

# Fire History in Coast Redwood Stands in San Mateo County Parks and Jasper Ridge, Santa Cruz Mountains<sup>1</sup>

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## Abstract

Fire regimes in coast redwood forests in the northeastern Santa Cruz Mountains were determined by ring counts from 46 coast redwood stumps and live trees. The earliest recorded fire from two live samples was in 1615 and the last fire recorded was in 1884, although samples were not crossdated. For all sites combined, the mean fire return interval (FRI) was 12.0 years; the median FRI was 10 years. There was a significant difference in mean FRI between the four sampled sites. Past fire scars occurred most frequently in the latewood portion of the annual ring or during the dormant period. It is probable that the number of fires recorded in coast redwood trees is a subset of those fires that burned in adjacent grasslands and oak savannahs. The Ohlone and early immigrants were probably the primary source of ignitions in this region.

*Key words: fire return interval, seasonality*

## Introduction

Evidence of past fires is common in California's coast redwood (*Sequoia sempervirens* (D. Don) Endl.) forests. Redwood trees and stumps commonly exhibit fire scars in their annual growth rings, charred bark, and burned-out basal cavities. Recent research has documented the ecological role of fire in coast redwood forests (Brown and Baxter 2003; Brown and others 1999; Brown and Swetnam 1994; Finney and Martin 1989, 1992; Jacobs and others 1985; Stuart 1987).

The objective of this study is to determine the fire history of four coast redwood stands in the northeastern Santa Cruz Mountains of California. This is only the second fire history study done using fire scars in the southern portion of the coast redwood range, the first (Greenlee 1983) was a small study that analyzed samples from two stumps to estimate past fire frequency.

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<sup>1</sup> This paper was presented at the Redwood Science Symposium: What does the future hold? March 15-17, 2004, Rohnert Park, California.

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## Methods

Fire scars were collected from the east-side of the northern Santa Cruz Mountains in San Mateo County, California. Three locations were included in this study, Stanford Universities Jasper Ridge Biological Preserve (Jasper Ridge), and two San Mateo County Parks, Huddart and Wunderlich. The three areas were reconnoitered to determine where clusters with fire-scarred materials were located. Each cluster that contained a minimum of seven fire scarred samples over an area  $\leq 5$  ha was selected for sampling. Partial cross sections were cut with a chainsaw from all fire-scarred snags, downed logs, and live trees with visible fire scars within the four fire scar sampling areas.

To determine the FRI's, annual rings between successive fire scars were counted for each sample and summarized for samples within each cluster. The position within the ring in which a scar occurred was noted as EE (early earlywood), ME (middle earlywood), LE (late earlywood), LW (latewood), D (dormant), or U (undetermined) to serve as an estimate of the season of fire occurrence (Dieterich and Swetnam 1984).

## Results and Discussion

Degradation of remnant materials from decay and post-harvest fires severely limited available fire scars in this region. FRI's were found to be frequent for the period of record (~1500s to 1800s) (*table 1*). For all sites combined, mean FRI was 12.0 years (SEM = 0.5); the median FRI was 10 years. There was a significant difference in mean FRI between the four sites (K-W test statistic = 15.2,  $p = 0.002$ ) but not between aspects (*table 1*). The earliest recorded fire from two live samples was in 1615 and the last fire recorded by both samples was in 1884 based from ring counts. Despite having several fire scar years coincident between the two samples, we do not consider these dates to be absolute.

**Table 1**—Fire history statistics for four coast redwood forests in San Mateo County. Mean values in a column followed by the same letter are not significantly different ( $p < 0.05$ ). SE = standard error of the mean.

	N samples	General aspect	Average FRI (SE)	Median FRI
Huddart 1	13	NW-NE	13.1 <sup>b</sup> (0.9)	11
Huddart 2	8	NE-S	16.1 <sup>b</sup> (1.9)	11
Wunderlich	13	NE-S	9.3 <sup>a</sup> (0.4)	9
Jasper	12	NW	14.1 <sup>b</sup> (1.4)	10

Comparison of fire frequency in coast redwood forests is confounded by several factors including differing methodologies (ring-count, crossdating, sprout aging), differences in the size of the sampled areas, and if MFI's are computed from intervals between fire scars or the actual differences in calendar dates between scars.

The season of fire occurrence was determined for 50.3 percent of the fire scars. Past fire scars occurred most frequently in the latewood portion of the annual ring or during the dormant period (99 percent). Early growing season (earlywood) fires were very rare (1.7 percent). Precise estimates of the seasonality of past fires in coast

redwood forests requires additional cambium phenology studies to characterize tree-ring growth within a year at different locations and elevations (Caprio and Swetnam 1995).

Lightning ignited fires are relatively rare in the coast redwood region because of modest topography and moist conditions that usually accompany lightning storms. The most common ignitions in this forest type were from Native Americans (Brown and Baxter 2003; Brown and others 1999; Brown and Swetnam 1994; Finney and Martin 1989, 1992; Fritz 1931; Stuart 1987). The Ohlone (Costanoan) Indians have lived in this region for thousands of years and they used fire as a management tool (Lewis 1973). Native Americans burned these areas for diverse purposes including increasing the efficiency of food gathering, reducing acorn eating insects, to clear areas for travel, to produce high quality cordage materials, and to increase food production (Blackburn and Anderson 1993, Brown 2001, Lewis 1973). Early ranchers and farmers also burned these areas during the 19<sup>th</sup> and early 20<sup>th</sup> centuries.

The first recorded Spanish expedition entered this region on November 6, 1769, when the first Portola expedition camped in Portola Valley. Shortly after this expedition the number of European immigrants increased because of abundant natural resources and easy access from the San Francisco Bay.

Continued development of old-growth and young-growth coast redwood parklands toward prehistoric conditions may be dependent of a fire regime where prescribed burning substitutes for the now-absent aboriginal ignitions.

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