Ecology and Management of Oak Woodlands on Tejon Ranch

Recommendations for Conserving a Valuable California Ecosystem

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INTRODUCTION

In 2008 a landmark agreement between a consortium of environmental groups and Tejon Ranch Company permanently protected 178,000 ecologically valuable acres on Tejon Ranch, and created the Tejon Ranch Conservancy.

The goal of this proect was to provide the Conservancy with analyses and recommendations for the oak woodland section of their Ranch-Wide Management Plan.

SIGNIFICANCE

Tejon Ranch is the largest contiguous private property in California encompassing 270,000 acres at the convergence of four major ecological regions. The ranch is home to many rare and endemic species and a variety of vegetation communities including some of the most intact oak woodlands remaining in California.

The Tejon Ranch Conservancy has a unique opportunity to preserve a large, contiguous block of some of the most scenic and ecologically valuable oak woodlands in California.

METHODS

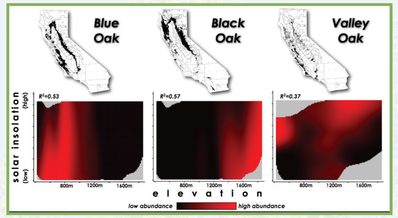
Soil, tree, and understory data was collected in 105 oak woodland plots

Overview of the methods and analysis done in this study:

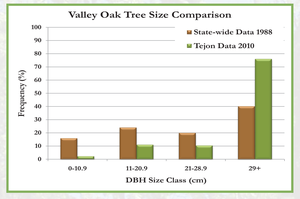
METHOD	PURPOSE
Timber Survey Map Validation	Quantify map uncertainty
Mutual Information Analysis	Stratified random sampling for plot selection
HyperNiche Species Environmental Gradient Modeling	Model species distributions as determined by environmental predictors
MaxEnt Species Distribution Modeling	Climate suitability forecasting
Historical Photo Analysis	Quantify change in population growth rate over
Comparative Analysis: Tejon Ranch vs. California	Oak stand structure & management comparisons

RESULTS

Extent, Distribution and Condtion of Tejon Oak Woodlands



Environmental gradient analysis was used to characterize Tejon's oak woodlands. Blue, valley and black oaks occupy distinct environmental locations on the Ranch. Blue oaks (left) persist at lower elevations while black oaks (center) are found at higher elevations above 1200m. Valley oaks (right) at Tejon show a very unique bi-modal distribution, occurring both at low and high elevations on the ranch. Tejon's oaks are at the southern extent of their ranges and as a result are found at relatively high elevations.



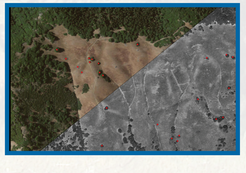
Comparing Tejon's Oak Woodlands to those of California

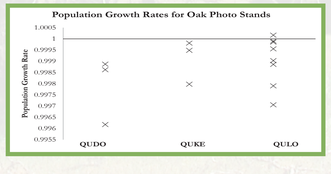
We compared stand basal area and tree diameter at breast height (DBH) in our plots to those recorded in a statewide sample by the U.S. Forest Service. Tejon's oak woodlands, particularly valley and black oak woodlands are better stocked than average. Tejon's valley oaks (left) are larger than average. Blue and black oaks showed a similar trend.

Oak Woodland Regeneration

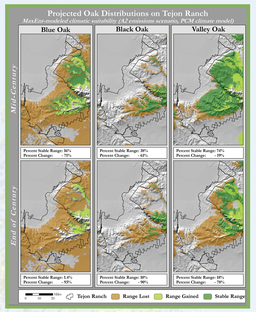
We compared archival air photos from 1952 and 2009 to determine how oak populations on the Ranch are changing over time. The estimated annual population growth rates for our three focal species are shown below. While these growth rates are only slightly less than one, oak populations will experience a 9% decline over the next 50 years if these current rates continue.

Oak population growth rates are known to fluctuate over time and it is possible that the 57 year period we investigated was a time of unusually low population growth. Nonetheless, we recommend that the Conservancy initiate management trials in order to determine how best to reverse this slow but significant decline in oak populations on the ranch.





RESULTS CONTINUED



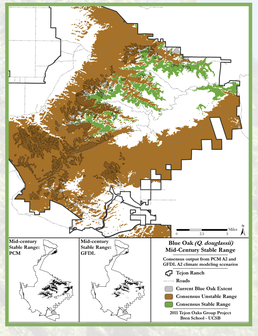
Climate Change

We modeled future oak distribution and found a general decline in suitable habitat for oaks by mid-century and further reductions by the end of the century. Suitable habitat is predicted to move upslope and toward north facing aspects.

Of the three species modeled, blue oaks (left panel) are predicted to have the greatest loss of climatically suitable habitat.

FINAL RECOMMENDATIONS

Tejon contains relatively large oak trees that are relatively well stocked, however there is a slow but significant decline in oak populations, and significant expected shifts in climatically suitable habitat. While grazing of acorns and understory by cattle, deer, elk, and pigs also pose a threat by impacting oak regeneration, our research did not characterize these relationships, and the Conservancy must initiate management trials to do so.



Management efforts should be focused on areas where climatically suitable habitat is predicted to be stable over the next 50 years (left). These areas will be climatically suitable for oak species today, allowing recruitment and establishment of new oaks, and will remain suitable into the future.

Management actions that may boost recruitment include large scale exclosures designed to exclude cattle and other large ungulates that consume acorns and browse seedlings and saplings.

ACKNOWLEGEMENTS

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Tejon Ranch CONSERVANCY

For additional information: http://fiesta.bren.ucsb.edu/~tejonoaks/