



# The Study of Indigenous Management Practices in California: An Introduction

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**Abstract** The purpose of this special issue is to present the findings of a collaborative, interdisciplinary eco-archaeological project that is examining evidence for indigenous landscape management practices in central coastal California in Late Holocene and historic times. In this introductory paper, we provide some background about traditional resource and environment management (TREM) practices in California, discuss the goals of the eco-archaeological project, outline testable expectations for anthropogenic burning, and introduce the papers in the volume. The papers represent a coordinated suite of investigations that empirically evaluate the degree to which native people may have ignited fires in and around the Quiroste Valley Cultural Preserve near Point Año Nuevo. Employing diverse lines of evidence derived from archaeology, silica phytolith research, palynology, plant population genetics, and dendroecology, the authors reconstruct past fire histories, faunal and floral resources, vegetation conversions, and indigenous cultural practices in the study area. The findings of these investigations indicate that people implemented sustained landscape burning practices that maintained productive grassland habitats from about AD 1000 to the time of Spanish colonization.

**Resumen** El propósito de este tema especial es presentar las conclusiones de un proyecto eco-arceológico colaborativo e interdisciplinario, que examina evidencia de los prácticos de gestión de los recursos indígenas en la costa central de California durante los tiempos tarde holoceno y histórico. En este artículo introductorio, proporcionamos contexto de los prácticos de recursos tradicionales y gestiones medioambiental (TREM) en California, discutimos los objetivos del proyecto eco-arceológico, exponemos expectativas para examinar fuegos

antropológicos, y introducimos los artículos en el volumen. Los artículos representan investigaciones coordinadas que evalúan el grado en que gente nativa ha hecho fuegos en y alrededor de Quiroste Valley State Cultural Preserve cerca de Point Año Nuevo. Usando varias líneas de evidencia basada en arqueología, investigaciones de fitolitos, palinología, genética de poblaciones de plantas, y dendrocronología, los autores re-construyen fuegos pasados, recursos de fauna y floral, conversiones vegetales, y prácticos culturales de indígenas en el área de estudio. Las conclusiones de estas investigaciones indican que gente ha implementado prácticos de gestiones recursos sostenidos, con fuegos controlados, que mantuvieron hábitats de pastizales desde AD 1000 hasta el tiempo de la colonización española.

**For more than 40 years**, some anthropologists have argued that Native Californians were nurturing land managers who constructed productive anthropogenic landscapes through a variety of methods, including tillage, pruning, seed broadcasting, weeding, irrigation, and prescribed burning (Anderson 2005; Blackburn and Anderson 1993; Lewis 1973). Fire is one of the primary management tools described for California hunter-gatherers. California Indians ignited landscape fires for many different reasons: to clear undergrowth; to control insect and pest infestations; to facilitate game hunting; to encourage plants to produce young, straight stems and other raw materials for cordage, baskets, and other household materials; and to enhance the diversity and quantity of economic plants and animals in their territories. The scale and organization of anthropogenic burning in Native California probably varied greatly across time and space, from fires set by individuals, hunting parties, and small kin groups to more coordinated communal activities by members of larger community groups and polities (Lightfoot et al. 2013:290).

Depending on the frequency, timing, and spatial distribution of fires, regular ignitions by independently acting individuals or well-organized communal groups could have had major effects on local biodiversity and habitat structure. While the proximate reasons for the fires may have varied, the overall effects of people setting a series of small, low-intensity fires in tribal territories would have been the development of patchy mosaics of biotic communities characterized by vegetation stands at different stages of succession. The creation of patchworks of recently burned plots that placed young herbaceous plants adjacent to “islands” of more mature shrubs and trees would have enhanced the availability of seeds, nuts, greens, fruits, and tubers for exploitation. The patchy distribution of habitats would also have facilitated hunting by attracting

game to succulent young forage following burns and by providing shelter to birds, rabbits, deer, and other creatures in more established vegetation stands (Lightfoot and Parrish 2009:94–102).

The broader implications of these ecosystem-engineering activities may have been twofold: not only would they have potentially increased the diversity and availability of floral and faunal resources used by hunter-gatherers, but they may have reduced occurrences of large catastrophic fires that devour everything in their path (Lightfoot and Parrish 2009:115–122). Recent field work among Aboriginal groups in Western Australia shows that the aggregate process of many small burns employed in the hunting of small, burrowing prey may not only create fine-grained mosaics with greater biodiversity than those produced by natural fire regimes alone, but that anthropogenic burning can help mediate climate-driven catastrophic fires (Bird et al. 2008, 2012).

There is now considerable interest among tribal groups, government agencies, land-holding trusts, and the general public in anthropogenic burning and other ecosystem-engineering practices of hunter-gatherers that can augment the diversity of indigenous plants and animals, improve the health and vitality of habitats, and mitigate catastrophic fire hazard. The various activities and knowledge employed by Indian groups to enhance the diversity, productivity, and/or accessibility of local resources, defined as “traditional resource and environmental management” (TREM, Fowler and Lepofsky 2011:286), are of particular interest to restoration ecologists and federal and state land managers. They are currently exploring how TREM practices may be integrated with modern range and Forest Service protocols to generate new policies aimed at improving the management of open spaces, tribal domains, and public lands (Clewell and Aronson 2007; Egan and Howell 2001).

However, it is important to acknowledge that our understanding of TREM practices employed by California Indians in the ancient past remains rudimentary in most areas of the state. We do not yet know *when* people first initiated sustained anthropogenic burning in California or *how* they may have developed and modified these practices over time. Nor do we know much about the kinds of impacts these landscape management practices had on the scores of biotic communities distributed across the topographically and climatically distinct regions of California. Lastly, there has not yet been much research on the social organizational systems, numbers of people, and degree of community coordination involved in various kinds of eco-engineering activities.

Elsewhere, we have discussed why many specific details about anthropogenic burning are lacking in ancient California (Lightfoot and Parrish 2009:94–97). Suffice it to say, our current understanding is based primarily on observations

by Spanish and Russian colonists in the late 1700s and early 1800s, along with some sporadic ethnographic accounts in the early 1900s made after state and federal fire cessation policies had already been enacted. Crucial sources are also provided by tribal narratives, but their oral traditions vary considerably in content depending on the kinds of colonial entanglements experienced by native peoples, which were especially devastating in such places as the southern and central coasts of California.

Significantly, the field of California archaeology has not been a major player in the study of indigenous landscape management practices. Consequently, a critical source for investigating long-term, diachronic trends in anthropogenic burning and other TREM practices has been largely missing. Various reasons for this exist, including long-standing perceptions about hunter-gatherers as passive immediate-return foragers, linkages often drawn between resource enhancement practices and agriculture, and issues in how we conceptualize resource management, as we have outlined in some detail elsewhere (Lightfoot et al. 2013:287–290). But probably the most vexing reason is the significant challenge involved in documenting anthropogenic burning and other resource management practices using archaeological and ecological data sets. This is particularly true in locations where prescribed fires may have mimicked natural fire regimes, producing rather subtle shifts in relative densities of indigenous plants and animals (Lepofsky and Lertzman 2008:138–139).

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### **Eco-Archaeological Investigations**

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Despite these challenges, we argue that recent developments in the environmental sciences and archaeology are now making it possible to undertake rigorous, empirically oriented studies of anthropogenic burning in a diachronic framework. We are blessed in California with ongoing, state-of-the-art research on fire regimes, which is providing crucial information about fire histories, fire seasons, fuel sources, and the ecological impacts of fire on diverse biotic communities across the state, as well as data for modeling natural (lightning ignition) fire regimes (e.g., Carle 2008; Sugihara et al. 2006). With advances in the study of archaeology, dendroecology, palynology, silica phytoliths, geomorphology, and plant population genetics, we are now capable of undertaking sophisticated eco-archaeological investigations that can generate information about fire histories, faunal and floral populations, vegetation conversions, and indigenous cultural practices for local California regions that transcend prehistory and history.

A crucial facet of the proposed eco-archaeological research in California is generating testable expectations for anthropogenic burning. Elsewhere, we have

discussed one set of expectations that begins by modeling the parameters of natural fire regimes based on the predicted frequency of lightning strikes, which vary appreciably by place and climatic conditions over time (see Cuthrell et al. 2012; Lightfoot et al. 2013:293–295). By simulating the return intervals of lightning-ignited fires and predicting the resultant vegetation structure under natural fire regimes, ecological baselines can be generated that serve as the null hypothesis. One can then evaluate the evidence for anthropogenic burning versus the null hypothesis in light of the results of eco-archaeological investigations.

If the observed fire-return intervals and/or vegetation patterns derived from eco-archaeological field work do not differ appreciably from those expected for natural fire regimes, then we may presume that there is little evidence for human-ignited fires. That is, the observed fire regimes and biotic communities can be most parsimoniously explained by natural ecological processes. On the other hand, if significant differences exist between the observed fire frequencies and vegetation patterns with those of the null hypothesis, then this may be an indicator of anthropogenic burning. Further investigations of the ecological and archaeological data sets may then be undertaken to evaluate the degree and impact that humans may have played in shaping local biotic communities. For example, we may expect to observe archaeological evidence that aligns with fire enhancement strategies, such as the increasing exploitation of fire-dependent or fire-adapted species, along with other changes in subsistence and community structures (Lightfoot et al. 2013:293–295).

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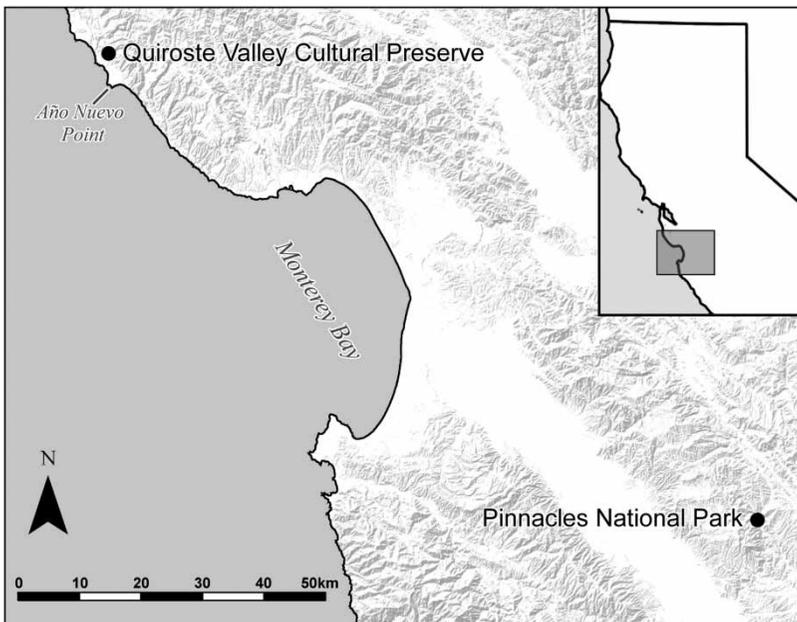
### **Collaborative Research in Central Coastal California**

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The inception of our eco-archaeological research program took place at the invitation of the Amah Mutsun Tribal Band and with the interest and support of the Muwekma Ohlone Tribe. After more than two centuries of demoralizing colonial entanglements, both tribal groups are today experiencing a cultural revival, with growing interest among tribal members in using landscape management practices to enhance the health and vigor of indigenous plants and animals, which provide sources of traditional food, medicine, and crafts. As Valentin Lopez emphasizes in the following article, there is a great opportunity for archaeologists and environmental scientists to work closely with California tribes in the study of TREM practices, but these relationships must be built on mutual trust and respect. In working on the tribal lands of the Amah Mutsun Tribal Band and Muwekma Ohlone Tribe in central coastal California, we are fortunate to have access to expansive public lands. These open spaces are managed by

forward-thinking land stewards who are interested in how TREM practices, in concert with modern range and forest management protocols, may provide new insights for administrating their lands and resources.

Our fieldwork focuses on two study areas (Figure 1). One is the Quiroste Valley Cultural Preserve near Point Año Nuevo, where the Amah Mutsun Tribal Band is collaborating with the California Department of Parks and Recreation to reinstitute traditional management practices. In this newly created cultural preserve, tribal members and land managers are working together to re-implement TREM practices designed to meet common restoration goals informed by ecological baselines reconstructed through our eco-archaeological research. The other study area is Pinnacles National Park, where biologists and resource specialists are working with tribal peoples in the management of deergrass (*Muhlenbergia rigens*) and whiteroot sedge (*Carex barbarae*) patches. This collaboration includes prescribed burns of deergrass plots, which are now being studied by members of our research team. In this special issue of *California Archaeology*, we present the initial results of our investigations in the Quiroste Valley Cultural Preserve; subsequent publications will focus on our ongoing research in Pinnacles National Park.



**Figure 1.** Quiroste Valley Cultural Preserve and Pinnacles National Park, the two primary locations of the team's research on indigenous landscape management.

The eco-archaeological study of Quiroste Valley addresses five major research questions. First, is there evidence for anthropogenic burning in the study area? Second, if there is evidence, then when did people first initiate sustained anthropogenic burning? Third, what were the characteristics of the anthropogenic fire regimes and what potential impacts did they have on local ecosystems (e.g., is there evidence for transformation in the structure of local habitats, enhanced biodiversity, etc.)? Fourth, how extensive were the areas burned by Native Californians? Finally, can we address whether anthropogenic burning activities were simply incidental to other foraging behaviors, such as hunting game, or more systematically managed by individuals, family groups, or broader communities to produce intended landscape-scale outcomes? While the individual articles in this special issue may only attend to one or two of these questions directly, in the concluding article we employ the combined results of the interdisciplinary research program to address all five questions.

The coastal environment of Quiroste Valley is an ideal place to study anthropogenic burning because natural sources of ignition (lightning strikes) are relatively rare, since the frequency of lightning in the state increases with distance from the Pacific Ocean and elevation (van Wagtenonk and Cayan 2008). Current data summarized by Cuthrell et al. (2012) and Cuthrell (this issue) suggests natural fire regimes on the central coast are characterized by fire return intervals on the order of 50 to 100 years or more. Under these conditions, we expect that the vegetation pattern on coastal terraces and hillsides would be characterized by coastal scrub shrublands and mixed conifer forests or oak/bay woodlands, depending on the specific fire return interval and local environmental conditions. Under natural fire regimes, the null hypothesis is that most coastal terraces and foothills in the area would have been covered in these woody vegetation types. Grasslands would have been limited to places where woody vegetation cannot grow due to physical and climatic conditions, as well as to burned areas in the years after stand-replacing fires.

In undertaking eco-archaeological research in this study area, we propose that significant differences between our findings and the expected baselines for natural fire regimes may be indicators of anthropogenic burning. These include fire-return intervals of less than 50 years and evidence of extensive and persistent non-woody vegetation types. An example of the latter is the coastal prairie, which is a disturbance-dependent community requiring regular grazing, tillage, or burning to persist in central coastal California. As outlined in this special issue, we make the case that the detection of long-term grassland vegetation in this region may be a signature of regular prescribed burning (Evet and Cuthrell, this issue).

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## Research Program

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Our collaborative, interdisciplinary eco-archaeological investigation examines the fire regimes, vegetation patterns, climatic changes, and human cultural practices in and around the Quiroste Valley Cultural Preserve in Holocene and historical times. The research program evaluates the evidence of anthropogenic burning and the related five research questions through an integrated study of five major data sets: archaeology, silica phytoliths, palynology, plant population genetics, and dendroecology.

### *Archaeology*

We employed archaeological research to study transformations in ancient and historical cultural practices and community organizations, and to document changes in floral and faunal resource use over time. Following Valentin Lopez's sage remarks about collaborative research, the next article in the special issue, by Mark Hylkema and Rob Cuthrell, presents a succinct overview of previous archaeological research in the local peninsular coast and northern Monterey Bay region that documents more than 6,000 years of pre-colonial developments leading up to the powerful *Quiroste* polity documented by early Spanish explorers. Rob Cuthrell, Mark Hylkema, and Laurel Collins follow with a discussion of the Quiroste Valley study area and a summary of our archaeological investigations to date. Much of our recent fieldwork has focused on CA-SMA-113, the probable location of the late Holocene to early historic *Quiroste* village of *Mitenne* or "Casa Grande," where members of the Portola land expedition in AD 1769 observed nearby burned grasslands.

The fifth and sixth articles in this collection outline the findings of intensive studies of archaeobotanical and archaeofaunal remains from CA-SMA-113, which are suggestive of anthropogenic burning of a coastal grassland community. In describing the intensive recovery of analysis of archaeobotanical remains, Rob Cuthrell outlines some of the major findings supporting evidence for the frequent burning of Quiroste Valley and the recurrent utilization of coastal prairie resources. Diane Gifford-Gonzalez, Cristie Boone, and Rachel Reid discuss the high points of the faunal study, including evidence from the rodent assemblage indicative of more expansive open grasslands in and around Quiroste Valley.

### *Silica Phytoliths*

Silica phytolith content in landscape soils provides an important data source for evaluating the existence of past grassland habitats. In the seventh article, Rand

Evelt and Rob Cuthrell present the results of their cutting-edge analysis of phytoliths from landscape (Quiroste Valley) and archaeological (CA-SMA-113) contexts. They argue that the unusually high levels of phytolith content in Quiroste Valley soils suggests that native people must have sustained coastal grass-dominated prairies for many centuries.

### ***Palynology***

Analysis of sediment cores from wetlands provides rich data for examining diachronic changes in pollen counts and frequencies, as well as the accumulation rates of charcoal as proxies for past fire events. Alicia Cowart and Roger Byrne describe the results of detailed analysis of a sediment core from Skylark Pond, situated 1.8 km inland from CA-SMA-113. Their findings suggest that regular anthropogenic burning was taking place from at least the fifteenth century, and that significant changes in vegetation and fire regimes associated with timber harvesting also took place in the American period.

### ***Plant Population Genetics***

Plant population genetics is employed to explore small-scale population genetic variability and evaluate whether post-colonial changes in land use practices created genetic bottlenecks in plant taxa. One hypothesis is that plants either actively managed by hunter-gatherers or affected by long-term anthropogenic burning may have experienced substantial population contractions following the cessation of these cultural practices. Paul Fine, Tracy Misiewicz, Andreas Chavez, and Rob Cuthrell discuss these issues in relation to their ongoing study of the population genetics of California hazel, the most prominent nut food in macrobotanical assemblages at CA-SMA-113.

### ***Dendroecology***

In the concluding article, we summarize briefly the results of previous dendroecological investigations that detail fire history reconstructions along the central California coast. Based on the analysis of fire scars from redwood samples, these studies provide fire return intervals for several redwood forests from about AD 1650 to 1850. Our eco-archaeological project also includes an ongoing dendroecological study of redwood forests in three watersheds of the Año Nuevo Point region. The results of this study by Chuck Striplen, Gregory Jones, and Scott Stephens will be available in a future publication.

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## Conclusion

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In order to make a strong case for anthropogenic burning along the central California coast, we argue that some level of temporal concordance should exist across the different data sets (archaeological findings, fire histories, and vegetation patterns). At a minimum, the initiation of sustained anthropogenic burning should be associated with changes in vegetation patterns and fire return intervals that deviate significantly from baseline predictions for natural fire regimes. These transformations in fire frequency and biotic communities should be temporally associated with changes in the archaeological record, such as increasing exploitation of fire-dependent or fire-adapted species. In examining the multiple lines of evidence for Quiroste Valley in the following articles, we believe that such a diachronic picture emerges for the anthropogenic creation and maintenance of coastal grassland habitats that may be the product of regularized prescribed burning in late Holocene and early historic times.

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