

A Comparison of the Landscape Stewardship Practices Employed by Native Californians in the United States and the Ancient Jomon People in Japan

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ABSTRACT

Recent research in California and Japan documents how Indigenous people employed various landscape stewardship practices to enhance the abundance and availability of local plants used as foods, condiments, medicines, craft materials, and building products. This work supports the idea that California Indians and ancient Jomon people can be characterized as nurturing land managers who actively modified and constructed anthropogenic landscapes to augment resource productivity in local environs. The purpose of this paper is to synthesize available information to describe their stewardship practices and to compare their similarities and differences. While many commonalities exist between California and Japan, some major differences were discovered in citations concerning the use of cultural burning, the spatial organization of cultivation practices, and the management of non-plant resources.

KEYWORDS: Jomon archaeology, Native California archaeology, Indigenous landscape, stewardship practices, plant cultivation, cultural burning, Indigenous seascape stewardship practices

1. Introduction

Much can be learned about the long-term development of maritime Pacific hunter-gatherer societies through detailed comparative studies of the archaeology of California and Japan. This point was made in the seminal volume edited by Koyama and Thomas (1981) that outlined some of the broad similarities between Native Californian and Jomon societies. In this and subsequent works, archaeologists have noted that California and Japan supported people defined as “affluent” or “complex hunter-gatherers” characterized by relatively high population densities, village communities, food storage, sophisticated collector-based economies, and elaborate sociopolitical and ritual systems (Habu *et al.* 2003; Kitagawa & Yasuda 2004; Matsui & Kanehara 2006; Okada 2003; Sasaki 1981). They also recognized that comparisons between California and Japan offer a remarkable opportunity for examining human interactions with many analogous resources from the Eastern and

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Western Pacific that included a diverse range of seeds, nuts, roots, shellfish, maritime and freshwater fishes, terrestrial game, and marine mammals (Habu 2004; Kitagawa & Yasuda 2004; Koyama 1981; Lightfoot & Parrish 2009; Matsui & Kanehara 2006; Sasaki & Noshiro 2018).

California and Japan provide exceptionally rich archaeological records that are ideally suited for examining how people incorporated these diverse resources into their lives for more than 10 000 years. The archaeology of Native California extends back at least 13 000 BP and there is an extensive record of human-environmental interactions over many centuries that continues to the present as California Indians still care for and harvest native plants and animals in their territories (Anderson 2005; Lightfoot & Parrish 2009). The chronology of Jomon hunter-gatherer people spans from about 16 000 to 2500 cal. BP when wet-paddy rice agriculture gained acceptance in the Yayoi Period (Habu 2014a, pp. 730–736; Kotani 1981, pp. 202–203).

The purpose of this paper is to build upon this foundational work to examine Indigenous stewardship practices among California Indian and Jomon societies. I begin by noting that archaeologists have only recently recognized the existence of hunter-gatherer stewardship in both California and Japan where Indigenous communities implemented cultural practices designed to enhance the quantity, diversity, and sustainability of selected resources. I then synthesize current interpretations about Indigenous stewardship practices in California and Japan. My discussion of the former is based largely on recent findings from an ongoing eco-archaeological study in Central California, while the synthesis of Jomon cultural practices is drawn from across Japan. In the final section of the paper, I compare the similarities and differences in how California Indians and Jomon people may have tended resources in local environs. While many commonalities existed in how they constructed productive anthropogenic environments, some significant divergences occurred in current interpretations about how fire was used for stewardship purposes, the spatial organization of cultivation practices, and the management of non-plant resources.

2. Indigenous Landscape Stewardship Practices

The idea that so-called hunter-gatherer people actively manipulated the environment and created anthropogenic landscapes many centuries ago in California and Japan is a relatively recent perspective. Interpretations of California Indians and their interactions with local environments have changed markedly in recent years. The early anthropological literature depicted Indigenous populations as passive foragers who practiced a modified seasonal round in a bountiful natural world, searching the countryside for available wild foods while minimally impacting local places (Barrett 1952; Kroeber 1925). Similarly, as Crawford (2011, p.S336) emphasizes, the orthodox view of Jomon societies is that they passively

foraged for resources in a naturally rich environment without making much of an impact to local ecosystems (see also Habu 2004, p. 63).

There is now a growing recognition in both Japan and California that Indigenous people were active agents in stewarding or tending selected resources in their local environs. New insights about Native Californian and Jomon people are being fostered by eco-archaeological research that considers human and environmental relationships in space and time. These studies, in combination with relevant ethnographic/historical observations and Indigenous scholars' research, suggest they were nurturing land managers who actively modified and constructed anthropogenic landscapes. Some scholars have even described them as sophisticated ecosystem engineers who employed a diverse range of well-honed methods to enhance the abundance, diversity, and sustainability of key economic resources in their territories (Crawford 2011; Anderson 2005; Lightfoot & Parrish 2009). While there is considerable debate in both California and Japan about whether these practices constituted a form of proto-agriculture or Indigenous agriculture (largely based on how one defines agriculture), there is little question that people were involved in the cultivation and intimate care of wild crops (Anderson 2005, pp. 252–254; Crawford 2008, 2011; Lightfoot & Parrish 2009, pp. 124–125; Sasaki 1981).

The study of Indigenous landscape stewardship practices in both California and Japan is greatly informed by contemporary and historic observations. Since California Indians have continued to maintain a close relationship with the plants and animals in their tribal territories that extends back many centuries, Indigenous elders and tribal oral traditions provide excellent sources about how they tended their lands (Anderson 2005). In addition, there is a wealth of information recorded in historic ethnographic studies and early ethnohistoric accounts written by Spanish, Mexican, Russian, and America explorers and settlers about how different tribes harvested, processed, stored, cooked, and consumed native foods, as well as how they employed specific plants as medicines, crafting materials, building materials, etc. (Kroeber 1925; Lightfoot & Parrish 2009). California archaeologists have made good use of this literature in generating their subsistence and settlement models and interpretations.

Japanese archaeologists have also made excellent use of historical sources and ethnographic observations about the gathering and processing of wild foods. Koyama (1981) describes how a diverse range of wild resources were still being harvested in mid-19th Century Japan, including various nuts (buckeye, chestnut, acorns, walnut, hazelnut), root crops, game, and fish. Matsuyama (1981, pp. 117–123) documents how nuts accounted for 20% of staple foodstuffs at end of 19th century in the Hida area. He presents a detailed account of how acorns and buckeyes were gathered and processed in the mountainous regions of central Japan for making cakes and gruel through the 1960s (Matsuyama 1981, pp. 131–138).

Nishida (1983) provides an insightful discussion about how the people of one of these villages (Mukasa Village) practiced paddy agriculture but still tended and harvested wild resources. His clinal spatial model demarks a series of concentric circles radiating out from the village center. The farthest circle contains the remnants of the primary evergreen broadleaf forest (protected as a shrine forest) where people gathered acorns (*Castanopsis cuspidata*) and water chestnuts (*Trapa natans*) for consumption and for sale. The next concentric circle contains secondary forests consisting of sun-loving plants that cover the hills around the village. Here are found chestnuts and wild yams (*Dioscorea* spp.) that are components of an anthropogenic environment created by the removal of other trees and shrubs for firewood and charcoal production. Within the village proper are found various domesticates and wild plants [prickly ash (*Zanthoxylum piperitum*), honewort (*Cryptotaenia canadensis japonica*), and lagwort (*Petasites japonicus*)] that grow in disturbed spaces between the houses and gardens. These useful plants are allowed to grow on the disturbed soils that are enriched with organic refuse. Nishida (1983, pp. 306–311) presents a neat spatial model for how people might invest more effort in tending and cultivating wild resources close to major villages—particularly sun-loving plants that thrive in disturbed and artificially enriched soils that have been cleared of primary forest vegetation.

3. Native Californian Stewardship Practices

California Indians employ various methods to enhance the availability and productivity of wild plants and animals in their territories that they depend on for foods, medicines, and raw materials (Anderson 2005; Blackburn & Anderson 1993; Lake *et al.* 2018). These methods include weeding, tillage, pruning, coppicing, and even irrigation of wild plants in some places. A significant management tool discussed in the literature is prescribed burning or what Indigenous scholars refer to as cultural burning (Anderson 2006; Goode 2015; Lake *et al.* 2017; Lewis 1973; Lightfoot & Parrish 2009; Stewart 2002). Cultural burning was widely used across Native California before it was outlawed by colonial and later American fire prohibition policies. There were many reasons why local Native communities ignited cultural burns in their territories: to clear undergrowth; to control insect infestations; to facilitate game hunting; to encourage plants to produce young, straight stems for cordage, nets and baskets; and, most importantly, to augment the diversity and quantity of economic plants and animals in tribal territories.

The specific characteristics of these anthropogenic fire regimes varied greatly across California given the local ecology, the kinds of plants and animals that were being treated, and the frequency and timing of lightning strikes that also contributed to local fire patterns. Yet most Indigenous communities appear to have instituted fire regimes characterized by frequent, small, low-severity surface burns (Anderson 2006; Lewis 1973). Fire masters

would ignite small patches of land in a rotational pattern across their territories depending on the kinds of resources being tended and the appropriate fire interval for facilitating their productivity (Lightfoot & Parrish 2009, pp. 97–112). They used local landscape features, such as streams, ridges, rock outcrops and past fire patterns, to constrain these light burns.

The outcome of this rotational burning pattern on a local landscape was the creation of a patchy mosaic of vegetation stands. The strategic use of “light burning” greatly increased local biodiversity by burning patches over multiple year cycles to create diverse stages of vegetation succession of grasslands, tubers, berries, nuts, and other resources across a community’s territory (Lightfoot & Parrish 2009, pp. 94–122). Recent fires also produced excellent forage in successive years that attracted and supported a greater quantity of deer, antelope, tule elk, rabbits, and other favored game. Thus, the consequences of employing the strategic use of cultural burning were twofold: it not only increased the productivity and sustainability of key economic resources, but it also diversified the availability of various resources across tribal lands. This latter outcome was crucial as some resources, such as acorns, varied greatly in their productivity from one year to the next, so that having back-up foods in years of low productivity proved to be highly beneficial.

The findings from our recent eco-archaeological research in Central California exemplify many of these observations. I have been privileged to work with a collaborative team of scholars from the Amah Mutsun Tribal Band, California State Parks, and the University of California campuses at Berkeley and Santa Cruz who are implementing an inter-disciplinary study of indigenous stewardship practices using multiple data sets drawn from tribal histories, ethnohistorical sources, and eco-archaeological research (Lightfoot & Lopez 2013). The specific goals of this work are threefold: 1) What is the earliest physical evidence for sustained cultural burning along the Central California Coast and how did these practices influence local biological communities? 2) Is there evidence for significant changes in Indigenous stewardship practices over time? and 3) At what scale was cultural burning implemented along the Central California Coast? These goals are being addressed through an eco-archaeological investigation of sites in several study areas along the Central California coast that date to Middle Holocene (7000–3000 BP), Late Holocene (3000–500 BP), and Historical times (500–200 BP). The findings of this ongoing work are summarized below.

3a. When did people first initiate sustained anthropogenic burning in Central California and did these practices influence local biological communities?

The results of our study indicate that Indigenous communities initiated cultural or anthropogenic burning at least 1200–1300 years ago that continued for many centuries as observed by Spanish explorers in the late 1700s (Cuthrell 2013b; Lightfoot *et al.* 2013). It appears that a major outcome of cultural burning was the creation and maintenance

of productive coastal prairies along with other vegetation patches. Fine-grained analysis of flotation samples directed by Cuthrell (2013a, 2019) revealed evidence of grasses (Poaceae), tarweeds (*Madia* spp.), clover (*Trifolium* spp.), panicked bulrush (*Scirpus microcarpus*), composites, such as sunflowers (Asteraceae), and other forbs that comprised the overwhelming majority of the ethnobotanical assemblage. High densities of California hazelnut (*Corylus cornuta* ssp. *Californica*) were also recovered, raising the possibility that people may have developed hazel management practices in Late Holocene times. Furthermore, it appears local communities were harvesting resources from patchy mosaics of biotic communities consisting of grassland, shrubland, woodland and riparian resources.

Corroborating evidence for the existence of nearby coastal prairies and frequent cultural burning is based on grass phytolith findings and wood charcoal analysis that show high frequencies of Coast redwood (*Sequoia sempervirens*), California lilac (*Ceanothus* spp.) and other fire-adapted plants that would have comprised a substantial proportion of vegetative cover in a regularly burned environment (Cuthrell 2013a, 2019). Frequent fires or other kinds of landscape disturbances (e.g., grazing) on a sub-decadal scale are necessary for the long-term maintenance of coastal grasslands—otherwise the open prairies convert relatively quickly to coastal scrublands and eventually conifer woodlands. Since lightning strikes along the Central California coast are relatively rare, the expected natural fire return interval is estimated to be 50–100 years or longer. Thus, natural ignitions of fires alone would have been incapable of sustaining coastal grasslands over multiple centuries (Cuthrell 2013a, pp. 266–269). We argue that this is strong evidence that Indigenous communities supplemented occasional lightning strikes by igniting cultural burns every one to five years to maintain patches of coastal grasslands that provided them with important food stuffs, medicines, and raw materials, as well as attracting their preferred game that grazed on the fresh verdant growth (Lightfoot *et al.* 2013, pp. 379–388).

3b. Is there evidence for significant changes in Indigenous stewardship practices over time?

Our results suggest that while anthropogenic burning took place during the Medieval Climatic Anomaly (*ca.* 1050–650 BP) when temperatures and drought conditions may have increased, people were also maintaining coastal prairies before and after this period of climatic warming. We found that coastal prairies were maintained along the Santa Cruz coast during the early years of the Little Ice Age (*ca.* 600–100 BP), when cooler conditions supposedly prevailed (Lightfoot *et al.* 2019). Thus, our study suggests that people initiated regular burning practices under diverse climatic conditions and/or that climate change was more moderate than argued elsewhere in western North America.

Our findings suggest that in Late Holocene times when Native people were investing more time and effort in undertaking Indigenous landscape stewardship activities, they were

also instigating shoreline practices that may have involved the management of shellfish populations and fisheries. Much research has now been undertaken along the American Northwest Coast on how local Indigenous communities enhanced intertidal and wetland resources through a variety of tending and harvesting methods (see Grier 2014; Lepofsky & Caldwell 2013; Lepofsky *et al.* 2015). Some of these enhancement strategies involved the construction of engineered coastal landscapes, including the creation of clam beds, stream scraping, holding ponds, fish weirs, and the use of shell middens as construction materials. Our eco-archaeological investigations along the Central California coast indicates similar kinds of practices were taking place.

The on-going investigation of the invertebrate assemblages from the Central California coast by Grone (2020) is providing information on resource harvesting, invertebrate demographics, and potential evidence of shoreline management practices through time. Ethnographic observations document the creation of clam beds that provided fertile habitats for Pacific Littleneck clams (*Leukoma staminea*) and other mollusks along the sandy shoreline of Tomales Bay (Baker 1992). The combination of ethnographic observations and eco-archaeological research suggest that Indigenous clammers employed selective methods for harvesting Pacific Littleneck clams that sustained this invertebrate population as a viable resource for more than 1300 years (Apodaca 2018; Grone 2020, pp. 49–68). The morphometric analysis and stable isotope geochemistry of mussel umbos from archaeological sites along the open coast suggest that California mussels (*Mytilus californianus*) from rocky intertidal habitats may have been harvested in resource patches at two-to-three-year intervals as part of a long-term shoreline management practice (Grone 2020, pp. 25–48). The study of small, non-dietary species from midden deposits is also providing information for the harvesting of intertidal plants that typically do not preserve in archaeological deposits. For example, the fine-grained analysis of flotation samples containing seaweed limpet (*Lottia insessa*) that lives exclusively on feather boa kelp (*Egregia menziesii*) is providing a proxy measure for kelp harvesting practices through time (Grone 2020, pp. 14–24).

Zooarchaeological research undertaken by Sanchez (2018, 2019) is also providing new insights on the stewardship of fisheries along the Central California coast. At about the same time that we see evidence for cultural burning and the regular use of grassland resources, we also see evidence for the mass harvesting of net-based resources, primarily forage fish such as Pacific herring (*Clupea pallasii*), Pacific sardines (*Sardinops sagax*), and Northern anchovies (*Engraulis mordax*) (Sanchez *et al.* 2018; Sanchez 2019). The association between the mass harvesting of small schooling fish and anthropologic burning continues through the Late Holocene. In reconstructing the size of ancient Pacific herring from archaeological contexts at several coastal sites in Central California, Sanchez (2020) shows that medium-sized fish were captured probably using gill nets with standardized

mesh sizes. By eliminating the harvesting of the youngest and oldest members of the herring population, this fishing practice allowed the Indigenous fishery to remain sustainable over many centuries.

3c. Is there evidence that people initiated anthropogenic burning at a regional scale on the Central California coast?

The results of our eco-archaeological investigation from several study areas provide evidence for an extensive spatial pattern of Late Holocene coastal grasslands and cultural burning along the Central California coast extending from the Santa Cruz Coast to north of San Francisco Bay (Cuthrell 2019; Lightfoot *et al.* 2019). Thus, our current findings suggest that cultural burning was part of a broader phenomenon that transcended the specific cultural histories and languages of local tribes. Our findings are thus far consistent with the hypothesis proposed by Weiser and Lepofsky (2009) that anthropogenic coastal prairies extended from southern British Columbia through Washington, Oregon, and into northern California in Late Holocene times.

4. Jomon Stewardship Practices

A suite of excellent eco-archaeological studies makes a strong case for the close interactions that Jomon people forged with ecosystems near their settlements. This research suggests that some Jomon communities intentionally modified local habitats to facilitate the growth and prosperity of specific resources used as foods, condiments, raw materials, and fuels. The idea that Jomon people worked intimately with specific plants is supported by changes over time in the frequency of these resources in the palynological and archaeological record, the increasing size of seeds and nuts, and DNA analysis (Crawford 2011, 2008; Habu 2004, 2014b, p. 514; Kitagawa & Yasuda 2004; Kotani 1981; Matsui & Kanehara 2006, p. 267; Nishida 1983; Noshiro & Sasaki 2014; Sasaki & Noshiro 2018). This literature suggests that various plants were selected for and managed by Jomon people, including barnyard grass (*Echinochloa crus-galli*)/barnyard millet (*Echinochloa esculenta*), shiso or egoma (*Perilla frutescens*), burdock (*Arctium lappa*), bottle gourd (*Lagenaria siceraria*), beans (*Vigna* spp.), goosefoot (*Chenopodium* spp.), rice (*Oryza sativa*), hemp (*Canabis sativa*), mountain yam (*Dioscorea japonica*), barley (*Hordeum vulgare*), paper mulberry (*Broussonetia papyrifera*), foxtail millet (*Setaria italica*), common millet (*Panicum miliaceum*), soybean (*Glycine max/G. soja*) and possibly buckwheat (*Fagopyrum esculentum*).

There is also eco-archaeological evidence for Jomon people managing tree crops for food, fuels, and building and crafting materials. Chestnuts (*Castanea crenata*) are recognized as an exceptional resource since individual trees can produce many highly

nutritious nuts requiring minimal processing, as well as providing sources of firewood and building supplies (Matsui & Kanehara 200, p. 268). As a sun-loving tree, it is argued that people facilitated the production of chestnut trees near settlements by keeping the environment open through the removal of competing plants (Kitagawa & Yasuda 2004, p. 90). For example, Matsui & Kanehara (2006, pp. 266–269) describe how people significantly altered the environment near Sanai-Maruyama and other sites that involved the expansion of the chestnut forests at the expense of other tree and shrub species that were presumably pruned or cut down. The *hansaibai* or tending of chestnuts is supported by 1) pollen analysis that indicates chestnut forests expanded in areas near settlements, 2) an increase in the size and uniformity of the nuts over time, and 3) the recovery of considerable quantities of charred chestnut wood used as fuel and construction materials at some sites (Kitagawa & Yasuda 2004, p. 90; Matsui & Kanehara 2006, p. 268; Sasaki & Noshiro 2018, p. 381).

Other trees that were probably tended by Jomon people near their settlements included walnuts (*Juglans mandshurica*) that exhibited an increase in the size of the nuts by Late Jomon times compared to modern wild varieties (Sasaki & Noshiro 2018, p. 381). The pollen and charred wood of lacquer trees (*Toxicodendron vernicifluum*) have been identified at sites from at least Early Jomon times. There is good evidence that Jomon people harvested the sap from these trees to produce lacquer, as well as wood for construction material. While direct evidence for arboreal management is ambiguous as the sap can be harvested from both tended and untended trees, there is little question that the growth of these valued plants would have been encouraged near settlements (Crawford 2011, pp. S334–S335; Sasaki & Noshiro 2018, pp. 370, 381).

Horse chestnuts (*Aesculus turbinata*) are another nut crop that may have been managed, but the stands were probably established naturally (Sasaki & Noshiro 2018, pp. 381–383). Unlike chestnuts, the fruit from horse chestnuts require extensive processing to remove tannic acids before they are edible. They were probably not utilized extensively until Middle to Late Jomon times when innovative methods for tannin removal were developed and widely employed (Matsui & Kanehara 2006, p. 266). Archaeological investigations have unearthed the remnants of wooden frames associated with horse chestnut middens near streams where the fruits appear to have been mass processed via water leeching (Sasaki & Noshiro 2018, pp. 376–377). Alternatively, Hosoya (2011) suggests that the diverse methods employed by Jomon people to process nuts, such as horse chestnuts, may have less to do with the tannic acid in the nuts themselves and more to do with the intended final cooking method. Thus, the wooden frames associated with horse chestnuts may certainly have facilitated the mass processing of the nuts, but these features may also be evidence of cultural diversity in how different Jomon people fixed their nuts for culinary purposes.

In summarizing the pertinent literature, three observations can be made about Jomon

stewardship practices. First, a diverse range of herbaceous plants and trees appear to have been managed by Jomon communities— not only as palatable and nutritious food sources, but also as medicines, spices, fuels, crafting materials, and building products. While a few of the plant species may have initially derived from outside of the Japanese archipelago (e.g., see discussion of lacquer trees in Crawford 2011, p.334), the majority appear to have been “wild plants” endemic to Japan for millennia before human nurturing. Second, people creatively interacted with these plants over many thousands of years. These intimate relationships involved the selection of plants over time with larger seeds and fruits that were gathered, tended, and possibly planted, as well as innovative ways of harvesting, processing, and storing them (Crawford 2008, 2011; Habu 2004, pp. 64–67; Sasaki & Noshiro 2018, p. 383).

Third, there is a strong spatial dimension to Jomon stewardship practices that involved the cultivation of plants near major settlements. Anthropogenic environments with nutrient-rich soils were probably created near settlements that facilitated the propagation and production of “sun-loving” herbaceous and arboreal plants (such as chestnut, walnut, and lacquer trees) that thrived in open areas (Crawford 2011; Kitagawa & Yasuda 2004, pp. 89–90; Matsui & Kanehara 2006, pp. 269–271; Nishida 1983; Sasaki & Noshiro 2018, p. 383). Similar to traditional villages in historic times, there was a marked clinal spatial pattern in the use of resources in Jomon communities with those that were regularly tended located in and around major settlements, while the outlying hinterland continued to be used for hunting, gathering, and fishing for other “wild” plants and animals. Habu (2004, p. 72) suggests that many of the tended crops near Jomon settlements may have served primarily as dietary supplements for meals and/or as prestige foods for feasts, ceremonies, and other special gatherings.

5. Discussion

How do current interpretations about Indigenous stewardship practices in California and Japan compare to each other? My examination suggests that there are many commonalities in the stewardship practices implemented by California Indian and Jomon communities. First, most of the plant resources they tended were “wild” resources endemic to either California or Japan. This finding suggests that the cultivation process was largely an independent grassroots development that involved people working intimately with native plants in local environs over many centuries. Second, it appears Native Californian and Jomon people selected for special attention a diverse range of analogous herbaceous plants and nut-bearing trees that populated Eastern and Western Pacific environments. They implemented cultivation practices that served to not only enhance seed and nut crops as foods that could be mass harvested, but also to embellish plants used for medicines,

fuels, crafting materials, and building products. For example, one of the most intensively cultivated plants in Native California was tobacco (*Nicotiana* spp.) that was used in various ceremonies and recreational activities (Lightfoot & Parrish 2009, pp. 126–128). The sap from lacquer trees was used to make lacquerware and other crafts (wooden bracelets, combs) in Jomon times (Habu 2004, p. 215), while California Indians harvested the stems from a variety of stewarded plants, including bear grass (*Xerophyllum tenax*), deergrass (*Muhlenbergia rigens*), sedges (*Carex* spp.), California hazelnut (*Corylus cornuta* ssp. *Californica*), and various species of willows (*Salix* spp.) for making baskets, cordage, nets, etc. (Anderson 2005, pp. 187–208; Biddy 2013; Blackburn & Anderson 1993).

Third, similar kinds of cultivation practices appear to have been employed by Native Californian and Jomon people, such as pruning, coppicing, weeding, removal of detritus, and vegetation thinning for “sun-loving” plants. Fourth, in some cases the stewardship practices involved the selection over time of plants with larger sized seeds and fruits. Eco-archaeological research in Japan has demonstrated this temporal trend for several plants, including barnyard grass, chestnuts, and walnuts (Crawford 2008: 448; Matsui & Kanehara 2006, p. 268; Sasaki & Noshiro 2018, p. 381). While not as well documented in the California literature, there is evidence for Little Barley (*Hordeum pusillum*) and Maygrass/Canary (*Phalaris* sp.) seeds to have increased in size over time, presumably through their selection and cultivation (Reddy 2009; 2016, pp. 237–239; Wohlgemuth 2004, pp. 125–133).

The comparison of Indigenous stewardship practices also highlights three major differences in how they were implemented in California and Japan that revolve around the use of fire, the spatial organization of cultivation practices, and the stewardship of non-plant resources.

The use of fire. While cultural burning played a primary role in the cultivation methods employed by California Indians, there is little mention of its use in the Jomon literature. This is an intriguing difference given the long tradition of highly sophisticated forms of swidden agriculture (*yakihata*) that were practiced in temperate Japan, particularly in mountainous terrains (Yokoyama *et al.* 2014). While some Japanese archaeologists argued several decades ago that swidden agriculture may have been employed by Jomon people (Kotani 1981, p. 204; Sasaki 1981, p. 15), more recent studies tend to downplay Jomon use of fire for plant cultivation. Kotani (1981, pp. 205–206) suggests that fire may have been employed to open-up areas that encouraged plant growth, but not the “continuous practice of slash-and-burn agriculture based on a fallow system.” Kitagawa & Yasuda (2004, p. 90) note that accidental fires could have opened-up areas where the sun-loving chestnuts would have thrived as they are relatively fire-tolerant. Yet their analysis of chestnut pollen and charcoal from the Sannai-Maruyama and Kamegaoke sites suggests the relationship of fire (based on charcoal frequency) and chestnut productivity (based on pollen) is ambiguous

(Kitagawa & Yasuda 2004, pp. 98–101). Thus, there is little support at this time, at least in the English-language literature, for the intentional use of fire as a major component of Jomon stewardship practices (see Nishida 1983, p. 319).

The spatial organization of cultivation practices. Another significant difference between California Indian and Jomon stewardship practices is the spatial organization of cultivation activities. The clinal spatial model proposed for the Jomon suggests that most of the energy invested in plant cultivation took place near major settlements and adjacent environs, while plants in the more distant hinterlands received far less attention and treatment. The primary activities that took place in the outlying hinterland were harvesting practices involving traditional hunting, gathering, and fishing activities. In contrast, the spatial organization of stewardship practices in California is argued to be at the scale of the landscape. That is, California Indians employed a rotational system of cultural burning to ignite fires in a suite of different resource patches both near and far from their settlements. This does not mean that some of the most intensive activities did not take place near major settlements where people might prune, weed, and clear debris from nearby patches. Yet people also used fire at the landscape scale to manage more distant patches containing productive oak woodlands, grasslands, fields of tubers, etc. Travel to these more distant patches would be facilitated by logistical movements of task groups and even occasional residential moves (Lightfoot & Parrish 2009, pp. 20–22).

Stewardship of non-plant resources. A third major difference between the discussion of Native Californian and Jomon stewardship practices concerns citations in the literature referencing the management of non-plant resources. The Jomon literature focuses primarily on plant cultivation and management with the possibility that some other faunal resources, such as wild boar or pig (*Sus scrofa*), may have been tended as well (Crawford 2011, p. S336). As discussed above for the Northwest Coast and California, there is growing evidence that both landscape and seascape resources were managed, including shellfish populations and fisheries. It is not clear from my comparative study if similar processes of seascape stewardship might have taken place during Jomon times in Japan.

6. Conclusion

The comparison of California Indian and Jomon stewardship practices provides many insights about how Indigenous people worked closely with a diverse range of analogous resources that populated the Eastern and Western Pacific. Information derived from recent eco-archaeological research, ethnographic/historical observations, and Indigenous scholar's studies strongly support the idea that Indigenous people in both California and Japan can be characterized as nurturing land managers who actively modified and constructed anthropogenic landscapes to enhance the abundance, diversity, and sustainability of various

resources in their territories.

My comparative study suggests that there are many commonalities in the kinds of practices employed by Native Californian and Jomon people in stewarding their lands. These include the tending of mostly wild resources in local environs that spanned over many generations; the selection of a diverse range of analogous herbaceous plants and nut-bearing trees for stewarding that were used for foods, medicines, fuels, crafting materials, and building products; a similar suite of cultivation practices that probably included pruning, coppicing, weeding, removal of detritus, and vegetation thinning for “sun-loving” plants; and in some cases cultivation practices that involved the selection over time for plants with larger sized seeds and fruits.

My comparative study also revealed some major differences in how archaeologists interpret the cultivation processes employed in California and Japan. The most significant difference is the widespread support for cultural burning in the literature on Native Californian societies and its less frequent reference in Jomon archaeology. I suspect that this may change in the future. Interpretations concerning Indigenous burning practices in California have been greatly facilitated by ethnohistoric and ethnographic observations and a strong legacy among contemporary tribes about the importance of this landscape stewardship practice. However, the study of cultural burning in archaeological contexts is still relatively new in California. As new methods are developed and applied in Japan for examining cultural burning in ancient contexts, I suspect that more evidence for cultural burning will emerge—but time will tell. The common use of fire in California also points to a second difference—the use of cultural burning on a landscape scale by California Indians in contrast to the clinal spatial organization of cultivated resources near Jomon settlements. Another major difference concerns the stewardship of non-plant resources in Native California, particularly shellfish populations and fisheries in seascape environments in contrast to the almost exclusive focus of Jomon people on plant cultivation. Again, archaeological interpretations for Indigenous seascape management along the Pacific Coast of North America have been greatly facilitated by working with contemporary tribes. I believe that as new methods for studying Indigenous management of coastal resources are developed and applied in Japan, then more evidence for these practices will probably emerge.

Yet there were probably some fundamental difference in the stewardship practices employed by Jomon and Native Californian societies. These differences may be important in understanding why Japanese societies initiated the adoption of wet-paddy rice and millet agriculture during and after the Yayoi Period, while California Indians continued to steward and tend native plants and animals that endures to this day. Why Japanese people in post-Jomon times chose to adopt exotic domesticated crops that were dependent on humans for their reproduction, while Native Californians continued their stewardship practices

that enhanced the availability and productivity of wild plants that could survive without human intervention is obviously a complex issue (see Lightfoot & Parrish 2009, pp. 124–140). It is likely that plant stewardship practices initiated in Jomon times, particularly in western Japan, may have facilitated the adoption of more intensive agrarian economies in post-Jomon times (Kotani 1981, p. 204; Sasaki 1981, p. 15). But given the overall similarities between Jomon and Native Californian stewardship practices, and the decision of the latter not to follow this historical trajectory, I suspect there is more to the story. Here is where future comparative studies of the Jomon people and California Indians focusing on this issue will be most illuminating.

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米国カリフォルニア先住民と日本の縄文時代人による景観の維持管理を比較する

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和文要旨

本稿では、カリフォルニア先住民 (Native Californians) が領域内の資源生産性を増やすために用いた、景観の維持管理の実践 (stewardship practices) について、現時点で知られている情報にもとづいて総合的に考察する。そして、これらの研究結果を、日本の縄文時代人が用いたと考えられる景観の維持管理と比較する。

カリフォルニア先住民は、除草、耕作、樹木の枝刈り (pruning) と刈込み (coppicing)、さらに野生植物の灌漑など、さまざまな方法を用いて人為的な景観を形成してきた。一般に、そのもっとも重要な方法は、火を用いた環境管理と言われている。先住民が計画的な野焼き (prescribed burning; 文化としての野焼き cultural burning と呼ばれる) を始めた理由としては、下草除去、虫害管理、狩猟の効率化、縄や籠を作るための植物性原材料の確保、食料や薬として利用する動植物資源の生産性向上、などが考えられる。この地域の人々は、野焼きの頻度、時期、場所を決めることによって、生物多様性と資源の持続可能性を高め、動植物生息環境の構造を変化させた。結果として、カリフォルニア先住民は、異なる遷移段階のスタンド木立の植生によって特徴づけられる生物群集のモザイク状景観を作り上げた。

筆者は、アマ・ムツン部族バンド (Amah Mutsun Tribal Band)、カリフォルニア州立公園、カリフォルニア大学バークレー校およびサンタクルーズ校を中心とする共同研究チームを結成し、部族の歴史と民族史資料、生態考古学的な研究から得られた複数の証拠を用いて、景観の維持管理に関する学際的な研究を進める機会に恵まれた。このプロジェクトでは、カリフォルニア中部海岸部において作り上げられた人為的な景観について、下記の3つの研究課題を設定し、研究を進めた。

1) 持続的・人為的な野焼き (sustained anthropogenic burning) はいつごろ始まり、それは地域の生物群集にどのような影響を与えたのか? 分析の結果、野焼きの起源は、少なくとも1200～1300年前までさかのぼることが明らかになった。17世紀後半に、スペイン人の探検家たちが野焼きを目撃していたことを考え合わせるならば、野焼きは、何世紀にもわたって継続していたと推測される。このような計画的な野焼きの結果、資源が豊富な海岸草原地帯が形成・維持された。植物遺存体をはじめとする遺跡出土資料の分析結果から、この遺跡に住んでいた人々の食生活は、草原、灌木地帯、森林、水辺環境を含むモザイク状の景観から得られた多様な資源に支えられていたことが明らかになった。

2) 野焼きの開始後、先住民による景観維持管理の実践に関して、大きな変化は認められるか? 野焼きの証拠は温暖化と乾燥化を特徴とする中世気候変動期 (1050～650BP) に認められると同時に、人々は温暖化以前とそれ以降にも海岸草原地帯を維持していたことがわかった。たとえば、サンタクルーズ海岸では、寒冷期である小氷河期 (600～100BP) の初期に海岸草原地帯が維持されていた。これらの結果から考えるならば、気候条件に関わらず定期的な野焼きが行われていた可能性が高い。また、分析の結果、後期完新世には、貝の養殖を含む水産資源の管理とその集約的利用

が積極的に行われていたことも明らかになった。

3) カリフォルニア中部海岸部における野焼きの地域的広がり、どの程度であったか？ 生態考古学的研究の結果、後期完新世には、調査地域における海岸地帯の草地と野焼きの痕跡は、南はサンタクルーズ海岸から北はポイント・レイズ国立海浜公園まで、幅広い地域に分布していることが分かった。この結果から、カリフォルニア中部海岸部における野焼きは、特定の文化や言語集団に限定されるものではなく、文化的境界を超えた広域的な現象であったことがわかる。

このようなカリフォルニアの研究結果を縄文時代の景観維持管理に関する研究結果と比較した場合、数多くの共通点が認められる。ただし、縄文時代の資源利用に関してこれまで発表された英語の論考から見る限りでは、1) 野焼き、2) 植生の管理・栽培を行う場所の選択とその広さ、3) 植物以外の資源管理、の3点について、カリフォルニアの研究結果とは相違が認められる。

キーワード：縄文時代の考古学、カリフォルニア先住民の考古学、先住民による陸上景観の維持管理の実践、植物栽培、文化としての野焼き、先住民による海浜景観の維持管理の実践