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Tejon Ranch Conservancy

Photo Credit: Sean McKnight



**FIRE MANAGEMENT STRATEGIES FOR TEJON RANCH**  
<http://fiesta.bren.ucsb.edu/~tejonfire/>

**Background**

Tejon Ranch is a 270,000 acre private property situated at the intersection of the Sierra Nevada, Mojave Desert, Coastal Range, and San Joaquin Valley bioregions. The Ranch’s size, location, and lack of fragmentation present an opportunity to protect a diverse array of species and habitats within a single reserve. Under a 2008 land use agreement, the vast majority of the Ranch is to be set aside for permanent conservation and managed by the Tejon Ranch Conservancy. As the Conservancy begins to manage the protected areas of the Ranch, it must consider fire as a natural process in the Ranch’s varied ecological communities. Fire can promote healthy ecosystems by influencing vegetation composition and structure. It can also adversely impact ecosystems that have not evolved to tolerate fire. On Tejon Ranch, fire frequency is increasing, likely due to the influence of climate and land use change. Proactive fire management actions may be warranted to protect the long-term functioning of the Ranch’s ecosystems in the face of changing fire regimes.

**Objectives**

This group project sought to assist the Conservancy by developing fire management recommendations for incorporation into its Ranchwide Management Plan. Specifically, the project aimed to:

- investigate the role of fire in the Ranch’s major ecological communities, and
- develop and evaluate fire management strategies for these communities.

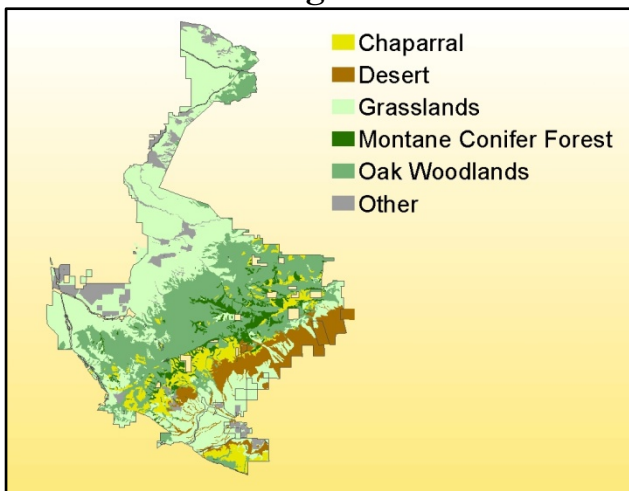


**Methods**

A combination of fire record research, fire return interval departure analysis (FRID), literature review, and computer modeling was used to accomplish the objectives. The project examined fire history on Tejon Ranch to characterize changes in the seasonality, size, and origin of fires over the past 60 years. FRID expanded on this analysis by showing the departure from historical fire frequency for each community on

the Ranch. To develop community specific management recommendations, an extensive literature review was carried out on fire ecology, fire management strategies, and drivers of fire. Additional analysis to simulate the effects of climate change, land use, and fuel treatments was done using a forest landscape model called LANDIS-II. The results from these analyses were drawn together to develop recommendations for the ranch.

**The Ranch’s Ecological Communities**



**Grasslands**

Non-native annuals dominate the Ranch’s San Joaquin Valley grasslands, while native grasses and forbs are relatively abundant in its Mojave grasslands. Historically, Native Americans burned grasslands frequently (even on an annual basis in some areas). Today, however, grasslands on the Ranch only burn when natural or accidental fires occur. The management goals for this system are to maintain biodiversity and prevent the loss of native species. Continued fire suppression and grazing are both recommended, although it is important to note that their effects on grasslands are not fully understood. It is recommended that careful monitoring be carried out to track changes in the abundance and distribution of native species. If native grasses appear to be declining, more aggressive management may be needed.

**Chaparral**

Stands of chaparral are distributed along the southeastern slopes of the Tehachapi Mountain Range and the southern edge of the Ranch. Chaparral species are well adapted to fire: many respond by producing new sprouts and seedlings, and some require chemical cues from fire for germination. However, chaparral fuels are highly flammable, and typically burn in high severity crown fires that can escape containment when driven by strong, seasonal winds. In addition, chaparral on Tejon Ranch borders more fire-averse ecological communities. Thus, in managing fire in this system, it is important to balance the ecological need for fire with the need to reduce wildfire hazards. Over the past century, the majority of chaparral on the Ranch has burned at variable frequencies in natural wildfires or prescribed burn treatments, and it is likely that variable fire frequencies have promoted a diversity of species with different fire adaptations. Continued fire suppression is recommended to reduce wildfire hazard.

**Montane Conifer Forest**

Mixed conifer, white fir, and incense cedar forests occur in the higher elevation regions of Tejon. Historically, frequent low-severity ground fires maintained relatively low tree densities and open understories in these areas. While localized crown fires occurred occasionally, these conifer forests were not highly susceptible to large, stand-replacing fires. In the modern period, a lack of fire may be leading to increased fuel loads and tree densities, which could increase the risk of stand-replacing crown fires. In light of these risks, management goals for conifer forests include preventing type conversion and promoting a mature, open forest structure. It is recommended that the Conservancy monitor fuel loads and forest density, and consider the use of active thinning treatments where necessary. Conifer forests may also benefit from the exclusion of livestock grazing, which can greatly increase the density of conifer seedlings.

**Oak Woodlands**

Oak woodlands comprise approximately 30% of the Ranch. These areas represent a wide diversity of habitats, ranging from park-like savannahs dotted with valley oaks to dense forests dominated by canyon live oak. Oaks are well-adapted to low-intensity ground fires, which occurred frequently in many oak woodlands in the past. Over the past century, however, fire suppression has greatly reduced the frequency of fire in oak woodlands on Tejon Ranch. The absence of fire can lead to fuel build-up, which increases the risk of catastrophic crown fires, although widespread livestock grazing on the Ranch appears to be keeping fuel loads under control. Management goals for oak woodlands on Tejon include promoting oak regeneration, preventing type conversion, and maintaining an overstory of mature oak trees. It is recommended that the Conservancy monitor fuel loads and oak recruitment but avoid the use of active management strategies (such as prescribed burning) unless a compelling need arises.

**Desert**

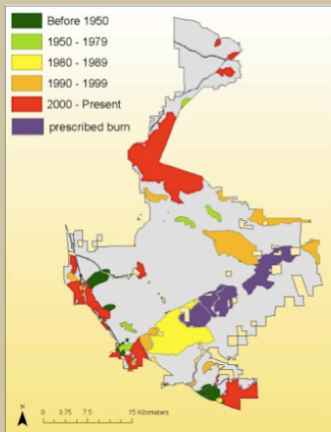
The Ranch hosts Joshua tree woodlands and desert scrub along its southeast edge. Fires burn very

infrequently in these communities. The majority of the Ranch’s Joshua tree woodlands and desert scrub have not burned since California started keeping fire records in the late 19<sup>th</sup> century. However, increased fire frequency has been seen elsewhere in the Mojave due to disturbance-exploiting invasive annual grasses, such as cheatgrass. These invasive grasses can create a continuous fine fuel layer which increases fire spread and frequency in desert communities that are not well adapted to recover from fire. The Ranch’s deserts are relatively far from this outcome, but invasive grasses have established a foothold. Continued fire suppression, as well as monitoring of annual grass invasions, is recommended in the Ranch’s deserts.

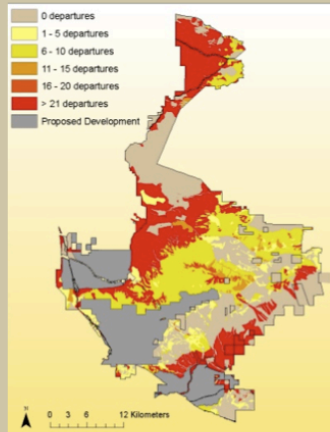
**Riparian Zones**

Tejon Ranch has valuable riparian habitat that is remarkably intact. Riparian communities are characterized by low severity fires, with fire frequency heavily influenced by the surrounding communities. Given this strong interaction with adjacent ecosystems, preserving and enhancing the diversity of vegetation types across the Ranch is important for maintaining healthy riparian systems. Key to accomplishing this goal is incorporating riparian communities into the management plans for

**Fire History on Tejon Ranch**

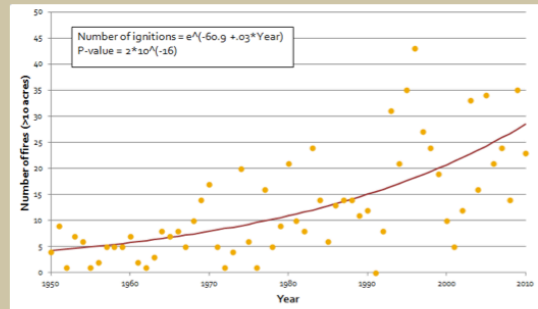


Recorded fire history on Tejon Ranch



FRID analysis showing estimated range of fire interval departures

Fires have become more frequent on Tejon Ranch and in the region since 1950, likely due to anthropogenic ignitions. Yet, FRID analysis suggests fires on Tejon Ranch occur less frequently than estimated pre-European settlement fire frequency. In fact, many areas have not burned during the period of record.

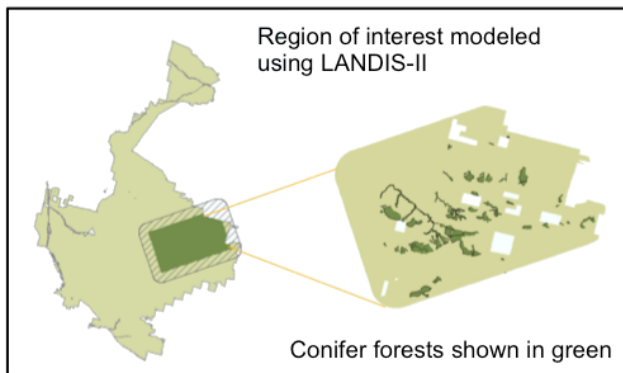


Number of fires occurring per year since 1950 in the 4 USFS ecoregion subsections which converge on Tejon Ranch

surrounding communities. This includes consideration of how fuel treatments and other fire management actions in these surrounding areas will impact the riparian community. Additionally, some areas of riparian habitat on Tejon warrant active management because of increased risk caused by climate change, tamarisk (an invasive plant), and proximity to roads.

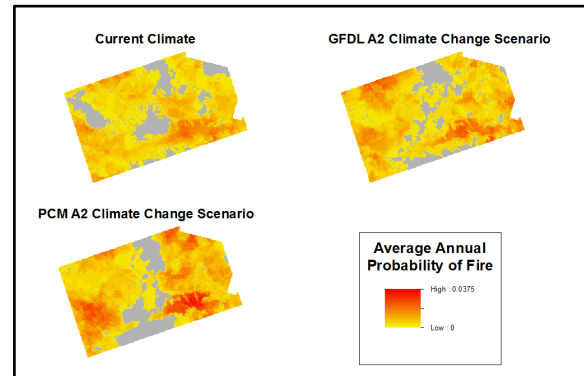
## Modeling Climate Change and Management

A computer model, LANDIS-II, was used to explore the effects of climate change and management treatments on fire regimes in a selected portion of the Ranch over the next 50 years. The selected region comprised approximately 32,000 acres and encompassed most of the conifer forests on the Ranch.



Climate change was simulated using the A2 emissions scenario and two Global Circulation Models (GCMs). The results indicated that the annual probability of fire may increase in areas that are already prone to frequent fires, such as Brewer's oak woodlands.

Two management treatments – hand thinning and a combination of thinning and prescribed burning – were simulated in conifer forests. It was hypothesized that these treatments might reduce the prevalence of fire in treated areas by reducing fuel loads. While the results showed no significant effect on fire frequency in the treated areas, the treatments may have decreased fire severity.



## Conclusion

Our analysis suggests that fire regimes on the Ranch may be changing. Fires on the Ranch have become more numerous in recent years and they may be increasing in size. However, this change is unevenly distributed: even with greater numbers of fires in recent decades, parts of the Ranch are actually burning less frequently than historical norms. As climate change intensifies, and continued development leads to more human caused ignitions, the Ranch's fire regimes may continue to shift.

Understanding these changes is likely to require improved monitoring of fuel conditions in the Ranch's major ecological communities. With the exception of fire suppression, which is recommended throughout the Ranch, adaptation measures will vary by community.

## Acknowledgements

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