
Preserving the Future:
A Case Study in Fire Management and Conservation
from the Santa Monica Mountains
Marti Witter and Robert Taylor

The Santa Monica Mountains (SMM) are coastal mountains that extend west from the city of Los Angeles to the Oxnard plain in Ventura County, and are a major habitat island within one of the world's largest urban areas. The 153,000 acre Santa Monica Mountains National Recreation Area was established as a part of the National Park Service system to protect this area as an important example of a Mediterranean ecosystem; an ecosystem that has a limited worldwide geographic distribution and high biological diversity (<http://www.biodiversityhotspots.org/xp/Hotspots>). The SMM National Recreation Area is a complex mosaic of federal, state, and private lands. Approximately 70,000 people live within the boundaries of the Recreation Area and 10% of the land area is developed. Millions more live within a short drive of its perimeter. Consequently, the Santa Monica Mountains includes a significant amount of wildland-urban interface where developed lands meet areas of undeveloped natural habitat.

The dominant vegetation in the Santa Monica Mountains is chaparral (55%) and coastal sage scrub (20%) shrublands, which burn in intense, stand-replacing fires. The result of development within this fire prone vegetation type is a long history of large, costly fires (fig. 6-3). Three of California's 20 largest fires for number of structures destroyed occurred in the Santa Monica Mountains: the 1993 Old Topanga, 1978 Kanan, and 1961 Bel Air fires.

As with all of southern California, the most damaging fires in the Santa Monica Mountains are large, wind-driven, autumn fires. The ability to control these fires is limited because of the associated weather conditions of low humidity, high temperatures, and high wind. The speed at which large fires spread means that fires at the wildland-urban interface can do major damage before the majority of firefighting forces have been deployed. The 1978 Kanan fire and the 1993 Old Topanga fire, for example, both started on the inland side of the mountains and spread rapidly downwind to the coast, causing large structural losses. The first fire covered nine miles in two hours, with flame lengths of up to 90 feet reported. The second fire covered six miles in four hours. During both fires, opportunities for safe and effective direct attack by hand crews were severely limited until the weather moderated. Local fire history is overwhelmingly dominated by these large, extreme fires in terms of total area burned, as well as in terms of structures and lives lost.

The combination of a well-documented fire history, complex wildland-urban interface, and extensive parkland make the Santa Monica Mountains an excellent model for both effective fire management strategies and ecosystem conservation.

YEAR	NAME	AREA (ACRES)
1982	Dayton Canyon	43,043
1993	Green Meadow	38,478
1956	Sherwood/ Zuma	35,217
1970	Wright	28,195
1935	Malibu	28,191
1978	Kanan	25,565
1970	Clampitt	24,650
1967	Devonshire-Parker	23,005
1949	Simi Hills	20,573
1930	Potrero No. 42	20,391
1958	(name unknown)	18,115
1993	Old Topanga Fire	16,462

Fig. 6-3 The Twelve Largest Fires in the Santa Monica Mountains 1928-2001.

Fire Management Strategies

In the Santa Monica Mountains all fires are suppressed as rapidly as possible, so fire management decisions involve those actions that can be taken between major fire events to reduce fire losses. An effective action that can be taken in the wildland-urban interface is to create a defensible space by reducing fuel loads in the area around a home or other structure. Vegetation that has been modified and maintained will slow the rate and reduce the intensity of an advancing wildland fire and provide room for firefighters to safely work in and around structures. In combination with fuel modification, property owners need to ensure that their homes are resistant to structural ignition, particularly from flying embers.

While the effectiveness of defensible space is well understood (Cohen and Saveland 1977), the benefits of non-strategic, prescribed burning or other vegetation fuel management projects in backcountry shrublands are not well documented. Fuel reduction efforts are most effective for fire control under slope and fuel-driven fires (i.e., fires occurring under moderate weather conditions). These types of vegetation treatments are also effective at the shoulders of an extreme weather event as normal weather patterns return to the local fire area. This was observed during the October 1993 Kinneloa fire on the Angeles National Forest (Kerr, pers. comm.). The fire was contained on the western flank along the Mount Lowe fuelbreak as the Santa Ana winds slackened. This fuelbreak had been maintained with a prescribed fire in February of 1993. However, the ten-month-old Lake Avenue fuelbreak, which had also been treated in February of 1993, burned over without substantially affecting fire behavior during the height of the Santa Ana winds condition.

In the SMM National Recreation Area the concept of using prescribed burning to create a landscape mosaic of varying aged chaparral stands has been abandoned as a viable or effective fire management strategy. This strategy does not reduce wildfire structural losses because it does not provide direct protection for residences. Treatments are often remote from development because of the danger of prescribed fire escape. Neither does prescribed burning provide effective control of wildfire spread under severe weather conditions because, under these conditions, fires burn through even very young-age classes of vegetation. Physically creating a vegetation age mosaic with prescribed fire in the Santa Monica Mountains would require burning 5,000 acres per year on a 20-year rotation interval and would be impossible to implement because of social and regulatory constraints. Finally, the Santa Monica Mountains already has an extremely high fire frequency and unnaturally short fire return interval of 32 years. Any landscape-level prescribed fire has the potential to eliminate native shrubs from a too-short fire return interval.

The Santa Monica Mountains Plan

A more focused fire management strategy proposed for the Santa Monica Mountains is *strategic fuels treatment*. This is different than the “mosaic” model because strategic fuels treatment tries to identify locations where reducing fuel loads by either prescribed fire or by mechanically removing vegetation would change fire behavior enough to either limit fire spread, allow control of a fire perimeter, or protect specifically identified resources at risk from wildfire (NPS 2004). Strategic fuels treatments are landscape level treatments and do not include the defensible space created by mechanical vegetation fuel modification immediately adjoining individual homes.

To identify areas for strategic fuels treatments that might provide opportunities to either control fire spread (fuel modification strategies) or provide opportunities to contain the fire perimeter (fire containment strategies), a simple geographic information system (GIS) based analysis was developed based on slope, vegetation type, vegetation age, and density of nearby structures. GIS allows the entire landscape to be plotted based on information gathered by satellite and other sources.

A 30-meter digital elevation model was used to calculate slope steepness and identify areas where slopes are moderate enough that opportunities to control wildfire might exist. The thresholds selected were slopes less than 20% (optimum) and slopes between 20–40% (moderately feasible). Slopes steeper than 40% limit tactical firefighting options such as use of mechanized equipment or safe deployment of hand crews, and make aerial support, particularly air tankers, less effective.

The value of fuel modification to reduce fire hazard is strongly dependent on the type and age of the vegetation. Coastal sage scrub and grassland attain only relatively low amounts of fuel at any age, and they exhibit very rapid rates of re-growth. Thus fuel modification projects in these vegetation types produce only relatively small and short-lived benefits to firefighters. Chaparral has the highest fuel loads, generates the most intense and hazardous fire conditions, and takes longer to accumulate maximum fuel loads than other vegetation types in the Santa Monica Mountains. Because total standing biomass in chamise chaparral has been shown to level off after approximately 35 years, chaparral over 35 years in age was selected as the vegetation type that would provide the greatest benefit on fire behavior from fuel modification. A simple overlay of

this information produced a map of areas meeting all the necessary criteria (proper slope, vegetation type and age). These sites are areas that may be appropriate for strategic fuel modification projects (fig. 6-4).

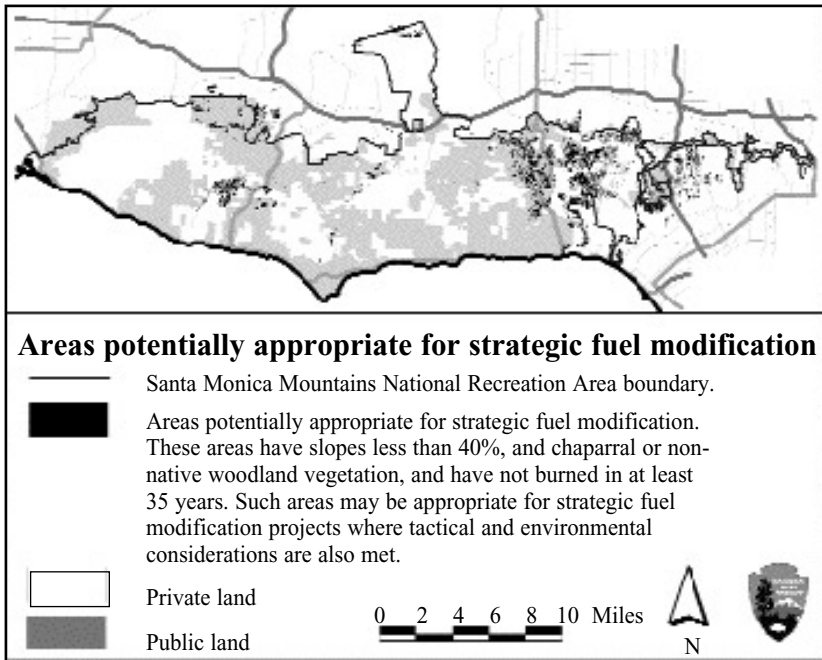


Fig. 6-4 Map of Santa Monica Mountain Area.

Given the reality of limited funds to support fuel treatments and the narrow window of opportunity to conduct these treatments under favorable weather and air quality situations, a prioritization process for evaluating potential treatments is required. To identify opportunities for projects that will produce the greatest demonstrable increase in fire safety, we evaluate population density and the ability of proposed treatments to protect residences and other improvements in the vicinity of the proposed treatment. Combining U.S. Census data on housing density with the previous analysis of opportunities for strategic fuel modification projects shows where opportunities for successful fuel modification projects are also close to high densities of structures at risk.

But proximity to high-density population areas cannot be used alone to judge the appropriateness of a strategic fuel treatment location. The ability to provide tactical options to firefighting resources is one of the key elements of many fuel treatments. When strategically located, fuel treatments can provide anchor points for ground-based firefighters to organize firefighting efforts and increase the effectiveness of fire retardant and water delivered by air tankers and helicopters. The reduction in vegetation on treated areas creates lower fire intensities, safer conditions and improved success rates for firefighters. These factors combine to increase the ability to control and extinguish wild-fires burning under all but the most extreme weather conditions. Our goal is to assess

the relative effectiveness of proposed fuel treatment projects by modeling fire behavior with high quality fuel data under realistic fire weather conditions. This modeling process, when compared with field observations from experienced operations personnel, is expected to provide useful decision-making support in choosing among competing fuel treatment alternatives to produce maximum fire safety with limited public funds.

Decision Criteria for Strategic Fuel Modification Projects

Identifying potential strategic fuel modification locations is only the first step in evaluating fuel treatment projects. Hazard fuel reduction proposals need to be rigorously evaluated to determine if a project will measurably reduce the fire hazard to homes or other resources identified to be at risk from wildfire, and should be evaluated with a formal decision model. The SMM National Recreation Area's Fire Management Plan outlines a decision model (NPS 2004). The use of a decision model ensures that an explicit risk/benefit analysis will be considered. It will make sure changes in fire behavior and potential enhanced protection from wildfire as a result of fuel treatment will be weighed against ecological risk from either subsequent wildfire or cyclic fuel treatments. The effects of fuel treatments are evaluated through the use of fire growth and behavior simulation programs (FARSITE and FlamMap) to determine how the proposed action would affect both fire spread and fireline intensity. The ecological risk is evaluated based on the best available data regarding vegetation and species' response to fire parameters including fire intensity and fire return interval.

Conserving Wildlands for the Future

Although the plant communities of the Santa Monica Mountains are tolerant of wildfire and resilient to a relatively wide variation in the fire return interval, it has been shown that chaparral communities can be degraded by high fire frequencies with a short fire return interval (Keeley and Fotheringham, 2003). The current mean fire return interval in the Santa Monica Mountains is 32 years. Only 1.6% of the vegetation is more than 77 years old. In the high fire frequency environment of the Santa Monica Mountains, no plant communities are considered to be at risk from an excessively long fire-free period. In contrast, short fire return intervals have had a drastic impact on native chaparral in some parts of the mountains. Areas where the fire return interval has been less than six years have experienced a significant decline of obligate seeding chaparral shrub species with subsequent type conversion from chaparral to grassland or coastal sage scrub (photo 32) (Jacobsen et al. 2004). With such high fire frequency years, the danger to native plant communities in the Santa Monica Mountains from fire is almost exclusively due to too-short a fire return interval.

Because chaparral is a fire climax community in which vegetation rapidly re-accumulates after fire or thinning, it is important to ask whether the benefits of reduced fire risk from proposed fuel treatments would last long enough to justify their ecological and economic cost. Frequently repeating a fuel treatment is expensive and increases ecological risk of type conversion and exotic species invasion. The trade-off between maintaining fire hazard reduction and limiting ecological risk to a chaparral plant community is illustrated by the graph in figure 6-5. This figure is based on chaparral

dominated by *Ceanothus megacarpus*, an obligate seeder species. The fire hazard curve shows that fire hazard is virtually non-existent in the first years following fuel treatment but then gradually increases with regrowth and reaches a threshold value sometime between 25–35 years post-fire. The benefits from treatment with respect to reducing fire hazard are at their maximum in the first years following treatment. Conversely, ecological risk of extinction for an obligately seeding chaparral species is highest in the first years post-treatment when a repeat fire would eliminate the population by killing all seedlings before the seed bank had been replenished. Ecological risk to the community gradually declines until approximately 15 years post-treatment when sufficient seed is available to replace the population in the event of another fire. Similar curves can be generated for any plant community based on its fire/fuel characteristics, the regeneration mode of the dominant species, and its sensitivity to repeated fires.

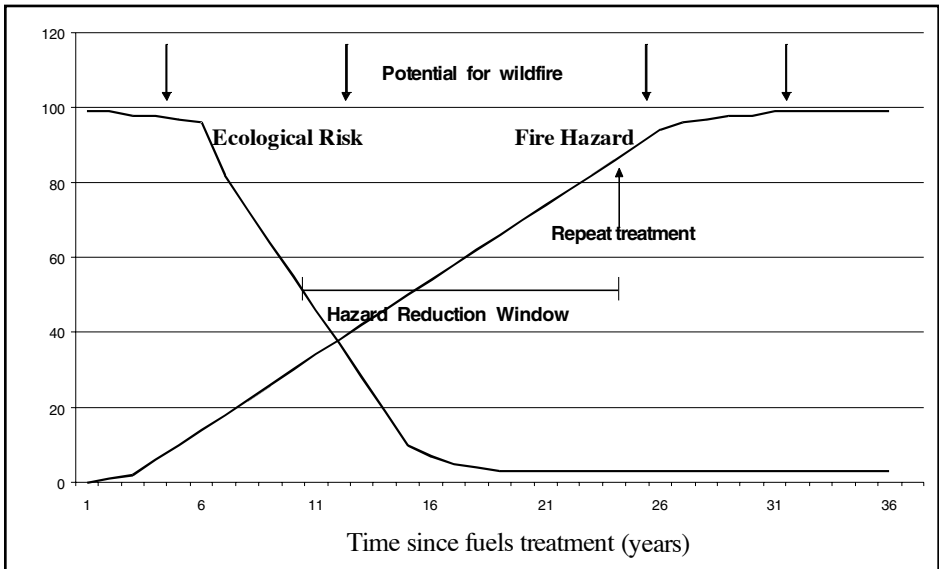


Fig. 6-5 Fire Hazard vs. Ecological Risk. Line graph estimating the trade-off between maintaining fire hazard reduction and limiting ecological risk to a chaparral plant community.

Any type of fuel modification project is meant to reduce the risk to communities from wildfire, but their effectiveness depends on when a wildfire occurs along the post-treatment timeline. This is illustrated with the arrows indicating the potential for a wildfire event at various points along the post-treatment timeline in figure 6-5. When a wildfire occurs early in the post-treatment timeline, the treatment will be most effective in providing protection and risk reduction, but only minimally effective when a wildfire occurs late in the timeline. The inherent conflict between fire hazard reduction and resource protection is that fuel treatments that provide the most benefit with an early wildfire also have the greatest potential to seriously degrade native plant communities.

In this example, it is only during the intermediate post-treatment time frame that treatment is both effective at reducing risk and does not adversely impact the plant community. The time between median ecological risk and the time at which re-treatment is necessary is called the “hazard reduction window.” The hazard reduction window is the period of time during which wildfire behavior would be successfully modified by the treatment and which would not adversely affect the composition of the native plant community. Obligate seeding species such as *Ceanothus megacarpus* are the most sensitive to short fire-return intervals i.e., they have the longest post-treatment period in which they are subject to ecological risk from fire return. Vegetation dominated by facultative seeder and obligate resprouter species will generally have a shorter post-treatment risk period.

All fire management strategies to reduce wildfire losses by fuel (vegetation) manipulation will degrade the quality of our native habitats because of the need to reduce the fuel load that is characteristic of the vegetation. Even defensible space around homes, one of the key components in the fire-safe strategy to reduce structural losses, has an enormous cumulative impact on loss of native habitat, spread of nonnative invasive species, and habitat fragmentation.

In the long term, only better land use planning with appropriate zoning and structure siting can stop the parallel processes of habitat degradation and spiraling fire costs. Increased development in the wildland-urban interface has been repeatedly identified as the cause of the escalating public costs of wildland fire suppression. It has been argued that providing public dollars to protect private property in an extreme wildfire environment allowed the development and urbanization of the Santa Monica Mountains (Davis, 1999). At a minimum, development should be limited to defensible sites (e.g., off of ridgelines and set back from steep slopes) and to sites with safe access (e.g., no lengthy or midslope driveways, adequate road capacity for evacuation).

It is impossible to create a fire safe environment for homes in wildland areas of southern California without unavoidable environmental impacts to habitat, wildlife, soil, and geology. In the absence of wise land use that acknowledges the reality of the southern California fire environment, we can only try to reduce the magnitude of the impacts from poor planning with appropriate design, construction materials and landscaping. To minimize the environmental effects of creating a fire safe home, residents in wildland areas should use fuel modification techniques that preserve native species; use appropriate native landscaping; remove serious weed species; avoid nonnative plants that increase fuel load; limit the use of irrigation; preserve slopes; and appropriately site structures to limit the size of the fuel modification zone. Fuel modification zones should be limited to the minimum required to effectively protect structures from ignition due to radiative heat transfer or direct flame impingement. Fire Departments should analyze individual sites and avoid requiring fuel modification beyond 100 feet unless it can be demonstrated by fire modeling that 100 feet would be inadequate to prevent structure loss or inadequate to provide a safe haven for residents and firefighters.