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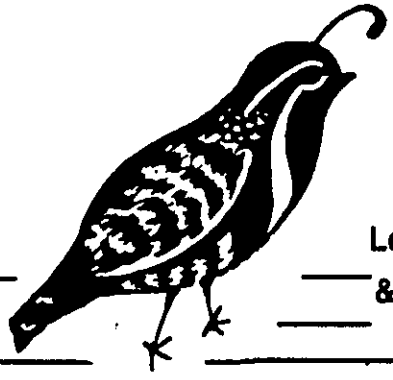
VEGETATION AND FIRE MANAGEMENT BASELINE STUDIES:

THE MARIN MUNICIPAL WATER DISTRICT AND THE MARIN COUNTY OPEN SPACE DISTRICT (NORTHRIDGE LANDS), MARIN COUNTY, CALIFORNIA

Excerpt: Redwood Fire Scar Analysis (Pages 31 - 33)



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JUNE 1991

SUMMARY REPORT

VEGETATION AND FIRE MANAGEMENT BASELINE STUDIES FOR THE MARIN MUNICIPAL WATER DISTRICT AND MARIN COUNTY OPEN SPACE DISTRICT (NORTHRIDGE) LANDS

Summary Report

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Fire History from Fire Scars in Redwoods

Using fire scars to date fire events is a well-recognized tool. Almost any woody plant which survives a fire can contain a fire scar. Such scars can be identified by recognizing the normal patterns of healing after fire induces wounds to woody tissues. Fire scars can be identified by viewing a cross-section of the tree. However, it is noted that the fire scar record derived from any one tree is generally incomplete as some fires will not scar each tree while other fires may erase scars of earlier fires. Redwood trees are excellent subjects for scar analysis because of the longevity of these trees and the resistance to rot of the heartwood thereby providing the conditions for the survival of fire scars.

The fire scar analysis conducted by Mr. Mark Finney for this report was based on samples taken from the Bolinas Ridge/Kent Lake area. Using 45 samples from 8 sample areas, fire data were determined and a master fire chronology was prepared.

The analysis of the 45 samples revealed a total of 217 separate fires between the years of 1399 and 1945. The data indicates that fire intervals between the 16th and 18th centuries were considerably shorter than the intervals prevailing during the latter half of the 19th and early 20th centuries. Records from older eras (before 1500) are too incomplete to provide meaningful data. Analysis of mean fire intervals shows that these intervals increased dramatically after the mid-1800s. Mean fire intervals during the 16th, 17th, and 18th centuries were about 1/2 to 1/6 the length of those found for the latter 19th and early 20th centuries. For example, mean fire intervals for the whole study area (2000 hectares) increased from 1.5 to 13.5 years between the last half of the 18th century and the first half of the 20th century. The data also indicate that the pre-European fires tended to be relatively small fires while the fires in more recent times burned larger areas.

Fire was a frequent phenomena in the redwood area of the water district. The data indicate that small fires burned any one 5 hectare area about every 4-10 years during pre-settlement times (pre-1800). It is likely that at least one fire burned somewhere on the water district every year (given the fact that the mean fire interval for the 2000 hectare study area was less than every two years). While this data cannot be used to precisely describe fire periodicity in other parts of the Study Area, the one sample taken from a stump at Fish Gulch to the east of the Bolinas Ridge area indicates similar fire intervals for that area.

The data suggest that mean fire intervals have increased dramatically since around 1800 to the present fire free period of 45 years after the large fire of 1945. The fires that burned the Study Area since 1900 appear to have been more extensive than earlier fire events; in addition, these fires appear to have been more intense with consequent vegetation changes (see earlier discussion of the displacement of Douglas fir on Bolinas Ridge). While it is not possible to accurately reconstruct fire boundaries, it appears that the fires of 1923 and 1945 occurred at almost all sample locations within the Bolinas Ridge study area. Evidence of a fire in 1904 is also very widespread, and the fire of 1890 was

recorded on most samples taken from Bolinas Ridge. Earlier in the 19th century, fires appear to have been more numerous and fire evidence more localized, although there were some fires - 1837, 1824, 1811 - which were recorded more extensively. During the 17th and 18th centuries, fires apparently occurred almost every year at some location within the Study Area.

Fire History from Recorded Sources

In addition to the fire scar analysis, a detailed historic study of fire records was conducted; this report prepared by Julia Gaudinski under the guidance of Dr. Jason Greenlee is also included in the Technical Appendix. This study included reviewing the files of all local fire departments that maintain records, file clippings at local libraries, newspaper accounts from 1852-present, fire maps of the Marin County Fire Department, and interviews with fire department personnel. Fires were classified and mapped.

The first historic record of a fire in the area was in 1793 and the next record was not until 1852. The first historic account that is accurate enough to map the fire occurred in 1859. Newspaper accounts record large fires in the area in 1852, 1859 ("Fire in Mt. Tamalpais burned for three months"), and 1875 ("Fires raged in the 'redwoods' and the air was filled with smoke"). By the 1880s, newspaper accounts of fires became more numerous and detailed. The 1881 fire began in Mill Valley and eventually burned over 65,000 acres ("Tamalpais last night flamed its topmost peak like a volcano. The great canyon of the Lagunitas sent up clouds of flame and cinder. The territory over which the fire extended is estimated at seven miles in length and 3 and 1/2 miles in width").

These historic records show that prior to 1930 there was a fire of at least 100 acres somewhere on the water district about every three years and a fire of at least 1,000 acres about every four years. The records indicate larger fires between 1850 and 1926 then after 1930. It is believed that active fire suppression began about this time (i.e., 1930). With fire suppression, fires after 1930 tend to be considerably smaller. After 1930, only the 1945 fire burned over 1,000 acres (it burned over 20,000 acres).

Causes of Fires

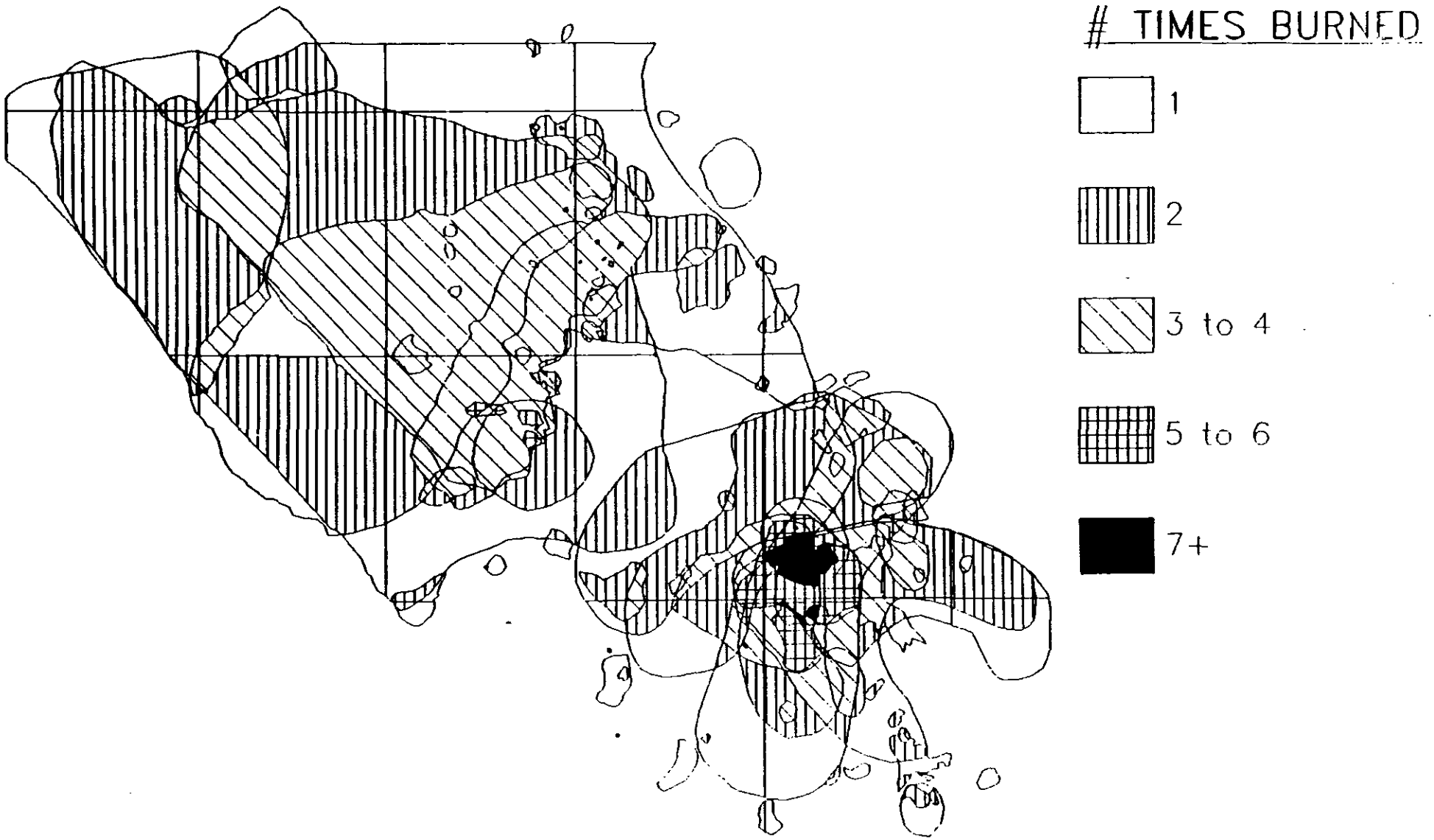
The redwood scar analysis indicates that fires occurred almost every year at some point within the Bolinas Ridge study area during the pre-settlement period. It is evident that Native Americans played an important role in burning, and their use of fire was pervasive. The contribution of lightning sources of fire ignitions to the fire regime is unclear. Lightning is uncommon in this coastal area when compared to the frequency of fires evidenced there. The separation of lightning from the total ignition record would be impossible even if lightning strike frequencies were known because the potential for successful ignition and fire spread are altered by the effects of intentional fires on area fuels and vegetation.

During the scoping meetings held prior to conducting this study, there was some interest in attempting to determine the prehuman fire regime with the suggestion

FIGURE 3

MMWD BASELINE STUDIES

FIRE HISTORY SINCE 1852



that the fire interval during this period might be considerably longer than that experienced during human occupation. It is likely that this is true, but it cannot be known. The only means of examining fire records back 12,000-to 20,000 years ago would be through analyses of old bogs where ash residue could be dated. However, the accuracy of fire prediction over any reasonable sample area based on such analyses would be very questionable.

There is no question that fire intervals may have been longer before humans appeared in the area. However, longer intervals may have resulted in larger fires once ignition did occur as is suggested by the fire data for the period of white settlement where the mean fire interval has increased as has the size of the fires. In addition, the climate would have been completely different 12,000 years ago thereby affecting vegetation and fire. Finally, there seems little point in determining what fire-vegetation patterns were prior to human occupation. Humans have occupied the area for millennia and have played a significant role in shaping the existing flora in Marin County.

5.2 Fuel Inventory and Fire Behavior Study

This section describes the methods used to define and measure the variables that determine the degree of fire hazard. The identification of areas of greater hazard was done using a Geographic Information System (GIS) which could correlate the numerous variables involved.

In order to assess the potential fire hazard situation on the Study Area, it was first necessary to gather data on the conditions that influence fire behavior. Data on slopes were collected and mapped, and weather data were collected. A major study of Study Area fuels was prepared (see Sapsis study in the Technical Appendix). The study of fuel conditions is quite technical, and only a brief summary is provided below. The reader who requires a complete understanding of fuels and the fire behavior of these fuels is directed to the Sapsis report.

There are many factors related to fire behavior including fuel loads (the volume of biomass), size-class distributions of the materials, fuelbed geometry, fuel continuity (both horizontally and vertically), fuel chemistry, and fuel moisture. Additionally, there are the physical characteristics of a given site (e.g., slope and aspect) and environmental conditions (e.g., relative humidity and windspeed) which affect fire behavior.

Fuel load estimates and fire behavior modelling inventories were conducted for 13 different vegetation types including Douglas fir forest, redwood forest, Sargent cypress forest, Bishop pine forest, mixed shrub, serpentine chaparral, chamise, coastal scrub, tanoak woodland, coastal live oak woodland/savannah, serpentine grassland, non-serpentine grassland, and wet meadow. The methodology of estimating fuel loads is included in the Sapsis report.