

Fire Management in Some California Ecosystems: A Cautionary Note¹

Hartmut S. Walter, Teresa Brennan, and Christian Albrecht²

Key words: Bishop pine, chaparral, closed-cone conifer, mixed-conifer forest, regeneration, stand renewal

Extended Abstract

Introduction

Fire has been recognized as a natural and important physical factor in many ecoregions of North America. We wish to point out that our understanding of the biocomplexity of our natural ecosystems is far from complete; in particular, the role of fire in vegetation succession and ecosystem health deserves more scrutiny where biodiversity conservation is a primary or major goal of management. We present four case studies from southern California that are evidence of species and community persistence and renewal in the absence of wildfire or in the presence of low frequency fire events. A simplistic application of the “fire is good and necessary” paradigm may put certain taxa and habitats at risk.

Study Areas and Methodology

1. Santa Cruz Island off Santa Barbara contains three distinct stands of Bishop pine (*Pinus muricata remorata*). This pine species has long been considered to belong to the group of closed-cone and obligate fire conifers (Vogl and others 1977). The present study searched for evidence of spontaneous cone opening, germination, and stand renewal in the absence and presence of fire. Field observations were made on live and dead trees regarding pine cone status. Cones were also collected and monitored for opening and seed release. Seeds were planted in commercial soil and mulch in the open air. Study plots on the island were monitored as to the number of seedlings per hectare. The opportunity to assess the pine’s response to a hot fire arose when a prescribed fire event went out of control in 1994 (Walter and Taha 2000). The research hypothesis was defined as *Bishop pines of Santa Cruz Island do not require periodic fire events for seed germination and stand regeneration.*

2. The North San Diego region in the Carmel Valley near Del Mar is unusually rich in endemic plant and animal taxa. Monitoring and conservation evaluation of

¹ A poster version of this paper was presented at Planning for Biodiversity: Bringing Research and Management Together, a Symposium for the California South Coast Ecoregion, February 29-March 2, 2000, California State Polytechnic University, Pomona, CA.

² Department of Geography, University of California, Los Angeles; P. O. Box 951524, Los Angeles, CA 90095-1524

several undisturbed chaparral parcels at and near Carmel Mountain was carried out in 1995-96. Dozens of vegetation transects were made, comparing burned and unburned chaparral patches (Walter 1996). The research hypothesis was worded as *The unusual arborescence, composition, and structure of this chaparral ecosystem are a result of a long absence of fire.*

3. The James San Jacinto Mountains Reserve near Idyllwild (Riverside County) is the site of a long-term post-fire succession study (Walter, in preparation) at the chaparral-mixed forest ecotone. A 5x80-m transect was established on completely burned ground at an elevation of 5,800 feet after a major wildfire in August 1974. Vegetation succession has been monitored for 25 years. The initial research hypothesis tested was *Post-fire succession includes a short-term chaparral stage of circa 15-20 years duration followed by mixed forest regeneration and dominance.*

4. The James Reserve is surrounded by a complex, unburned forest community near Hall Canyon. This mixed conifer-oak forest is species-rich and appears to contain a number of different age cohorts. For this study, we censused three slope transects of 1x100-m at 5,500 feet elevation for species abundance and tree height. The research hypothesis for this forest surrounding the James Reserve was *This species-rich and mature forest does not require fire for stand renewal.*

Results

Bishop Pine on Santa Cruz Island

After the drought years of the early 1990s a significant portion of the island's Bishop pines died. Subsequently, aided by sheep removal, seedling and sapling pines began to replace the dead trees and expand from the remnant forest stands into surrounding grassland. In 1998 and 1999, detailed studies and experiments on cones of island Bishop pine (Walter and Taha 2000) revealed that (1) some cones open while still on the tree under a normal temperature regime, (2) all cones may release their seeds when exposed to normal summer temperatures and solar radiation, and (3) seeds germinate easily and grow well in normal soil.

In 1994, study plots near pine snags contained hundreds of healthy pine seedlings; their density reached more than 1,400 seedlings per hectare. The December 1994 hot wildfire event, however, killed most remaining pine trees as well as thousands of seedlings in the affected area. Five years later (1999), only a small number of seedlings (about 10/ha) were detected on the burn site.

North San Diego Chaparral Ecosystem

Carmel Mountain and a few adjacent chaparral patches constitute rarely seen mature and over-aged chaparral with dominant shrubs such as *Ceanothus verrucosus*, *Xylococcus bicolor*, *Comarostaphylis diversifolia*, *Cercocarpus minutiflorus*, and *Adenostoma fasciculatum*. In canyon bottoms, this community forms dense arboreal thickets because one or more recent fire events jumped across slopes without burning these habitats.

On the high mesa of Carmel Mountain there is a shallow valley with open habitat dominated by shrubs, bunch grasses, rocky ground, and several small trees of mission manzanita (*Xylococcus bicolor*) attaining record heights of 5 to 7 m. Nearby, an

old California sagebrush (*Artemisia californica*) has become woody, with a diameter of about 15 cm. The vegetation must not have burned for ages, that is, over several historic fire cycles or generations. This ecosystem differs from frequently burned chaparral. It is likely quite stable and not senescent.

Chaparral-Mixed Forest Ecotone Succession (San Jacinto Mountains)

After 25 years of succession, the chaparral community (*Ceanothus leucodermis* *Arctostaphylos glauca*) is still a dominant matrix and shows no sign of senescence. Resprouting oaks (*Quercus chrysolepis* and *Q. wislezinii*) and sapling pines (*Pinus coulteri*) are a minor part of the chaparral vegetation in and around the transect. It may take more than 100 years to bring back a mixed forest stand resembling the pre-fire vegetation at this ecotone location.

Hall Canyon Forest Ecosystem (San Jacinto Mountains)

The mixed conifer-oak forest of Hall Canyon, located on the east slope of the San Jacinto Mountains, has been subjected to several natural mortality factors (drought, insects, and wind throw) over the past 25 years. However, it has not experienced a stand-burning fire in more than 200 years. An analysis of woody vegetation data (seedlings included) from three 1x100-m transects shows a mixed forest dominated by canyon live oak, black oak, incense cedar, and sugar pine. The stand structure of Hall Canyon is complex, with dominant species having average heights of 0.099 m, 0.24 m, 1.05 m, and 0.53 m respectively. The low average height values obtained are representative of the large number of seedlings and saplings observed and are also indicative of the varied age structure within the forest. Preliminary research results for the mature conifer-oak forest of Hall Canyon show significant regeneration of dominant tree species after episodes of severe drought, insect infestation, wind throw, and in the absence of fire.

Discussion

The continental distribution of the Bishop pine is peculiarly coastal and insular, suggesting that this species is actually persisting as a fire evader, although it cannot persist in more interior regions where the occurrence of hot fires is more likely. We conclude, therefore, that fire is not a necessary agent for regeneration of the island Bishop pine populations, of the species as a whole, and possibly of other closed-cone conifers as well. The Santa Cruz Island Bishop pine can be categorized as a “pyrofugal” taxon (Walter and Taha 2000).

Some North San Diego chaparral patches represent a unique biodiversity asset. We conclude that old and mature chaparral remains viable and species-rich in this coastal study region; there is a low incidence of natural fire events. Mature and fire-free chaparral constitutes a unique habitat due to the quality of its structure as well as its species composition (lichen richness, and so forth). In light of the generally short successional cycles seen in California’s chaparral ecosystems, this habitat qualifies as old growth or ancient chaparral in analogy to the old growth forests of the Pacific Northwest. Any control burn of this habitat would eliminate a unique plant and probably also a corresponding animal community. Patches of ancient chaparral deserve priority conservation management.

Our research hypothesis was not validated at our ecotone succession transect in the San Jacinto Mountains. This surprising result provides evidence that long-term fire cycles have in the historic past included between-fire intervals of 100 years or more resulting in an open conifer-oak forest with a minor understory of tall chaparral shrubs. Cultural fire suppression should be ruled out as a contributing factor to extended fire-free intervals in this part of California. The Hall Canyon forest history of the last 25 years offers further support for forest regeneration and rejuvenation in the absence of fire. Catastrophic wind throws and a severe and prolonged drought episode followed by insect infestations have opened up the forest canopy, created excellent breeding opportunities for cavity-requiring vertebrates and sunlight for tree seedlings.

References

- Agee, J.K. 1993. **Fire ecology of Pacific Northwest forests**. Washington, DC: Island Press.
- Aplet, N.J.; Olson, J.T.; Sample, V.A., editors. 1993. **Defining sustainable forestry**. Washington, DC: Island Press.
- Berg, K. 1982. **Hall Canyon annotated floristic list**. Riverside, CA: University of California, James San Jacinto Mountains Reserve, Natural Land and Water Reserves System.
- Carroll, M.C., Laughrin, L.L.; Bromfield, A.C. 1993. **Fire on the California Islands: Does it play a role in chaparral and closed cone pine forest habitats?** In: Hochberg, F.G., editor. Third California Islands symposium: Recent advances in research on the California Islands. Santa Barbara, CA: Santa Barbara Museum of Natural History; 73-88.
- Hobbs, E. 1980. **Effects of grazing on the northern population of *Pinus muricata* on Santa Cruz Island, California**. In: Power, D.M., editor. The California Islands: Proceedings of a multidisciplinary symposium. Santa Barbara, CA: Santa Barbara Museum of Natural History; 159-165.
- Spurr, S.H.; Barnes, B.V. 1980. **Forest ecology**. 3rd edition. New York: John Wiley & Sons.
- Vogl, R.J.; Armstrong, W.P.; White, K.L.; Cole, K.L. 1977. **The closed-cone pines and cypress**. In: Barbour, M.G.; Major, J., editors. Terrestrial vegetation of California. New York: John Wiley & Sons; 295-358.
- Walter, H.S. 1977. **Effects of fire on wildlife communities**. In: Proceedings of the symposium on the environmental consequences of fire and fuel management in Mediterranean ecosystems; 1977 August 1-15; Palo Alto, California. Gen. Tech. Rep. WO-3. Washington, DC: Forest Service, U.S. Department of Agriculture; 183-192.
- Walter, H.S. 1996. **Biological resource conservation and mitigation issues: Neighborhood 8A, north city of San Diego**. Los Angeles, CA: Research Report. 106 p.
- Walter, H.S.; Taha, L.A. 2000. **Regeneration of Bishop pine (*Pinus muricata*) in the absence and presence of fire: A case study from Santa Cruz Island, California**. In: Browne, D.R.; Mitchell, K.L.; Chaney, H.W., editors. Proceedings of the fifth California Islands symposium; 1999 March 29 to April 1; Santa Barbara, California. San Diego, CA: U.S. Dept. of Interior, Mineral Management Service (OCS Study MMS 99-0038); 172-181.
- Wehtje, W. 1994. **Response of a Bishop pine (*Pinus muricata*) population to removal of feral sheep on Santa Cruz Island, California**. In: Halvorson, W.L.; Maender, G.J., editors. The fourth California Islands symposium: Update on the status of resources. Santa Barbara, CA: Santa Barbara Museum of Natural History; 331-340.