

**HARVESTING THE LANDSCAPE:
DEFINING PROTOHISTORIC PLANT EXPLOITATION IN COASTAL SOUTHERN CALIFORNIA**

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Recent excavations along Santa Monica Bay have provided an extraordinary opportunity to study macrobotanical remains from Mission-period Native American deposits. European domesticates have been recovered from aboriginal contexts, and intensive exploitation of two native grasses (Canary grass and Little Barley) is evident. The paper discusses the relevance of these findings to the question of the selective use of native and introduced plants and aboriginal horticulture.

Defining the precise character of plant exploitation in coastal Southern California has remained a challenge for archaeologists. Very often interpretations have been held captive to either poor sampling or a lack of archaeobotanical studies. Although modeling past human adaptations using ethnohistoric information is one effective avenue for understanding prehistoric behavior, direct analogies are limiting and often one-dimensional. Recent excavations along Santa Monica Bay have provided an extraordinary opportunity to study macrobotanical remains from deposits ranging in age from 3,000 years ago in the Early Intermediate period through the Mission period (Altschul et al. 2005, 2007).

This paper focuses on the relative reliance and changing character of Native exploitation of grasses during the Mission period (1769-1834) along Santa Monica Bay in the Los Angeles Basin. In doing so, three main points are emphasized. First, despite lack of reference in ethnohistoric accounts of their use, the ubiquitous recovery of two particular grasses, Maygrass/Canary grass (*Phalaris* sp.) and Little Barley (*Hordeum pusillum*), from Mission-period Native American contexts in the Los Angeles Basin, demonstrates that they were primary plant staples throughout the sequence. Furthermore, the intensity of their exploitation increased over time, and European domesticates were added to the repertoire in the Mission period. (Note that *Phalaris* sp. is referred to as Maygrass or Canary grass by different paleoethnobotanists [Popper 2002; Wohlgemuth 2002]. This report uses Canary grass, but does not reflect a preference.)

Second, the average size of Little Barley increased over time. Moreover, in the Mission period there are differences in the size of Little Barley seeds recovered from domestic versus mortuary contexts. An increase in seed size is widely recognized by archaeologists as one of the early indicators that the selective pressures on a wild plant species have changed (Harlan and de Wet 1965; Smith 2006). The third and final observation is related to food practices in Mission-period aboriginal contexts where a cultural preference of certain plants as food and as mortuary offerings was noted. Some plant foods, particularly nonnative introduced taxa, were consumed readily, but generally considered inappropriate as mortuary offerings, while others (all of which are native wild species) were heavily utilized in both domestic and mortuary contexts. These data provide a unique glimpse into Native Californian perspectives on the symbolic nature of food during a period of unprecedented culture change. In particular, the Mission-period Native Americans (the Gabrielino) strove to maintain traditional practices while selectively integrating certain new foods into mortuary offerings, and adding other new plants to daily consumption.

GRASSES AS PLANT-FOOD STAPLES

The macrobotanical remains were recovered from two sites adjacent to Ballona Lagoon in the Los Angeles Basin (Figure 1). Both sites have been intensively excavated as part of Statistical Research's

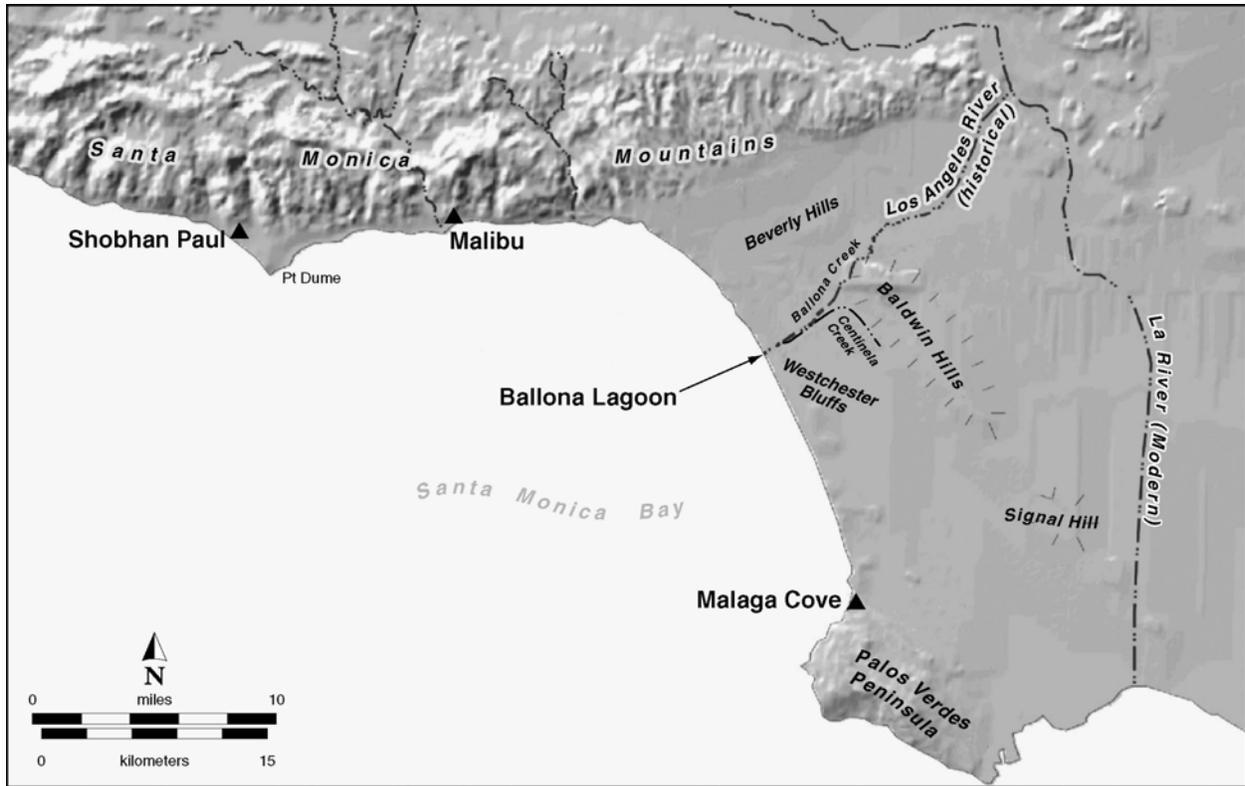


Figure 1. Project location.

Playa Vista Archaeological and Historical Project (Altschul et al. 2005). They are located near the ocean and alongside Ballona Lagoon, a drowned river valley on the edge of Santa Monica Bay in west Los Angeles. Mission San Gabriel is located approximately 45 km to the northeast. The two sites, CA-LAN-62/H and LAN-211/H, yielded macrobotanical data from varied temporal (Early Intermediate through Mission period) and functional contexts (notably domestic versus mortuary). As such, the samples date from 3,000 to 250 years ago. This paper is focused on the cultural adaptations at the end of a long sequence of Native American occupation. Mission-period occupation is present at these two large sites, located adjacent to each other at the base of the hills alongside the lagoon. The Intermediate deposits at the two sites are similar, but the Mission-period occupation at LAN-62/H consists entirely of burials and mortuary-related features. In contrast, the Mission-period component of LAN-211/H consists of non-mortuary features and occupation debris. Given their close proximity to each other and highly divergent archaeological assemblages, we consider the sites to represent complementary aspects of a single Mission-period settlement. In this paper the seeds from mortuary contexts are those recovered from distinct Mission-period features related to mortuary ritual adjacent to a large burial area at LAN-62/H, while the seeds from domestic contexts are from Mission-period occupation deposits and features related to habitation, food consumption, and disposal at LAN-211/H.

More than 425,000 carbonized seeds were recovered from the two sites, with an average density of 189 seeds per liter of sediment (Table 1). The large quantities of wild plant foods provided a rare opportunity to examine diachronic changes in Native American plant use. Annual, spring-seeding grasses, particularly Canary grass and native Little Barley, dominate the assemblages at both sites. Other native grasses are present, and Old World domesticated crop seeds were recovered from the Mission-period deposits at both sites, but in significantly higher densities from the domestic contexts at LAN-211/H.

Table 1. Summary of Macrobotanical Remains Recovered from LAN-62/H and LAN-211/H

Carbonized Macrobotanical Remains	LAN-62/H		LAN-211/H		Total
	<i>n</i>	%	<i>n</i>	%	<i>n</i>
Total Carbonized Seeds	381,892	-	44,087	-	425,979
Seed Density (n/L)	254.5	-	46.2	-	189.3
Total Grasses	334,471	88	30,598	69	365,069
Total Legumes	3,693	1	3,986	9	7,679
Canary grass (<i>Phalaris</i> sp.)•	268,982	70	15,824	36	284,806
Little Barley (<i>Hordeum pusillum</i>) •	45,322	12	11,414	26	56,736
Domesticated Corn (<i>Zea mays</i>) †	-	-	10	0.02	10
Domesticated Wheat (<i>Triticum</i> cf. <i>aestivum</i>) *	19	0.01	264	0.6	283
Domesticated Barley (<i>Hordeum vulgare</i>) *	24	0.01	117	0.3	141
Chick Pea (<i>Cicer</i> sp.) *	-	-	24	0.1	24
Sweet Clover (<i>Melilotus</i> sp.) *	27	0.01	1,973	5	2,000
Pea (<i>Pisum</i> cf. <i>sativum</i>) *	554	0.2	163	0.4	717

• Native wild grass

* Old World

† New World

Canary grass occurs in relatively higher densities than Little Barley at both sites, especially at LAN-62/H where Canary grass is the predominant grass.

Canary grass and Little Barley are ubiquitous at both the sites. Canary grass is the most ubiquitous plant with a ubiquity score of 100 percent, while Little Barley has a 90 percent ubiquity. As such, there is a preference for Canary grass over Little Barley. For example, Canary grass at 70 percent is the predominant grass seed at LAN-62/H, and it constitutes more than one-third of the plant diet at LAN-211/H (see Table 1). Little Barley constitutes for about one-quarter of the plant diet at LAN-211/H but is in a lower percentage (12 percent) at LAN-62/H. When the macrobotanical data from the two sites are organized chronologically, strong temporal trends are evident over the 3,000-year span starting in the Intermediate period. Notably, Canary grass becomes even more dominant over time, and Little Barley increases twofold in the Mission period.

Based on these data, it is evident that Canary grass and Little Barley were the main plant food staples of the Native American diet well into the Mission period. It is interesting to note, however, that there is a significant lack of fit between the ethnohistoric accounts for the region and these paleoethnobotanical results, because typically California ethnohistoric accounts emphasize non-grass plants (such as nuts, roots, berries) being used as food by pre-contact and contact-period Native Americans. As such, this stands in contrast to what is found in the macrobotanical record not only at the two Gabrielino sites in the Los Angeles Basin, but coastal Southern California in general. Ubiquitous quantities of Canary grass and Little Barley have also been recovered in Late and contact-period contexts along coastal San Diego on Camp Pendleton Marine Corps Base (Reddy 1999, 2004). That is not to say that there is no mention of Native Californian grass use in the ethnohistoric references. Several sources,

including Crespi's memoirs, note that grasses were a significant part of the diet of coastal Native American populations (Hackel 2005; Pourade 1969; Simpson 1938). Similarly, Serra wrote that soon after Gabrielino women first saw an image of the Virgin Mary, they "went to their homes and came back loaded down with seeds and provisions, which they offered to the holy image" (Hackel 2005:165). What is surprising is the absence of details, such as which particular grasses were being exploited. In fact, it is not clear if they were including other small-seeded plants under the general label of "grasses." In contrast to the lack of reference of specific grasses as food, Spanish accounts do mention the use of specific nuts (such as acorns, pine nuts, etc), berries (Manzanita, Elderberry, etc.), and small seeds such as Chia (*Salvia*).

What is the reason for this notable gap in the ethnohistoric record, particularly since the paleoethnobotanical record clearly demonstrates they were the staple and dominant food source? It is possible that this simply reflects the limitations of ethnohistoric accounts, which were informal and subjective. Alternatively, it is possible that there were cultural biases against these grasses. Native Americans may have consciously de-emphasized grasses in contexts where they hosted or provided food to the Spanish. Instead, they may have emphasized foods that were less common, and potentially of higher value and prestige. These included acorns, pine nuts, and berries, potentially considered more desirable owing to their higher fat content and their taste relative to grasses. Thus, cultural prestige, particularly in the contexts of feeding guests, may have biased initial impressions of the Spanish and led to the limited discussion of specific grasses in early Spanish accounts.

Putting aside the lack of congruence, this subsistence focus on the exploitation of Canary grass and Little Barley has an important implication for the Mission-period Native American adaptations. If indeed there was an impact on the native vegetation with the onset of the Mission period as has been suggested by some scholars, this should be reflected in the macrobotanical remains. With the establishment of the missions in California, several Old World domesticated animals were brought into the habitat, such as cattle, horses, and pigs. Scholars such as Hackel (2005) and Larson et al. (1994) have argued that there was competition between these Old World domesticated grazing animals, native wild animals, and Native Americans for wild forage. If there was such an intensive competition in the Los Angeles Basin (where Mission San Gabriel was situated), how can the recovery of high densities of carbonized seeds of wild grasses and other plants from the archaeological contexts at the two Gabrielino Mission-period sites be explained in terms of marginalized and decreased native vegetation? If indeed there was an impact and competition, could Native populations continue offerings of wild plants to the degree noted in the mortuary contexts at LAN-62/H? Instead, one would predict that the offerings would be more symbolic and significantly less profuse. However, this is not the case. The large-scale offerings of native wild grasses indicate that traditional gathering practices were able to continue.

INTENSIVE USE OR INCIPIENT CULTIVATION?

Given the intensive exploitation of Canary grass and Little Barley at these two Mission-period sites along the Santa Monica Bay, were these plants being gathered in the wild, or were they possibly being cultivated? Cultivation, which entails sowing, tending, and harvest, is generally considered to represent the first step toward morphologically domesticated plant crops and a fully agricultural food base. Initial cultivation of morphologically wild plants is very difficult to discern in the archaeological record (Smith 2006). However, an increase in seed size is widely recognized as one of the early indicators that the selective pressures on a wild plant species have changed (de Wet and Harlan 1975; Harlan and de Wet 1965; Harlan et al. 1973; Smith 1998, 2006). This is particularly true for grasses and legumes.

To examine potential changes in seed size, trends across time were analyzed -- from Intermediate through the Mission period (Table 2). Both the length and width of carbonized Little Barley seeds from Mission- and Intermediate-period contexts at LAN-62/H and LAN-211/H were recorded. The results reveal statistically significant increases in the length and width of Little Barley over time from Intermediate (n=49; mean length = 2.97 mm) to Mission periods (n=154; mean length = 3.56 mm).

Table 2. Little Barley Seed Measurements.

Period	n	Mean Length	P value	Standard Deviation	Mean Width	P value	Standard Deviation
Intermediate (1050 B.C. - A.D. 950)	49	2.97	< 0.0001	0.45	1.61	< 0.0001	0.22
Mission Period (A.D. 1769-1834)	154	3.56		0.37	1.9		0.24

This significant increase in seed sizes of Little Barley in the Mission period, relative to the Intermediate Period, is due to intentional human activities. It is noted that in certain situations, environmental factors may possibly influence seed size. Ecologists have suggested that seasonal droughts, grazing, and burning may have a positive impact on seed size among annuals (Baker 1972; Blumler 1998, 2002; Dyer 2002). Although these factors cannot be fully discounted, I argue that they are not the most likely explanation for these archaeological data sets. Although prescribed burning was noted by initial Spanish explorers in Southern California, it's an activity that undoubtedly was more frequent prior to the Mission period. Similarly, prolonged droughts appear to have been more pervasive prior to the Mission period. For example, Wigand (2002) argues that the prior the Late period (1000 B.P.-European contact in A.D. 1542) and the Protohistoric period (A.D. 1542-1770) was a time of fluctuation in precipitation, with wet periods followed by prolonged droughts, and he argues that the Late period was a time of high productivity in the receding marsh.

As such, human actions are the most likely explanation for these changes in seed size. Two major questions, however, remain unanswered. First, when did the increase in seed size begin? Although seed size is larger in the Mission period versus the Intermediate period, seed size increase may have begun prior to the Mission period, perhaps in Late Period. Finer resolution in the chronostratigraphy at the two sites is necessary to provide data into the precise time and pace of these changes in seed size.

The second question entails, how did the selection process start? In other words, was it a conscious decision or an accident which was later opportunistically exploited? If it was a conscious decision, then cultivation is the most likely human action that caused these changes in seed size. Both selective sowing of larger seeds and tending of fields, including weeding, could have been primary causal factors in this context. Cultivation also may have resulted in fairly rapid changes in seed size. For example, Harris and Hillman (1989) argue that initial cultivation of grasses in the Near East may have resulted in changes in seed morphology within a relatively short time, perhaps less than 50 years. It is also conceivable that selective gathering of only the larger seeds of each species in a wild context could have also created larger-sized assemblages. However, this is less likely, given that this would be fairly inefficient in terms of time and energy.

What we may be seeing here could be an example of coevolution (Rindos 1984). For example, foragers harvesting these plants would have necessarily harvested and retained more of the variants that were larger. Subsequently, if the humans accidentally dispersed this variety to new locales by spilling some seeds in middens which later propagated naturally, the fitness of this variety will be enhanced and natural selection will favor its evolution and spread. It is predicted that if coevolution is the explanation, then the process would have been gradual.

Cultivation is the most likely explanation for these changes in seed size. The Mission-period populations at LAN-62/H and LAN-211/H may have emulated the practice of Old World plant cultivation occurring at the mission and began applying it to wild native grasses. The motivation for such an adoption may have been in part to ensure continuing success of traditional plant foods, especially if they were competing with mission-owned animals (cattle, horses, pigs) that may have begun grazing on the these wild cereals. If indeed there was competition between Old World domesticated grazing animals, indigenous wild animals, and Native Americans, then wild grass cultivation may have been a means to keep traditional food practices in place in a rapidly changing context.

Intensive competition in the Los Angeles Basin is not very plausible, given the recovery of high densities of carbonized seeds of wild grasses and other plants from the archaeological contexts at these two Mission-period sites. Furthermore, these high densities do not fit with the model of marginalized and decreased native vegetation. If indeed there was an impact and competition, could Native populations continue offerings of wild plants to the degree noted in the mortuary contexts at LAN-62/H? Instead, one would predict that the offerings would be more symbolic and significantly less profuse. This is not, however, the case. This situation increases the likelihood that native populations were cultivating wild grasses and were, at least for a short time, successfully keeping traditional grasses as a diet staple even while native vegetation was being depleted.

CULTURAL PREFERENCE IN PLANT USAGE

The nutritionist Victor Lindlahr popularized the phrase “You are what you eat.” It is also true that what you believe influences what and when you eat. Notably, the foods eaten at special occasions, such as feasts, are generally different than the food eaten at everyday meals. In addition, modern sociological research tells us that traditional meals, particularly of immigrants or generations undergoing major culture change, can play a key role in reinforcing cultural continuity and intergenerational stability.

Recently, Atalay and Hastorf (2006) have eloquently affirmed that food, more than any other human activity, intensively creates the individual as well as the community through the daily practices of eating. If this is so, then food residues in mortuary context are that unique medium which acts as the means of cementing the community and extended social networks through ritual behavior. Although archaeologists studying hunter-gatherers in California have rarely had opportunities to study such issues in mortuary contexts, there is a rich ethnographic and ethnohistoric data for the area which provides examples of the interweaving of food with mortuary ritual practices. Similarly, the study of plant foods from public and private domains of prehistoric daily and ritual life has remained an elusive avenue with the exception of a few studies, for example, the work at the Neolithic site Çatal Hüyük in Turkey (Atalay and Hastorf 2006), and at Cahokia in the southeast United States (Gremillion 1993). Hunter-gatherer contexts rarely offer the opportunity to address this fascinating research question. The Playa Vista Archaeological and Historical Project is proving to be an exception with its rich dataset from mortuary and habitation contexts. In California, plant food usage in ritual contexts has not been systematically studied archaeologically. The main reason for this situation is that appropriate contexts are rarely preserved in the archaeological record of California hunter-gatherers. Ethnohistoric and ethnographic data in the region has, however, provided some insight into how food was interwoven in ritual settings, including those associated with mortuary practices.

Recent paleoethnobotanical research at LAN-62/H and LAN-211/H is revealing a potential association in the frequencies of nonnative domesticated crop seeds and particular behavioral contexts. Seeds of Old World domesticated crops, such as barley, wheat, and chickpea, and New World corn (*Hordeum vulgare*, *Triticum aestivum* [cf.], *Cicer* sp., and *Zea mays*) were recovered in higher frequencies from the domestic contexts (LAN-211/H) relative to the mortuary contexts (LAN-62/H). These results suggest that different social norms and rules guided what foods were offered in mortuary ritual as opposed to what foods were acceptable to eat daily. Although it is unclear why these conventions varied between the two contexts, it is interesting to note there are significantly lower frequencies of seeds

of domesticated crops in mortuary rituals. The mortuary offerings had enormous quantities of seeds, and a wide range of taxa, dominated by local grasses, especially Canary grass. In contrast, the domestic contexts had more moderate quantities of plant remains and a more limited range of taxa (that cannot be accounted for by sample size alone).

So how did these Old and New World domesticates become incorporated into what, for the most part, appears to be traditional cultural practices associated with honoring the recently departed? Moreover, why were domesticated crops consumed, but infrequently included in the large-scale offerings documented in the non-burial mortuary features? Insight into this topic requires both an understanding of the regional economy and the reconstruction of prevailing social conventions that dictated which foods were appropriate for certain ritual activities and which were not. Measuring cultural food preferences is a challenging task; but before we model how a plant is “ritualized,” we need to assess how Native Californians may have incorporated new crops into their existing subsistence system.

In general, new crops or foods are not adopted into existing economic systems unless certain baseline requisites are met. This is not a topic that has been extensively explored in California since domesticated plants, including New World ones, were infrequently adopted. Recent research on the adoption of Old World crops into existing agricultural economies of Native Americans in the southeastern U.S. provides comparative insight into why some plants were initially adopted over others. The initial European crops adopted by southeastern Indians soon after contact were not traditional European staples (e.g. wheat, barley, peas); instead, they included watermelon (*Citrullus vulgaris*), peach (*Prunus persica*), and cowpea (*Vigna* sp.) (Gremillion 1993; Scarry 1993). Several characteristics likely contributed to these foods being the first to be adopted (Gremillion 1993). Initially, each of these domesticates only supplemented existing native plant foods and did not replace them, so there was little risk and no economic tradeoffs involved. Second, these crops thrived in the hot, humid southeastern summers and they produced high yields relative to the work needed to cultivate them. Third, their cultivation employed techniques similar to those already in use, and no new methods were required.

So, to understand how the domesticated plants of the California missions fit into the existing Native American plant gathering economies requires insight into the cultivation techniques, likely yields, risks, and potential economic trade-offs of these new plants. It also requires an understanding of the preexisting economy and how the regional economy changed with the establishment of Mission San Gabriel.

Around the onset of the Mission period, the Ballona was occupied by aggregated populations in a few large settlements near the lagoon edge, where they could exploit the most reliable wetland resources. The paleoethnobotanical data demonstrates that, in particular, Canary grass and Wild Barley were intensively exploited. During this period of dramatic culture change and disruption, potential environmental downturns and periodic disease epidemics, the cultural and economic traditions were maintained and perhaps altered to fit the challenges of the times. Based on the plant data from the Ballona and its relative distance from the mission, it is very likely that the Native Americans maintained an economic system focused on traditional resources while incorporating a few New and Old World domesticates. An unresolved question is whether these domesticates were cultivated by the inhabitants or obtained as payment for labor. During a period of unprecedented culture change, Mission-period Native Americans in the Ballona appeared to have maintained cultural norms that embraced long-standing traditions with respect to cultural preference for particular plant usage in ritual contexts and mortuary offerings.

In summary, this ongoing research project has presented a rare opportunity to investigate cultural behaviors revolving around particular plants and the preference of particular plants over others. Canary grass and Little Barley were staples in the Mission-period Native American diet and also the predominant offerings in ritual ceremonial contexts. Changes in seed size of Little Barley documented in the Mission period appear to be due to human actions, and intentional cultivation is the most likely explanation. Old and New World domesticated crops were consumed by Native American populations during the Mission period, but sparingly incorporated into the ritual activities. During a period of exceptional culture change,

Mission-period Native Americans appeared to have maintained cultural norms that embraced long-standing traditions with respect to cultural preference for particular plant usage in ritual contexts and mortuary offerings.

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