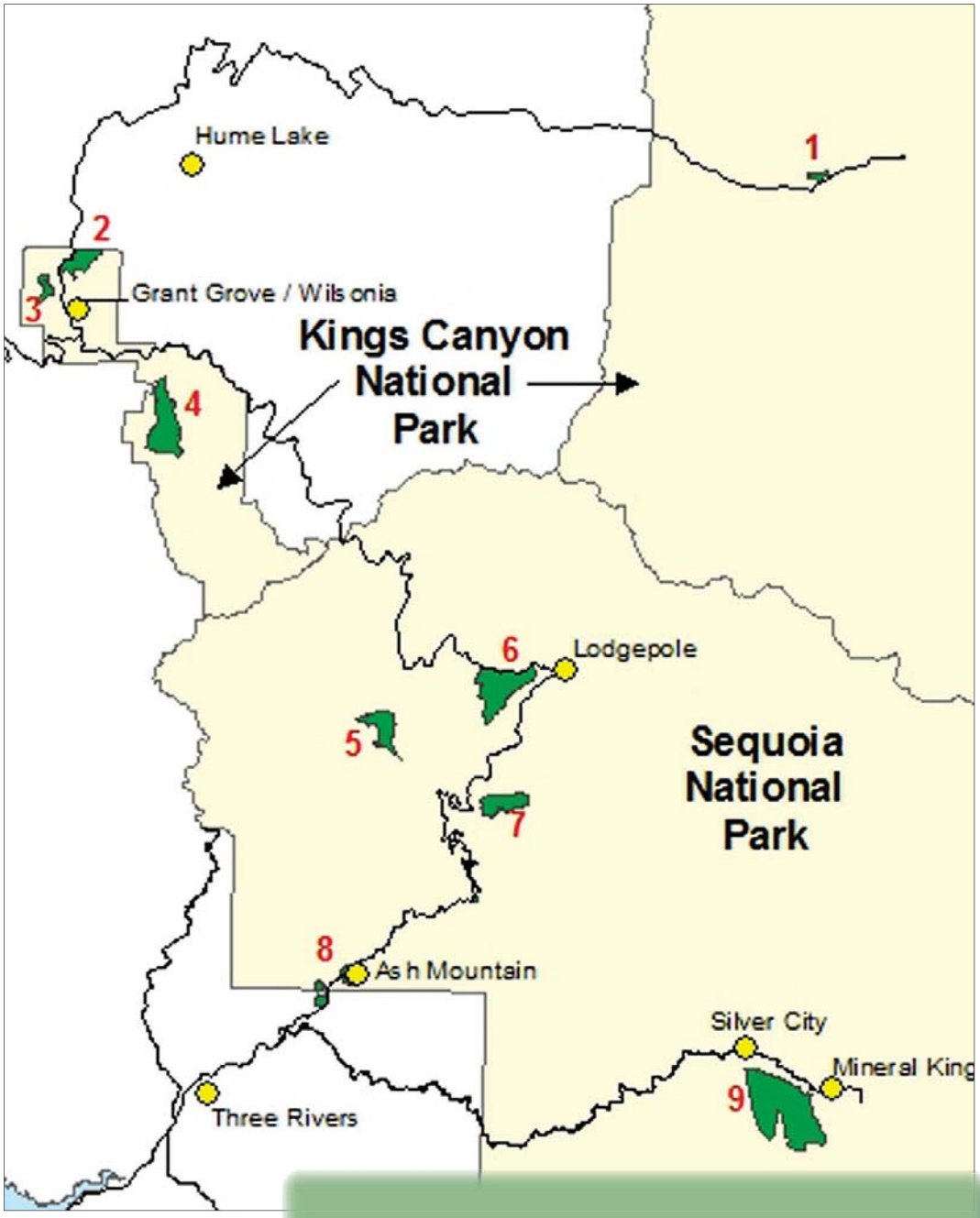
5 Cave
(310 acres)
Fall prescribed fire

6 Halstead
(686 acres)
Fall prescribed fire

7 Huckleberry
(310 acres)
summer prescribed fire

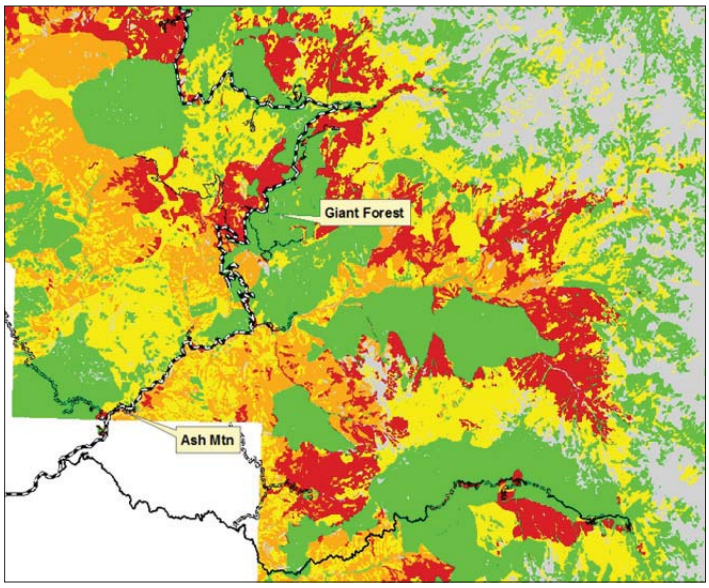
8 Ash Mountain / Hospital Rock
(25 acres)
Spring/early summer prescribed fire

9 Mosquito
(1485 acres)
Fall prescribed fire



What About Lightning Fires?

Lightning fires are unplanned events. NPS crews are trained to respond quickly in these situations. When necessary, the parks shift priorities from planned projects to the management of lightning fires.



This map is of the Middle Fork of the Kaweah River. Red on the map represents areas missing several fire cycles and are highest risk for unwanted fire, followed by orange and then yellow. Green areas have had recent fires that help reduce risk. Gray areas are rock.

Fire Behavior and Smoke Projections Modeling: Several modeling programs help inform the decisions of fire managers. By determining the conditions of the fuels (e.g. through missed fire cycles), the steepness of the terrain, and through various weather conditions, these programs can forecast the potential for growth and spread of a particular fire. For the 2009 Granite Fire in the Middle Fork of the Kaweah River drainage, modeling programs suggested the fire would likely grow to about 20,000 acres if left to burn.(It was contained at two acres.) Smoke models can determine how smoky a fire would be (again based upon available fuels that could be consumed by the fire) as well as where the smoke will likely travel. These models provide valuable guidance for park managers.

Fire Weather: Weather, fuels, and topography are the main factors that influence how a fire will behave and grow so knowing current and expected weather is essential for fire response. Along with forecasted weather (the parks request localized forecasts from the National Weather Service and the San Joaquin Valley Unified Air Pollution Control District), firefighters also take weather measurements (wind speed and direction, relative humidity, temperature, etc.) during fires. These readings are often taken on an hourly basis (the hot afternoon shows the most active fire). Some of this is done with instruments (thermometers, wind gauges, etc.), other times it can be as simple as kicking some dirt to determine wind direction. Significant changes in weather such as wind shifts, drops in relative humidity, or incoming weather systems provide vital information for a safe fire response.

Fuel Moisture Content: How wet or dry the forest fuels are determines how flammable they are. Samples of fuels are collected, weighed, dried in an oven, and re-weighed. Samples range from twigs to downed logs since these fuels will dry out and burn at a different rate. Fuel moisture is one method used to determine when an area is within prescription.

Ignition methods: Firefighters take advantage of the environment around them to help influence fire behavior. As a rule, fire burns uphill (wind-driven events are a noted exception). Ignitions on a prescribed fire unit will start at the high point of the unit and firefighters then slowly bring fire downhill. This helps control the intensity of the fire, especially if there is an unnatural amount of fuel on the unit. The Sierra Nevada is subject to diurnal wind shifts—up canyon in the morning and down canyon in the evening. For the Hart Prescribed Fire, the unit was down slope of the Generals Highway. Ignitions along the highway were conducted in the evening to take advantage of the down canyon winds to deepen the fire line.

Firefighter Kristy Hanjy takes local weather readings. This information is used for safe fire response.
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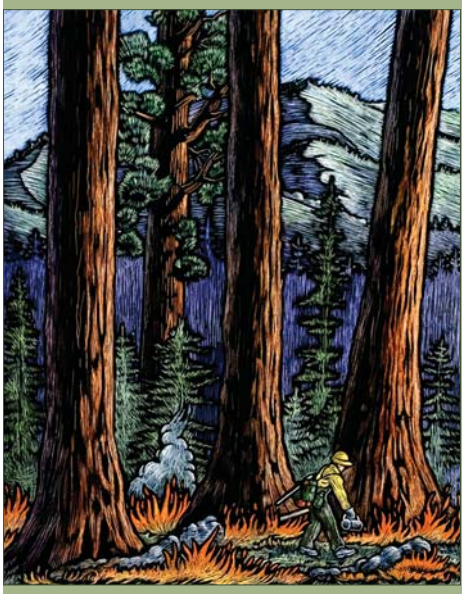

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For more information
www.nps.gov/seki/naturescience/fire.htm

Smoke in the Sierra

Here in the southern Sierra Nevada, smoke is our reality. Whether present from a wildfire or a prescribed fire, here are a few simple actions that you can take to reduce your exposure:

Stop outdoor activity when smoke is present. Smoke often settles with inversions at night and lifts in the late morning. Avoid physical exertion. Seniors and children are more sensitive to the effects of smoke.

Close windows, doors, and outside vents when it's smoky. Set your air conditioner to re-circulate. Ventilate your home and work place when it is not smoky.

Drink lots of water, eat a balanced diet, and get adequate rest. A healthy immune system is the best protection against the effects of smoke.

Take medicines prescribed by your doctor. People with pre-existing respiratory problems like heart or lung disease, asthma, or emphysema are at greater risk from smoke.

Consult the local Air Quality Index (AQI) through your air district or the parks. The higher the AQI value, the greater the level of air pollution and the greater the health danger.

Consult your healthcare provider for further guidance.

Smoke from the Sheep Fire and the Canyon Fire on September 25, 2010 as seen from NASA's MODIS webpage.