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RESEARCH REPORT

Research team studies fire history and forest structure in mixed conifer forest under an unmanaged fire regime

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Executive Summary

This research project gives quantitative information on what types of forest structures (live tree densities, fuel loads, snag densities, regeneration patterns, fire history, etc.) exist in a Jeffrey pine mixed-conifer forest containing a disturbance regime which has not been affected by management, with the exception of livestock grazing. Analysis of fire scar data concludes that the fire return interval of the Sierra San Pedro Martir (SSPM) in Baja, California, Mexico is less than 15 years. The distribution of trees in this forest can be classified as clumped. It was also found that there are differences in size and distribution of trees between the forests of the SSPM and that of a similar forest type (in the Santa Rosa Mountains of California) that has been managed using fire suppression. Researchers expect this information

to assist in the development of guidelines for the management of California's mixed conifer forests.



Researcher determines age of tree using a power increment borer.

Major Accomplishments

- ◆ Conifer forests in northwestern Mexico have not experienced systematic fire suppression or logging, making them unique in western North America. Fire regimes of *Pinus jeffreyi* mixed conifer forests in the Sierra San Pedro Martir, Baja California (SSPM), Mexico were



Landscape view of
Sierra San Pedro
Martir, Baja California

determined by identifying 105 fire dates from 1034 fire scars in 105 specimens. Fires were recorded between 1521 and 1980, and median fire return intervals were shorter than 15 years at all compositing scales. Significant differences in mean fire return intervals (FRI) were detected

from 1700-1800, 1800-1900, and 1900-1997 most often at intermediate spatial compositing scales, and the proportion of trees scarred in the fires of the 1700s was significantly different from either the fires of the 1800s, the 1900s, or the combined post-1800 period. There was no statistical difference between the proportions of specimens scarred in the 1800s compared to the 1900s.

- ◆ Superposed epoch analysis determined that moderate and large spatial scale fires occurred on significantly dry years during the length of the record, but before 1800 these fires were preceded by significantly higher precipitation one year before the fire. After 1800 the year before fire was not significantly wetter, but two years before fire there was a significant correlation to slightly higher precipitation. Fire regimes reconstructed using dendrochronology methods do not overstate past fire occurrence. The dominance of earlywood fires in the SSPM is similar to the seasonality found in the southwest United States and is different than the western slope of the Sierra Nevada and Klamath mountains of California.
- ◆ Using the statistical measures Ripley's k and L -hat, it was found that the spatial distributions of the trees were mostly clumped. When the analysis was formed on all species or only Jeffrey pine (the dominant species), the distribution was clumped at all size classes. However, when analysis was performed only on the white fir, the distribution was random. This information will be helpful in determining desired future conditions for California forests.



View of one of the research plots

One aspect of this project included comparing the forests of the SSPM to those of the San Rosa Mountains (SRM). Both forest types are similar, but the forests of the SRM have had nearly 100 years of fire suppression and those of the SSPM have not had fire suppression. The forest structures we investigated were rather different as a result of fire suppression. It was found that there are significant differences in the size of the trees (diameter, height, and height-to-crown base). Differences

also were found in the distributions of the trees and the amount of regeneration present. This information is useful for examining the effects fire suppression has played on our forested ecosystems.

Impact Statements

Classroom impacts

Information learned from this project has been incorporated into several courses including FNR 318 (Geographic Information Systems), FNR 315 (Mensuration and Sampling), and FNR 532 (Biometrics and Econometrics).



View of one of the research plots

Research impacts

Very large and detailed data sets were collected for this project. These data will be used in several other projects throughout the coming years. Equipment and software purchased as part of this research will be used for other projects for years to come.

Publications: submitted

Stephens, S.L., C.N. Skinner, and S.J. Gill. A Dendrochronology based Fire History of Jeffrey Pine-Mixed Conifer Forests. *Submitted to Canadian Journal of Forest Research April, 2002.* (refereed journal).

Publications being prepared:

Gill, Stephens, and Weise. Comparison of Jeffrey pine-mixed conifer forest types of the Sierra San Pedro Martir and the San Bernardino Mountains.

Stephens and Gill. Fuel loads and forest inventory of the Jeffrey pine mixed conifer forests of the Sierra San Pedro Martir.

Presentations

Gill and Stephens, "Spatial statistics to determine the distribution of trees in an undisturbed Jeffrey pine forest in the Sierra San Pedro Martir, Baja, CA, Mexico." Presented by Gill at the Western Mensurationist Meeting, Whitefish, MT. June 2000.

Stephens and Gill, "Jeffrey Pine-Mixed Conifer Fuel Loads and Snag Densities Under an Unmanaged Fire Regime in the Sierra San Pedro Martir Mountains, Mexico" Presented at Ecology and Management of Dead Wood Symposium, Reno Nevada, Nov. 1999.

Stephens and Gill, "Mixed conifer forest structure under an unmanaged fire regime in Sierra San Pedro" presented at the SAF National convention in Portland, OR, Sept. 1999.

Stephens and Gill. Mixed conifer forest structure in an unmanaged fire regime in the Sierra San Pedro Martir, Mexico presented by Stephens at Association of American Geographers 95th Annual Meeting in Hawaii, 1999.

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For More Information

This Research Report contains summarized results of Samantha Gill's study entitled "Fire History, Forest Structure and Early Land Uses in Jeffrey Pine-Mixed Conifer Forests Under an Unmanaged Fire Regime," ARI project No. 00-3-050 (Research Focus Area: *Natural Resources*). To view and/or obtain a copy of the complete final report, or to obtain additional information about this or other research projects, visit the ARI web site at ari.calstate.edu. For information specific to ARI research at Cal Poly San Luis Obispo, visit the Cal Poly site at ari.calpoly.edu.

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