Pyrogeography in Riparian ecosystems: An Indigenous Tool for Resource Management and Conservation

Final Report

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Program Director
U.S. Community Forestry Research Fellowships
College of Natural Resources
101 Giannini Hall #3100
University of California, Berkeley
Berkeley, California 94720-3100

Submitted by:

Don Hankins
Dissertation Fellow
Department of Geography and Planning
California State University, Chico
539 Butte Hall
Chico, California 95929-0425

Data provided in this report are partially preliminary and as such should not be cited without further consultation with Don Hankins

Introduction:

Land managers and conservationists struggle with the complexities of managing diverse ecosystems to support biological diversity and achieve an array of objectives. Prescribed fire has long been recognized as a tool that can effectively achieve these results in a variety of ecosystem types. With this in mind, it is often acknowledged that Native Americans have utilized fire for a variety of purposes including land management and conservation over the course of millennia. However, detailed studies of how Native Americans (and other indigenous groups globally) utilize or utilized fire to achieve such objectives are generally lacking. Recognizing a need to undertake this research a diverse cadre of research partners participated in a research project to investigate the effects and applications of prescribed fires in central California riparian forests. This research project has attempted to provide a baseline of information regarding Native American burning practices in central California riparian forests. All applied components of this research were carried out at the Cache Creek Nature Preserve in Woodland, California (CCNP) and Plant Materials Center in Lockeford, California (PMC) (see Figure I).

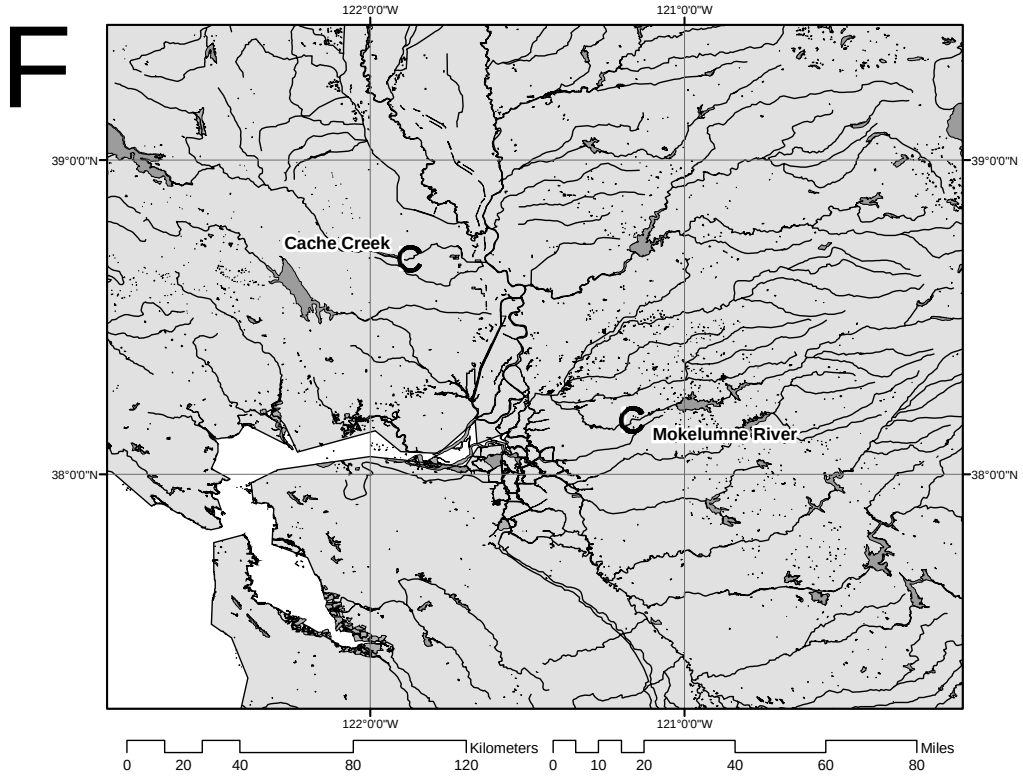

Figure I. Maps of Cache Creek and Mokelumne River study site locations. Components of this map were obtained from the California Spatial Information Library data sets.

Objectives and Hypotheses:

The primary objectives of this dissertation research are as follows: 1) study the effects of indigenous prescribed fire on riparian ecosystems in central California through implementation of wet and dry season fires; 2) integrate participation and expertise of traditional cultural practitioners and other knowledgeable individuals into the applied and investigative components of this research; and 3) facilitate an understanding of how indigenous land management practices might benefit contemporary resource management and conservation within the study region and perhaps globally

The research tested the following hypotheses:

(1) Native plant diversity and abundance (as measured in numbers of individual ground cover plants and species richness) will increase as a result of coppicing and burning
(2) Mid dry season and late wet season burning results in a decrease in canopy cover by woody vegetation (trees and shrubs)
(3) Mid dry season and late wet season burning results in a higher percent of cover by non-native ground cover vegetation
(4) Early wet season burns do not result in significant differences in trap captures and species diversity of herpetofauna and small mammals.

Preliminary Findings:

Following the first rains of late fall, prescribed burns at the CCNP were carried out on November 20 and 27, 2002 respectively, and at the PMC on December 8, 2002. During these fire events, various observations were made of fire conditions and wildlife activity. The fires were generally low intensity with average flame heights less than 3 feet. Generally, the fire could be described as a cool slow-moving fire. Primary fuels ignited were leaf litter and woody fuels less than one inch in diameter along with grasses and forbs. (Discussion of these burns exists in the previous final report for the M.A. Fellowship [Hankins 2003]).

On July 2, 2004, two mid dry season transects were burnt at the PMC. Surprisingly, the dry fuels at this site burnt with relatively low intensity, similar to those described above for the fall burns. The main difference between the fall and dry season burn is that the spatial complexity (burnt versus unburnt area) of the dry season burn was much less than observed in the fall burns in 2002. In the months following the burning of these two transects, a delayed mortality of crown growth was observed in many of the woody species. This is an interesting phenomenon because the fire did not directly scorch the canopy of these plants. However, it is probable that the heat stress at the base of these plants has triggered a response in the canopy of these plants. Although many of these plants exhibit signs of stress induced by the fire, they continue to persist as evidenced by the basal sprouting of new growth in the weeks and months following the burn. Thus, it appears that fire does affect the growth of existing woody vegetation, but does not necessarily cause widespread mortality.

Late wet season burning occurred at the Cache Creek and Mokelumne River over a period of several days throughout the month of March 2005. Since the fuels were too moist to burn using broadcast methods a hand-held propane torch was used to scorch vegetation within plots surrounding established transects. Essentially, all grasses, herbs, forbs, shrubs, and vines of low stature were burned to the ground (grasses, herbs, and forbs) or to remove all leaves (shrubs and vines). Within weeks of burning these transects with a hand-held propane torch much of the vegetation was on its way to recovery. Specifically, perennial grasses, herbs, forbs, and shrubs showed signs of vigorous growth. Due to continued rainfall following this burn treatment some annual grasses, herbs, and forbs were also showing signs of recovery.

In response to hypotheses one through three above the analysis of the data from these burn treatments suggest that all prescribed fire treatments yielded an increase in ground cover of grasses, herbs, and forbs, while also increasing the native species richness of treated areas. Additionally, the results suggest that prescribed burning has negligible impacts to shrub, vine, and tree canopy cover.

During and after the fire events, community participants observed the activity levels of wildlife within the treated areas. No mortality of wildlife was observed during any of the burns. The mid dry season burns were only completed for two transects at the PMC, and were aborted for all remaining transects at the PMC and CCNP due to the presence of nesting spotted towhees (*Pipilo maculatus*) in one of the remaining transects. Western fence lizards (*Sceloporous occidentalis*) were among the most common wildlife observed during and following burn events. Prior to and following the fall burns in 2002 a wildlife trapping was conducted to test hypothesis four above. The results suggest that fall burning had an insignificant effect on trap captures and the number of species captured. However, when outlier trap captures are removed, species richness is higher in burned areas in comparison to control areas. Thus, fall burning may be a useful tool in managing and conserving herpetofauna and small mammal biodiversity.

Field/Data Collection Experience and Successes and Challenges:

Overall, the research experience was quite successful and gratifying. However, some obstacles to the completion of the research were present. These obstacles mainly stemmed from burn treatments scheduled for dry fuel conditions. Specific obstacles included: 1) advanced scheduling of burn treatments conflicted with the permissive burn days (which are set each day) forecasted by regional air quality regulators (often, the onsite conditions were ideal for conducting burn treatments, but the conditions across the air management district were less favorable); 2) scheduling of late season burns often conflicted with fire crew unavailability; and 3) miscommunication regarding the spatial extent of the burns (the air quality management districts generally regulate prescribed burns by the spatial extent of the intended burn). Additionally, as indicated above, the presence of ground nesting birds precluded the implementation of further mid dry season burns at the PMC site. Cumulatively, these conflicts necessitated the modification of the burn treatments in order to complete the research project within the approximated timeframe for completion. At the onset of this research my community partners and I had

not considered the possibilities of such conflicts. In all, a total of three burn treatment types were implemented on a total of 16 transects divided between the CCNP and PMC study sites (*e.g.*, eight early wet season burn transects, two mid dry season burn transects, and six late wet season burn transects). These burn treatments are representative of a mixture of contemporary and traditional (*i.e.*, California Indian) burning practices.

Lessons Learned:

Throughout this research project and participation in this fellowship program, I have gained a better sense of appreciation for how communities are defined. At the onset, I had a narrowly defined community of Native American traditional cultural practitioners, land managers, academics and volunteers. Through the course of my research my view of community in relation to the project has expanded to include other crucial participants including the regional air quality control board staff and fire suppression personnel (see Appendix A). Although the broader community may have served a more peripheral role in the research process, they were integral to the success of the research.

Benefits to the Research Community:

This research serves the community in a variety of ways. It is a long-term goal that through this project fire will be utilized more broadly to achieve land management and conservation objectives at a landscape scale. Among California Indian traditional cultural practitioners the use of fire to tend to the land is an obligation. This research has served to restore this relationship between the indigenous research participants, fire, and the land. This has also aided in the realization of place-specific knowledge with respect to localized phenomena (*e.g.*, localized wind conditions). The validation of indigenous fire management practices will enable California Indian communities to cite this research when attempting to implement similar burns for resource management and conservation purposes. Similarly, land managers will have this research to reference when making decisions for achieving their management and conservation objectives for riparian forests. By familiarizing community members with the process and players involved in this research they are now aware of the complexities of implementing prescribed fires under contemporary circumstances. However, this familiarization has potentially streamlined the implementation of future burn projects between the participants by making them aware of each another and their respective intents or objectives. Fire suppression personnel have benefited from this research by enabling them to receive training and observe fire behavior under the prescribed conditions.

For additional information please refer to the dissertation:

Hankins, D.L. 2005. *Pyrogeography: Spatial and Temporal Relationships of Fire, Nature, and Culture*

Literature Cited

Hankins, D.L. 2003. *Aboriginal Management of Riparian Environments in Central California: Final Report*. Submitted to Program Director U.S. Community Forestry Research Fellowships

Appendix A