ECOLOGY OF SEDENTARY SOCIETIES WITHOUT AGRICULTURE:
PALEOETHNOBOTANICAL INDICATORS FROM NATIVE CALIFORNIA

by

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JULIA E. HAMMETT. Ecology of Sedentary Societies Without Agriculture: Paleoethnobotanical Indicators in Native California (Under the direction of RICHARD A. YARNELL)

The Chumash of Coastal Southern California maintained a relatively high population density through reliance upon diverse terrestrial and aquatic resources. This dissertation investigates several lines of evidence in order to determine the extent to which plant resource management was employed to ensure reliable plant food production. Archaeological, ecological and botanical sampling techniques are integrated with historical information in a multifaceted approach to studying human impacts and disturbance regimes, in particular burning and clearing, in Southern Coastal California.

Archaeobotanical analysis indicated that important Chumash plant resources included acorns (*Quercus* sp.), walnuts (*Juglans* sp.) and islay (*Prunus* sp.) nutmeats, berries from manzanita (*Arctostaphylos* sp.), toyon (*Heteromeles arbutifolia*), and elderberry (*Sambucus mexicana*), several bulb, corm and tuber plants including members of the families Liliaceae (i.e. *Chlorogalum* sp., *Yucca* sp., and *Calochortus* sp.), Amaryllidaceae (*Dichelostemma* sp.) and small seeded plants including grasses (*Phalaris* sp. and *Hordeum* sp.), composites (*Madia* sp. and *Hemizonia* sp.), members of the Boraginaceae family (*Amsinckia* sp. and *Plagiobothrys* sp.) and Portulacaeae (*Montia* sp. and *Calandrinia* sp.).

Ecological investigation of important Chumash resource plant crops and investigation of growth habits and disturbance responses indicated that the food parts of many herbaceous and bulbous plants utilized by the Chumash did increase in frequency in the years immediately following fires. Large woody shrubs also responded to intermediate levels of disturbance with good fruit production within only a few years following a fire. Apparently no important Chumash plant crop suffered from periodic and moderately intense fires. Fires also would have served to reduce plant competition, to clear areas of tree and shrub plants prior to harvest, and to facilitate hunting.

Site areas selected for archaeological analysis include an interior woodland site, a coastal stabilized sand dune site, and a coastal estuary site. Archaeological and historical data from these sites provide evidence of the use of burning and clearing by the Chumash to intensify and enhance the effects of ongoing disturbance regimes within the region in order to increase and ensure reliability and productivity of imporant crops. This Chumash managed landscape was a "tessellation of patches" resulting from varied periods and intensities of burning and clearing.

Conversely, the Euroamerican policy was to intervene in the management practices of the Chumash and to halt, to the best of their abilities, the preexisting natural and cultural disturbance regimes. The contamination of the Native Californian landscape with introduced species of plants and animals, and the intervention of Euroamericans resulted in changes in the ecology of the area. Even over a hundred years later the legacy of these impacts is evident, although more remote areas of the landscape gradually are returning to previous environmental regimes.

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DEDICATION

"Burn 'im off, rain fall, grass comin' up, plenty of kangaroo."

Warlpiri Man, April 29, 1980 (Kimber 1983)

This work is dedicated to the Chumash, whose grandfathers and grandmothers were prevented from passing much of this resource management information on to them directly. I hope that this research may be of some use to their granddaughters and grandsons.

CHAPTER 1

ANTHROPOGENIC LANDSCAPES IN NATIVE NORTH AMERICA

Ecology is a funny business. Everybody thinks they know something about it; and in a way they do, because we are all part of it. But few understand a lot about it. As scientists we have specialized in certain aspects; our subdisciplines include (but are not limited to) population ecology, human ecology, landscape ecology, disturbance ecology, community ecology, evolutionary ecology, cultural ecology, historical ecology and paleoecology. A study of the ecology of a human group involves all of the above subdisciplines; all potentially are equally relevant, necessary, and intriguing. Humans have especially complicated systems because their adaptations involve extensive reliance on **culture**; this distinguishes us from all other organisms, even our closest primate relatives. All human societies have a variety of traditions, values, beliefs, and viewpoints to guide behavior at the group and individual levels.

The current study is a multidisciplinary approach that investigates the ecology of sedentary societies without agriculture. Contemporary industrial societies take for granted their means of support through agriculture; but there are other means of making a living and supporting a permanent settlement. My example is taken from Native California where, prior to contact with Europeans, sedentary harvesters supported themselves by means of managing a wealth of non-agricultural resources. I will utilize a series of ecological techniques that crosscut academic disciplines of anthropology, botany, geography and history. Grafting new techniques onto old, I will present evidence of resource management strategies that are not agricultural. This will be done by the identification of resource "patches", by studying the dynamics of resource productivity, and by comparing these findings with archaeological data and historical information. But first, the historical and recent precedents of this approach are reviewed in order to lay a framework for analysis that bridges this multidisciplinary evidence.

HISTORY OF ANTHROPOGENIC LANDSCAPES

Scholars long have known that humans have played a significant role in altering their environment. Perhaps the first documentation of environmental degradation was that of Plato in *Critias*, IIIA-D, where he noted that the plain of Attica, formerly rich in timber and arable land: "compared with what then existed is like the skeleton of a sick man, all the fat and soft earth having wasted away, and only the bare framework of the land being left." According to Greek scholars (Darby 1956:185; Heinemann 1966; Warmington 1934) the denudation he described was due to a combination of natural catastrophic events, in particular a period of severe earthquake activity and flooding, and human activities that resulted in deforestation, overgrazing and subsequently severe erosion.

It was quite some time later before the subject of humans' activities and their resulting impacts upon local environments was of general interest. In North America, early European-born explorers in both the east, such as Adriaen Van der Donck (1621) and John Lawson in 1709 (Lefler 1967), and in the west such as Fr. Juan Crespi in 1769-1770 (Timbrook *et al.* 1982) and Longinos Martinez in 1791-1792 (Simpson 1939), observed the ecological use of fire by local groups. These first observations in North America tended to be purely descriptive; rarely did they consider the environmental impact of these native burning techniques.

Scientific interest regarding human impact on the earth began with the works of Marsh (1864, 1874), Woeikof (1901, 1949), Shaler (1905) and Thomas (1956). Later, Sauer (1927) and Stewart (1951, 1956) recognized the effect of **prescribed burning**, and suggested this practice explained maintenance of vegetational landscapes at secondary successional levels. The human ability to modify the environment and maintain artificial plant and animal associations, or **anthropogenic communities** (Tansley 1935; Bye 1981; Ford 1983) has continued to be the subject of research in ecological anthropology. Tansley (1935:304-305) assumed that a "conspicuous component" (or characteristic) of a system was to "attain dynamic equilibrium." The dynamic equilibrium is always changing, subject to mild fluctuations and perturbations. In some cases, humans have used these disturbance events to their benefit. Apparently one of the most common management strategies utilized by nonindustrialized societies has been burning (Stewart 1956; Jones 1969; Lewis 1977, 1980, 1982), and this was a key technique of non-agricultural management in Native California. In California, we find a dynamic changing environment full of moderate fluctuations, where women and men manage, harvest and store plants and animals.

RECENT THEORETICAL ADVANCES IN ECOLOGY

In ecology, recent work (i.e. Pickett and White 1985; Foin and Davis 1987) has demonstrated that while equilibrium may or may not be sought by some systems, a disturbed or unstable state is actually more typical in living systems. This recognition of the natural role of **disturbance** to rejuvenate and, in some cases, to increase productivity of secondary successional levels (Pickett and White 1985; Forman and Godron 1986) has led to increased interest in concepts related to **patch dynamics**. The **borders** of patches and **corridors** between patches have also been identified as useful units of analysis related to characterizing a landscape (Forman and Godron 1986). Corridors and patch mosaics are now known to have been created by many human groups in diverse biological zones worldwide (Lewis and Ferguson 1988).

Over the years, ecological anthropologists, accentuating inter-relationships between culture and environment, have developed a number of tools for environmental interpretation. Rappaport's (1968) study of the Tsembaga in New Guinea recognized a difference in perceptions of the environment between that of the native (cognized or idealized) view and that of the ecologist's (operationalized or realized) view. Current work in **landscape ecology** (Brookfield 1969; Forman, personal communication 1987) is also beginning to note the significance of human perceptions of their environment, both from the people directly affecting their environment and from the researchers studying the landscape. Both points of view must be taken into account in order to accurately reconstruct environmental management strategies of the past. Historical analysis adds more levels of interpretation; not only are the reporters' perceptions at issue, but also their intentions in writing (Bloch 1953).

For the archaeologist interested in landscape ecology, one basic objective is to characterize 1) exploitation patterns, that is the **graininess** of the inhabitants' behavioral response to spatial heterogeneity in their environment (Wiens 1976, 1985; Winterhalder 1980), and to identify and characterize 2) **patches**, or the resource units utilized by the past inhabitants within the 3) **catchment**, or the area containing a set of resource units. It should be noted that when studying human adaptations, graininess does not remain simply a behavioral response but is also related to the grain size of elements within the landscape (Godron 1981; Forman and Godron 1986) perceived and exploited by humans groups of the past; grain size is a characteristic of the landscape. These three concepts can be applied to many aspects of human systems including resource procurement and exploitation, exchange and settlement. They are useful in virtually any study situation in which spatial or scalar aspects of a landscape are studied, particularly where perceptions of the environment are related to a behavioral response. The concepts of patch and catchment in particular prove invaluable to our ability to interact between data sets. This is made evident in Chapter 3. But first it is important to consider the cultural factors that contributed to resource exploitation strategies in Native California.

MAKING A LIVING WITHOUT AGRICULTURE

Numerous works have been published in regions to the south and east of the California region using macroplant remains to reconstruct plant/people interactions (e.g. Yarnell 1964; Streuver 1971; Flannery 1976. 1986; Ford 1979, 1981). Often research in these other study areas has addressed problems related to origins of agriculture. This is partly due to the substantial stratigraphic deposits associated with some of these large sedentary populations of agriculturalists and partly because the origins of agriculture have been associated with other cultural developments that intrigue anthropologists, in particular increased sociopolitical complexity. Here it is essential for understanding coevolution between people and plants to divorce the interactive processes from intentionality or any single hierarchical set of eminent stages or cultural developments.

In general paleoethnobotanical research in California has lagged behind that of other regions. For a number of years ecological and economic anthropologists have realized that the people of the western coast of North America were not "typical" hunter/gatherers. Relatively simple models generated from studies of groups living in marginal arid environments such as the Kalahari Desert of Africa (Lee 1968) were inappropriate for explaining the cultural adaptations and developments of groups living in temperate diverse environments such as the Northwest Coast and California (Testart 1982). Nevertheless, some authors (i.e. Deetz 1968;284; Murdock 1968:336) have been satisfied simply to acknowledge these Pacific Coast groups as exceptions to their rules, then go on and generalize about hunter-gathers often as marginal groups, or even in some cases living essentially a hand-to-mouth existence.

There are countless agroecologies of coevolving organisms that through time may gradually lead to mutual dependency (Rindos 1984). Native Californians participated and affected their local landscape, but not until after the Spaniards had invaded, did the inhabitants of California depend upon domesticated plants and animals for their livelihood. In Rindosian terms, Native Californians maintained a symbiotic relationship with important food resource plants and animals. This relationship enhanced selective advantage for both the resources utilized and the people (Rindos 1984). Incidental domestication in the form of harvesting and selecting some foods over others is an inevitable process of symbiotic relationships. In the case of Native Californians, this process may have been gradually intensifying in some instances to include specialized relationships that would have led to specialized domestication. For the special cases of Native California, it is necessary to isolate the particular organisms and agroecologies involved and what is understood regarding the strategies of non-agriculturalists, that is societies that are not dependent upon agricultural domestication (an obligate and exclusive relationship between people and plants) as their primary means of subsistence.

Fortunately, a few researchers have focused upon the obvious diversity of non-agricultural adaptations (i.e. Martin 1974; Testart 1982). Testart has argued that these so called "exceptions" may be **key** to understanding several cultural developments including increases in population growth, sedentarism and cultural complexity. What these "exceptions" share in common with developing agricultural societies is a reliance upon a **stored food economy**. Thus, rather than **foragers**, that is, people that collect readily available resources, these Pacific Coast groups appear to have been regular **harvesters**, that is, intimately involved in the scheduling, planning, and management of non-agricultural crops. Although in some cases food resources were protected, selected and their production yield intensified, harvesting and management strategies for non-agriculturalists did not require systematic planting and exclusion of competition to the point of coevolutionary dependency. Thus, some non-agricultural groups such as Native Calfornians developed large sedentary populations with relatively complex sociopolitical systems without dependency upon agriculture because their food resources were abundant and storable (Testart 1982; Cowan 1985).

Food storage may indeed be a key ingredient but other considerations, for example, **exchange patterns** or **territoriality** may be equally important. C. Gamble (1986) has recently presented evidence that changes in trade alliances, from emphasis on autonomous trade between individuals to the development of centralized trade with the emergence of an elite sector of specialists acting as representatives between groups, may be an early indication of increased sociopolitical complexity.

A separate development in economic theory led human ecologists to model human behavior based on analogs drawn from studies of animal foraging behavior (i.e. Winterhalder and Smith 1981). Following from research in ethology (i.e. Reynolds and Reynolds 1965; Horn 1968; Brown 1970), Dyson-Hudson and Smith (1978:21) have developed a model which proposes that human "territoriality is expected to occur where critical resources are sufficiently abundant and predictable in space and time, so that costs of exclusive use and defense of an area are outweighed by the benefits gained from resource control." Their applications of the model seems to demonstrate that variability of territorial responses are related to resource defendability.

All three factors (storage, centralized trade, and territoriality) are related to a concern over the control of resources, which is basic to maintenance of populations at greater density and greater sedentariness than those supported by a strict foraging subsistence pattern. All three factors came into play in the Native Californian economy. The relationship of these factors to control of natural resources will be discussed more fully below.

Another crucial factor related to assessment of resource control by harvester groups is the extent or **intensity of resource management.** Tree crops, as well as non-arboreal crops, may have been managed in aboriginal North America. Munson (1986) has proposed that hickory silviculture may have been practiced in the Eastern United States by about 7500 B.P. Different types of resource exploitation patterns may result in different types of settlement patterns. Cultivators with annual gardens tended toward limited duration year round occupations; typically they remained in one place so long as environmental conditions allowed. Silviculturalists and range managers may not have to guard their crops as closely as gardeners. But the long term productivity of their tree and grassland crops may have allowed them to remain at the same locality for many generations, so long as crops were reliable and storable.

Aboriginal resource utilization and management practices tend to develop slowly and gradually (c.f. Flannery 1971; Rindos 1984). Yet drastic changes or modifications may come about through severe climatic fluctuations or cultural interventions. Invasion by European groups into North America resulted in drastic technological and environmental changes. The localized type, degree, and rate of changes varied immensely. Aside from the obvious factors of time scale and ethnicity of groups involved, researchers have demonstrated that geography, land tenure and subsistence pattern have an effect on the differential impacts of culture contact (Fried 1952; Hohenthal and McCorkle 1955; Morey and Morey 1973; Holder 1986).

Thus far storage, territoriality, centralized trade, and the extent of resource management have all been important factors to consider when characterizing land use and landscape in Native California prior to contact with Anglo-Europeans. After contact, a whole set of additional factors affected the ecology of California. Our next step is to obtain reliable evidence for past relationships between Native Californian people and plants. In the following section I briefly examine some techniques and approaches developed in the adjacent region of Oceania in order to assess their applicability to California archaeobotanical problems.

ARCHAEOBOTANICAL EVIDENCE AS ENVIRONMENTAL INDICES

Like ecologists, rarely do archaeologists have the opportunity to find a "natural" field situation in which the effects of a specific disturbance event or source of disturbance can be isolated, dated and quantified. Thus for some of the same reasons that island biogeography has contributed to the study of ecosystems (i.e. MacArthur and Wilson 1967; Connell 1978), archaeological work in Oceania has been an asset to ecological anthropology. From studies of sites such as Tikopia and Hawaii (Kirch 1983) we can begin to understand the nature of human impacts such as the introduction of exotic species, the local extinctions of others, as well as transformations of the landscape through soil removal and deposition. An impact more difficult to detect archaeologically, even in an island situation, is the effect of burning.

Vegetation reconstruction at a broad scale often involves palynological studies (i.e. Martin 1963; Chapman *et al.* 1982; Delcourt *et al.* 1983). Identification of the actual direct effects of disturbance mechanisms including human activities such as plant utilization and environmental manipulation necessitate a more site specific type of data. At this smaller, more specific scale, analysis of macroplant remains can prove much more satisfactory. In the current study, I examine the feasibility of the use of two key botanical techniques; modern vegetation sampling will be described and discussed in Chapter 4; analysis of botanical remains from selected archaeological sites will be discussed in Chapters 5 and 6. Fire is a key process of disturbance in the subregions of Central and Southern Coastal California and considerable attention will be given to this mechanism.

Evidence of past burning activity has been most frequently identified through analysis of both pollen and charcoal from sediment cores. Clark (1983) has noted some of the problems related to this technique and to interpretation of the sediments: 1) the difficulty of identification of small pieces of charcoal; 2) the destructive nature of preparing samples; 3) the variability of deposition and redeposition of pollen and charcoal (both can be carried by wind and water which will effect their depositional history); 4) problems of resolution for analysis; 5) change in the sediments that would affect the abundance of pollen and charcoal; and 6) the geographical bias related to cores collected in areas of higher moisture being used to infer changes in drier areas.

Working with Australian materials, Clark (1983) attributed vegetational changes identified in core samples to changes in climate. Rain forest gymnosperms disappeared with the expansion of sclerophylls between 40,000 B.P. and 25,000 B.P. According to Clark, an initial increase in the amount of charcoal is likely related to a change in climatic patterns resulting from a reduction in precipitation; however, whether or not the increase in charcoal was the work of aborigines, intentionally or unintentionally, has not been resolved. Clark also noted that a decline in "fire-intolerant" *Casuarina* and replacement by "fire-adaptive" *Eucalyptus* credited by several other researchers to aboriginal burning is misleading. Local historic records indicating the presence of *Casuarina* at times when charcoal remains indicates the prevalence of fires raises doubts about the correlation of fire tolerances in these genera as evidence of fire history.

A study conducted in the Eastern United States (Chapman *et al.* 1982) is subject to the same problems discussed in Clark's Australian example. In one study (Chapman *et al.* 1982) of the lower Little Tennessee River Valley, plant taxa identified from charcoal deposited in sites were assigned (often at the genus level) according to environmental conditions. For example oaks were attributed to river bottomland despite the fact that oaks can grow in many upland situations throughout the Southeast. Such limited ecotonal assignments of wide ranging genera are misleading if not inaccurate. Although such a technique may appear convenient, they are virtually useless for purposes of reconstruction.

On the other hand, Chapman *et al.* (1982) are to be applauded for stating their assumptions, which are also extant (whether or not stated) for every environmental reconstruction based on deposits from archaeological sites: 1) the need for fuel is the primary reason for collecting wood; 2) wood is primarily limited to a collecting area within 1 kilometer radius of the settlement; 3) the "firewood indifference hypothesis" (stated simply, there is no bias for the taxa of woods collected); 4) the frequency of woods present reflects frequency in the forest; and 5) there is no differential fragmentation for specific taxa of wood. Clearly all of these assumptions are problematic, but by their statement the inherent biases of such a technique are at least highlighted.

Based on this review, it is evident that a set of indicators are needed for paleoethnobotanical reconstruction. In the following chapters, an interdisciplinary approach drawn from archaeobotany, plant ecology and archaeological survey is employed to unearth Native Californian landscape dynamics. A further problem to be addressed is how their subsistence strategies were altered as a result of early European invasion and intervention. It is argued here that in Native California, sedentary harvesters maintained a high population density with relatively complex social structure by means of resource control and management practices. This Native North American example will serve as a key to our understanding of non-agriculturalists as resource managers and of non-egalitarian economic systems in general.

The Chumash, native inhabitants of the Santa Barbara Channel area at the time of European contact, are the primary research group for this study. Chapter 2 describes the cultural and physical environmental setting of the study based on research in historical ecology, plant ecology, and ethnohistory. Chapter 3 discusses theoretical concepts essential for integrating the varied sources of data used in this study. Chapter 4 describes the vegetation sampling conducted in the Santa Monica Mountains at the southern end of the Chumash area. These contemporary field studies provide information on the productivity of plant taxa recognized to be economically important to the traditional Chumash economy. Within the Chumash area, plant remains recovered from several archaeological sites were analyzed in order to elucidate the pattern and diversity of local and regional exploitation and management strategies. These findings are discussed in Chapters 5 and 6. In Chapter 7, I bridge the varied data sets of Chapters 4 through 6, assess their strengths and weaknesses and weigh their validity. Based on these findings I will characterize the dynamics of Chumash landscape ecology.

CHAPTER 2

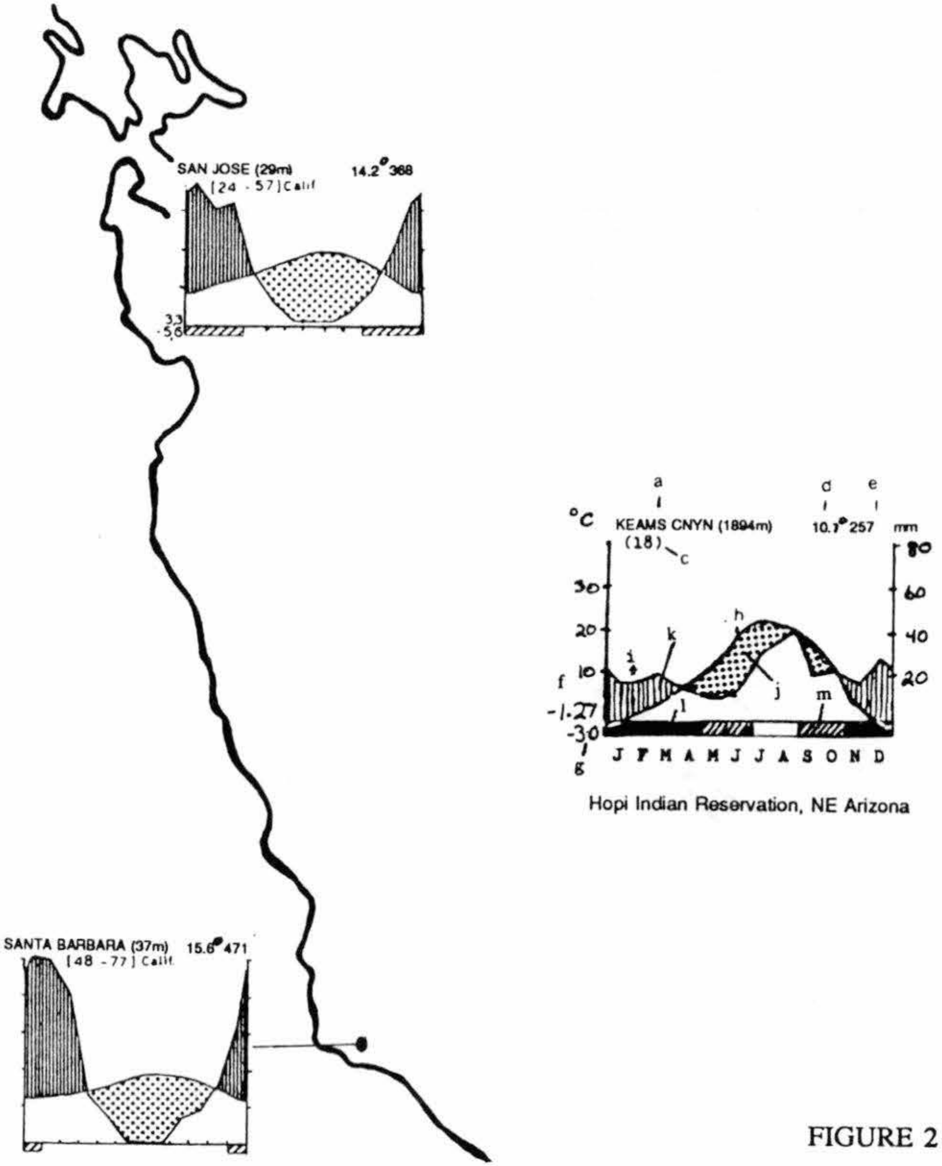
NATIVE CALIFORNIANS AND THEIR ENVIRONMENT

In this chapter, ethnographic, ethnohistoric, and environmental data are utilized to obtain an overview of the interplay between human societies and the landscape in Native California. At the end of this chapter, I develop a model and set of research propositions by which to investigate the specific dynamics of the Chumash ecology prior to and at the time of contact with Europeans.

CLIMATE

The California climate is dominated by a winter precipitation pattern. Northern California receives four times the precipitation of the lower half of the state (McCutchan 1977). In Southern California any rain at all in June, July, or August is considered rare (Figure 2.1). This region's pattern contrasts sharply with the bordering Southwestern region where rain showers in the months of July and August can produce the greatest monthly mean precipitation rates for the entire year (Hack 1942; Hammett 1980).

Southern California is particularly susceptible to a series of seasonal weather conditions that bring about an extremely strong, foehn-type winds (warm, dry winds coming off the lee slopes of mountains) known in this subregion as the **Santa Anas.** These conditions typically involve a surface cold high pressure center in the Great Basin and a surface trough or low pressure area off the California coast (Serguis 1952; McCutchan 1977). The Santa Ana season, which extends from late August until June (Keeley 1977), is characterized by very strong winds that originate in the coastal mountain tops and drive downward toward the coast, lasting for several days at a time. When combined with low moisture availability in the late summer/early fall months,



KEY: a, station; b, height above sea level; c, number of years of observation (first number: temperature, second number: precipitation; d, mean annual temperature (degrees centigrade); e, mean annual precipitation (millimeters); f, mean daily temperature minimum for coldest month; g, absolute minimum temperature (lowest recorded); h, curve of mean monthly temperature (1 division = 10 C); i, curve of mean monthly precipitation (1 division = 20 mm, i.e. 10 C = 20 mm); j, period of relative drought (dotted) for the climate region concerned; k, relatively humid season (vertical shading); l, months with a mean daily minimum below 0 C (black, = cold season; m, months with absolute minimum below 0 C (diagonally shaded) i.e., with either late or early frosts.

FIGURE 2.1: CLIMATIC DIAGRAMS

these conditions are optimum for fires. It is during this peak fire season, that the catastrophic fires occur in California (McCutchan 1977:9). Fires under these conditions can sweep down canyons, covering many miles in only a matter of hours or a few days.

PHYSICAL LANDSCAPE

Topography

The landscape of California is naturally rich and diverse. The most prominent feature is the Great or Central Valley (Figure 2.2) running two thirds the length of the state, approximately 400 miles long and about 50 miles wide. Prior to European contact there were large tule lakes and marsh areas at the southern end of the Central Valley (Burcham 1957). Beginning just south of the Central Valley and its bordering mountain ranges, the desert stretches the full length of the southern and southeastern third of the state. The Central Valley is bordered by mountains, the most impressive being the Sierra Nevadas on the east which reach elevations of 14,000 feet at their highest peaks. To the west of the valley are the Coast Ranges skirting the valley and the Pacific Ocean from the southernmost extent of the Northwest Coast to Southern California. The Coast Ranges scarcely reach above 2000 feet, except for the southern Transverse Range which runs northwest to southeast and rises nearly 3000 feet in the Santa Monicas and over 8000 feet in the San Gabriels.

The Santa Monica Mountains, where the southern end of the Coast Ranges meet the easternmost edge of the Transverse Range, are bordered on the south and west by steep cliffs dropping to the sea. The Santa Monicas are made up of igneous, sedimentary, and metamorphic formations. They stretch fewer than 50 miles, the entire length of the east/west running coastline

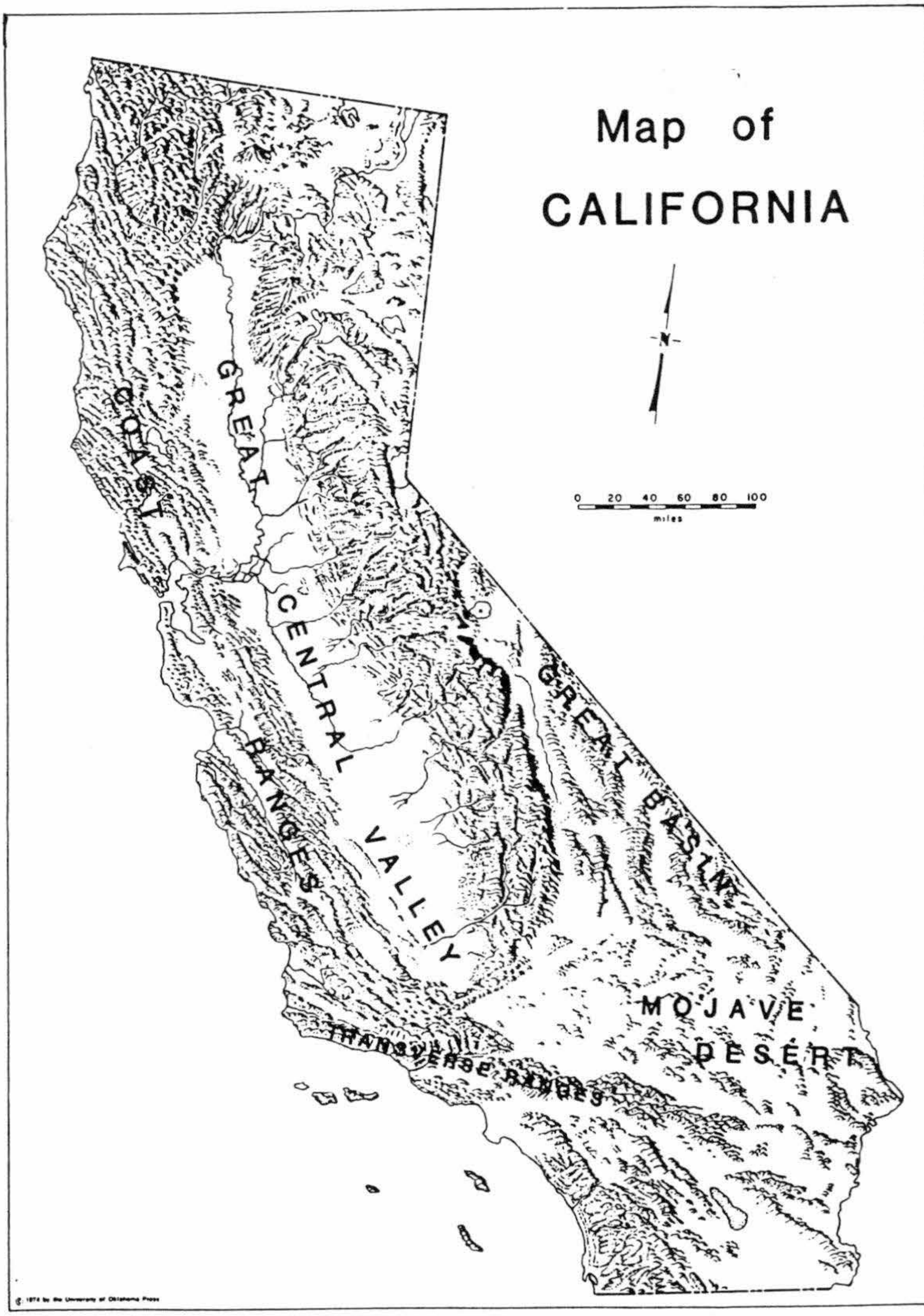


FIGURE 2.2 Map of California.

between Oxnard and Los Angeles, and for their width they climb from the coast to their highest peaks and then down to the interior valley floor in less than 10 miles as the condor flies. Here, heavy faulting, erosion cutting, and distinct depositional periods are often clearly evident in cliff faces, road cuts, and creek beds. The physical diversity of the Santa Monica Mountains is indicative of the overall Chumash resource zone.

Flora and Fauna

Early historical accounts described marsh grasslands and prairie grasslands of the Central Valley and oak woodlands in the bordering foothills as areas that supported large herds of deer, pronghorn antelope and elk (Burcham 1957). The actual size of these herds is unknown, partly because these species did not congregate into large migratory herds such as the bison (Burcham 1957:95). Nevertheless, by the 1840s, 3000 deer and elk skins produced in the Central Valley were being exported yearly from San Francisco alone (Wilkes 1945; Burcham 1957). King (personal communication, 1991) has also found comments in early Spanish documents regarding the trade for otter pelts in the Chumash region. From this historical documentation, it is fair to conclude that the extent of large mammals present in California prior to and at the time of contact with Europeans was sizeable.

The native grasslands were so radically altered with the introduction of European species of plants and animals that their actual pre-contact landscape character remains poorly understood. Based on historic accounts and studies of remnant (presumably pristine) stands, Burcham (1981) has argued that the grasslands were characterized by perennial bunch grasses such as purple needlegrass (*Stipa pulchra*), nodding needlegrass (*Stipa cernua*), and beardless wild-rye (*Elymus triticoides*). The southern end of the valley and Coast Ranges shared two additional species of needlegrass (*S. lepida* and *S. coronata*). June grass (*Koeleria cristata*), and California melic (*Melica imperfecta*), and deergrass were also important in southern California grasslands. Important forbs in the grasslands included *Trifolium tridentatum*, *Gilia tricolor*, and various species of *Brodiaea* sp., *Calochortus* sp., and *Allium* sp. (Burcham 1957:80).

The woody vegetation of the coast ranges is somewhat better understood because of its more persistent nature. During early European contact, while the native perennial grasslands could be characterized by their rapid displacement by introduced annual species, the dominant vegetation of the Southern Coast Ranges, the chaparral could be characterized by its persistence. It will be argued below that this "impenetrable" (Menke and Villasenor 1977) trait of the Coast Range vegetation was enhanced by the policies of early European and Euroamerican rule in California.

The dominant Coast Range vegetation has been characterized by plant ecologists as a classic example of **Mediterranean** type of flora. The California **chaparral** vegetation association that dominates this landscape has analogous associations in other Mediterranean areas of the world, including Mediterranean Europe, the South African Capeland, central Chile, and southern Australia (Walter 1973). This vegetation is characterized by woody stump sprouting shrubs with broad leathery (sclerophyllous) evergreen leaves, and occurs in semi-arid areas characterized by winter rain (Walter 1973; Barbour *et al.* 1980). An important characteristic of the chaparral vegetation is its reliance upon fire for rejuvenation. Numerous studies have demonstrated how particular species and vegetation types have developed traits that allow them to resist fire, tolerate fire, or even to thrive from the impact of fire (i.e. Aschmann 1959; Hanes 1971; Minnich 1983).

Similarly, Sweeney (1956) listed over 200 grass and herbaceous species that he found growing on burns in the California chaparral. In his study, Sweeney observed that not all species respond in the same way to fire: some occur in greatest frequency the first year after a fire while others may not appear until several years later. The **periodicity** of this post-fire occurrence would be an important factor to take into account by people when managing for the enhanced productivity of particular species.

Citing several studies done in North America, Bendell (1974) noted some of the animals that favor areas opened by fire. These include white-tailed deer, black-tailed deer, jackrabbits, moose, black bear, brush rabbits, hares, elk, blue geese, muskrat, beaver, coyote, and cougars. Cowan et al. (1950) observed that clearing and burning can lead to a marked improvement in the nutritive properties of forage, although these changes are short-lived. There is also some evidence for some game animals that suggests their total numbers increase following a fire (Spencer and Chatelain 1953; Mellars 1976). This may be because of an overall improvement in general health due to better forage (Einarsen 1946).

In recent years range managers have developed recommendations of "optimal areas of burns" and periodicity of burning for various animals (Hendricks 1968; Lewis and Harshbarger 1976; Hamilton 1981; Landers 1981). Overall, most mammals and many birds benefit from various intermediate levels of disturbance through clearing and burning. The only mammal identified that may **not** benefit from prescribed burning is the tree squirrel of the woodlands of Eastern North America. Apparently their dependence upon hardwood forests is hampered by current prescribed burning practices in the south that favor softwoods (Kirkpatrick and Mosby (1981). However, the productivity of some hardwoods in the south, notably many oaks, can be enhanced with small scale periodic burning. Thus even in this example, prescribed burning can not be demonstrated to be entirely detrimental to the habitat preference of game animals.

Taber and Dasmann (1958) found that after fires in the California chaparral, there was an increase in deer populations for several years due to increased productivity and decreased mortality. This improvement in health has been attributed to the sprouting of shrub species. With an increase in smaller game animals comes an increase in predators such as red-tailed hawks, Cooper's hawks, sharpshinned hawks, sparrow hawks and great horned owls. Thus, disturbance in the form of fire in the chaparral is linked to predator-prey relationships. Within 5 to 10 years this increase in numbers of game animals has returned to the pre-fire condition (Menke and Villasenor 1977). Because fires produce higher numbers of game on which to prey and increases in some plant foods, humans also benefit from this process.

Lewis'(1973) ethnohistoric work on prescribed burning in northern California led to studies of aboriginal resource management in other parts of California. More recent work (Timbrook *et al.* 1982) has demonstrated that burning was an equally important management tool to the south. The implications for the use of prescribed burning in Central and Southern Coastal California are threefold: 1) chaparral vegetation would be stimulated and rejuvenated (Aschmann 1959; Hanes 1971); 2) understory plants such as small perennial and annual herbs and grasses would increase in productivity (Sweeney 1956); 3) herbivores, such as large and small mammals considered game animals by humans (Mellars 1976), would cluster in burned areas; and their overall health and presumably their reproductivity would improve (Biswell 1963 and 1967; Hendricks 1968; Komarek 1974; Bendell 1974).

PEOPLE

Social Setting

Prior to the European invasion native populations in central and southern California were among the largest in Native North America (Cook 1976). Native Californian society for the most part was characterized by relatively complex social integration. A reconstruction based on historic descriptions and ethnographic informants depicts a system of communities ruled by powerful hereditary chiefs and bureaucratic elites who apparently controlled production, management and distribution of resources, in particular food and other wealth items (Strong 1929; White 1963; Bean 1972, 1974; Bean and Lawton 1973; King 1974). Intergroup social mechanisms included ritual and kinship reciprocity, fiestas and trade fairs which served many social and economic functions including the redistribution of wealth and the region wide reduction in risk and hardship during microenvironmental fluctuations in resource availability (Bean 1972; Bean and Lawton 1973; King 1976). In Southern Coastal California social institutions included a hereditary ruling elite (Bean 1974), secret male societies (Blackburn 1974), craft specialization such as boat making and bead making (King 1971; Blackburn 1974), and an exchange network based on a shell bead currency (King 1971; Heizer 1978).

Fortunately, some of our best documented historic and most detailed early ethnographic accounts for Native California are related to the Chumash of the Santa Barbara Channel area of Southern Coastal California, which are the primary focus for the current research. Unfortunately, due to the fact that their homeland was within the part of California most quickly taken over by the Spaniards and then Anglo-Americans, much of the traditional lifestyle of the Chumash was swept away by the early 1900s. By far the most extensive source of information is derived from the work of John P. Harrington, who collected extensive oral histories from elderly informants in the early 1900s (Harrington 1917; Blackburn 1975; Hudson *et al.* 1977; Hudson and Blackburn 1979). The complete set of the *Papers of John Peabody Harrington in the Smithsonian Institution, 1907-1957*, containing more that 750,000 pages of field notes, dictionaries, unpublished grammars, drafts and various manuscripts related to groups throughout western North America (Briscoe 1981) have been obtained by several libraries in California, making the collection readily accessible to California scholars. Ironically, while Harrington was hard at work recording all that he could obtain of Chumash "memory culture"[1] , archaeologists working in the region ignored living informants and instead relied almost exclusively upon historic Spanish documents for interpretation of archaeological materials (Hudson and Blackburn 1979). By the time that Harrington was conducting field work, this information was rapidly vanishing with the passing of every Chumash elder. Harrington spent the greatest portion of his time interviewing elderly native informants in Southern California. His notes on the material culture of the Chumash alone have spawned numerous published volumes by scholars working with his documents. For example he collected 3000 pages on *tomols*, the plank boats used by the Chumash (Hudson and Blackburn 1979:24)

Today there is a relatively rich ethnohistoric record of some aspects of Chumash life, which was pieced together from Harrington's notes, Spanish documents and early Anglo-American historic accounts. At the same time, some topics remain poorly understood, due to the categories of subjects that Harrington and his informants chose to discuss and those ignored. There is excellent information on many aspects of Chumash material culture, extensive

1 By memory culture, I mean the oral history, customs, rituals knowledge, songs, legends, folk stories and myths and other information that had been passed down generationally by Chumash as traditional knowledge.

word lists including names of plant foods and their uses, and a rich oral history of the legends and stories of actual and mythical heroes and events that were passed down from the elders, but little actual information related to resource management, procurement, and distribution. Thus for many purposes, our information is extensive and quite useful, and a reasonable characterization of Chumash socio-political institutions can be reconstructed. But for other purposes it is necessary to rely on analogs from adjacent cultural areas or other types of information.

The Chumash had an elite male secret society called *Antap* to which exclusive membership could only be bought (by relatives) at birth for a very high price. The Chief and all his male relatives were required to join. This society was made up individuals who took the roles of shamen and dancers. As a unit they functioned in the society as the collectors of tribute (usually beads). They toured the territory giving dances and all citizens were expected to contribute (beads, other wealth items or food) for these dances. Apparently they routinely extracted money from the wealthy by choosing a victim and slowly poisoning him, until it was decided he had paid enough to be healed, or he was dead (Blackburn 1974:104-106). Through this means they convinced most people to contribute their rightful share. A certain amount of the wealth gained through dances was used to sponsor subsequent fiestas and thereby redistribute resources. Major Chumash settlements carpeted the coastline from Point Conception to Malibu (Brown 1967). Five to ten miles inland, where the coastal mountains meet the interior valley floor, a series of smaller communities settlement were distributed parallel to the larger coastal communities. Spanish mission records indicate that the residents of these communities were usually related to members of adjacent communities, and often had strong kin ties to the closest major coastal town. The latter was apparently particularly the case for the upper elite (Edberg 1982).

Local resource bases were subsidized by use of trade routes that connected each village (or in the desert, each water source). Major north/south routes running along the coast or down large valleys connected Baja California to the Northwest Coast Area. Major east-west routes ran from the Pacific shores to the Sierra Nevada's (Heizer 1978) and to the Colorado River (Sample 1950; Johnston 1980), cutting through a variety a environmental zones, thus allowing communities to benefit from resources more diverse than their own borders would allow. Trading paths were often marked (Heizer 1978) and tribal borders were well known (Heizer 1958). Traders apparently travelled only short distances in most cases; but trade goods were passed on for perhaps hundreds of miles (Heizer 1978).

At the time of European contact, the Chumash were trading directly with the Yokut of the southern end of the Central Valley, the Tubatulabal of the Sierra foothills, and the Mohave traders of the Mohave Desert (Sample 1950; Davis 1961:28). Through trade the Chumash obtained food items such as fish, salt from saltgrass, seeds, pinenuts, grasshoppers, herbs and non food items such as obsidian, skins and furs, steatite beads, asphaltum and baskets. In return they supplied seeds, acorns, shells, and shell beads and ornaments and steatite vessels (Davis 1961:28).

Subsistence

The widely cited ecological model by Baumhoff (1963) and a later refinement by Gage (1979) simplify Native Northern California subsistence to a tripartite diet of fish, acorns, and deer. Although these are indeed important items throughout much of Native California, the diet of Central and Southern

Californians appears much more diverse. Research on early ethnographic and ethnohistoric notes (i.e. Burcham 1957; Lewis 1971; Bean and Lawton 1972; Hudson and Blackburn 1982; Timbrook *et al.* 1982; and Bocek 1984) have provided a baseline for constructing a more detailed model of aboriginal subsistence practices in these subregions. Native Californians relied on a diverse economy of nuts, fruits and berries, small seeds, terrestrial mammals, sea mammals, fish and shellfish.

TABLE 2.1: IMPORTANT CHUMASH FOOD RESOURCES

PLANTS:

Nuts: acorns (*Quercus* sp.), walnuts (*Juglans* sp.), wild cherry pits; islay (*Prunus* sp.)

Roots, bulbs túbers, flower stalks: yucca (*Yucca* sp.), mariposa lilies (*Calochortus* sp.), blue dicks (*Dichelostemma*), and soaproot (*Chlorogalum* sp.),

Small seeded plants:
Grasses: *Stipa pulchra*, *Avena* sp., *Elymus* sp., *Hordeum* sp.
Forbs: chia (*Salvia columbariae*) and red maids (*Calandrinia* sp.), and tarweeds (*Hemizonia* sp. and *Madia* sp.)

Berries: manzanita (*Arctostaphylos* sp.), elderberry (*Sambucus mexicana*), and toyon (*Heteromeles arbutifolia*)

ANIMALS:

Birds: quail, dove, ducks, geese, and coastal birds

Terrestrial Mammals: mule deer, tule elk, rabbits, jack rabbits, squirrels, badgers, and dogs

Sea Mammals: Guadalupe fur seals, California sea lions, otters (the latter may have been primarily for pelts)

Shellfish and Crustaceans: crabs, lobsters, mussels, clams and abalone

Freshwater fish: rainbow trout, steelhead

Ocean fish: perch, guitarfish, croaker, halibut, shark, stingray, bonito, mackeral, jackmackeral, hake, sardine, anchovy, swordfish, seabass, and dogfish

Sources: Burcham 1957; King 1971; Heizer and Elsasser 1980; Johnson 1982

Naturally, even with trade and storage each subregion was constrained, to a certain extent, by the set of locally available resources (i.e. coastal, woodland, and bay). Furthermore resource availability was subject to local environmental conditions and also former and recent inter- and intra-systemic perturbations. That is, the productivity of available resources would have been dependent upon local histories of various disturbance events, such as localized drought, flood, fire, pestilence, and competition factors.

ENVIRONMENT AND HUMAN BEHAVIOR

Prehistoric Ecology of Native California

Recent work in palynology and dendrochronology has generated a controversy over the severity of climatic change in California during the past 10,000 years and its impact upon cultural and technological changes (Byrne 1979). Byrne (1979) has argued that overall changes in continental climate in North America would have been relatively minor in California. Any climatic trends would have been further constrained in the Santa Barbara region by the moderating influence of the coast (Moratto et al 1978; Byrne 1979). Nevertheless, climatic changes apparently did have an impact on the greater California region, and this may have had an indirect effect on the study area as well.

Moratto et al (1978) have compiled what they consider to be the most significant climatic changes over the last 4000 years for areas in Central and Southern Sierra Nevada's and attempt to correlate changes in trends with important changes in social organization. Byrne (1979) has criticized their effort to apply climatic information to social innovations because they apparently lack thoroughness in their study of these environmental data. Byrne uses this opportunity to caution archaeologists who attempt large scale borrowing of climatic data to plug into cultural reconstructions. Byrne considers Moratto *et al.*'s (1978) intentional use of archaeological information to assess "models of environmental change developed in other sciences" (Moratto *et al.* 1978:147) to be "unwise and unnecessary" because human populations are "less than ideal climatic indicators" (Byrne 1979:196). Humans have the unique ability to buffer many types of disturbance, including climatic change, through **cultural** adaptations; and the archaeological record is often lacking in the information necessary to distinguish climatic factors from other sorts of phenomena. Byrne adds that such attempts as this example are extremely vulnerable to "the trap of circular argument" (Byrne 1979:196).

This cautionary tale does not preclude the likelihood of some correlations between climatic change and social innovations in the Sierra Nevada's. Given the severity and unpredictability of weather conditions in these mountains, human responses to fluctuations and changing patterns may result in modified or innovative behavior responses that produce material evidence. At the same time, it would seem premature to develop explanations for material culture innovations for whole regions based on local environmental data alone, given our knowledge of the importance of trade in goods and the exchange of information within and between regions in California.

In the Santa Barbara region we have no documented evidence for severity of climatic events. Recently, Arnold (1990) has hypothesized that warm water related to El Nino episodes may have at times induces serious subsistence stress" on Island Chumash. In particular she suggests the period between A.D. 1150 and 1250 was such a stressful time. The episodic events of this period prompted intensification of mainland ties, and specialized bead production. Her model is problematic for several reasons. First, it should be noted she has yet to produce any archaeological data to substantiate her claim of food stress in the Channel Islands. Indeed, the opposite may have been true. Fluctuations in water temperatures tend to move aquatic resources along the coastline which would affect resource availability and predictability along a given stretch of coastline. She points to a recent brief El Nino episode in 1982-83 that killed hundreds or thousands of baby pelagic red crabs which were thrown ashore by the surf. But such an incident may not have been considered a crisis. It seems plausible that a harvest of such numbers of baby crabs could also have been considered justification for a feast. Thus her example fails to demonstrate conclusively her claims of the deprivation, let alone stress for the island inhabitants.

Another problem with her approach is an implicit assumption that the Island Chumash were not socially and economically integrated into the rest of Chumash society. Although she apparently dismisses the impacts of El Nino episodes on the mainland (this too is problematic), she fails to consider that trade and kinship ties were firmly established prior to this time. Again, thus far there has been no evidence forthcoming to support her claims.

Despite this critique, there exists the possibility that particularly severe or prolonged episodes of El Ninos may have affected availability of aquatic and marine resources for coastal and island Chumash, but the extent and nature of impact has yet to be documented. Indeed, Swetnam and Betancourt (1990) suggest that oscillations in both directions, warm (El Nino) and cold (La Nina) episodes may be linked with disturbance dynamics in "fire-prone ecosystems."

Clearly, this is an important direction for further study. To date we have no evidence regarding the severity of these episodes, their impact on the local disturbance regime, or the degree that they affected the Chumash economy. Given the length of time that the Chumash inhabited the coastline and the fact that most oral traditions record periods of stress, it is likely that the Chumash considered the events resulting from these episodes to be from minor to intermediate levels of disturbance. The availability of resources could have remained within their societal memory of anticipated parameters of spatial and temporal heterogeneity. In other words these climatic fluctuations contributed to the dynamic mosaic of patches recovering from disturbance in the Santa Barbara Region without necessarily causing undo stress on the local inhabitants.

Despite the controversy regarding the impact of occasional El Nino/La Nina episodes, overall it is certainly safe to assume that the Santa Barbara Region was relatively free from the degree of unpredictability and severe environmental extremes experienced in the Sierra Nevada's and the deserts to the east (Moratto 1978). Although this Mediterranean environment was susceptible to variability in placement of aquatic and marine resources along coastal areas and to seasonal fires, at present there is no direct evidence to indicate that this disturbance regime limited food supply. Actually in the case of fire, it is quite likely that intermediate levels of disturbance expanded their breadth of resources. Fires lasted only a few hours or days and the conditions for intermediate to catastrophic fires were seasonal and rather predictable.

In sharp contrast to this pattern, adjacent Sierra mountain and desert subregions of California were subject to severe climatic events that could negatively affect food supply; inhabitants of these subregions were more subject to changing patterns than in the Mediterranean environmental regime with its moderating coastal influences. It may be more significant to compare Chumash technological and material changes with climatic changes in regions bordering the Chumash than to limit observations to local climatic events. In fact, the rather secure condition of Chumash social institutions and their apparent affluence may be related to stress in bordering regions more dependent upon limited sets of food resources and more constrained environmental conditions. Coastal groups such as the Chumash may have benefited to a certain extent when the prehistoric Pueblo systems of the Anasazi, Mogollon, Hohokam, and Fremont suffered their declines between about A.D. 1050 and 1350. The following discussion highlights critical climatic patterns and events in regions to the east of the study area. A case will be made to argue that climatic events in these regions may be related to a certain extent to cultural developments identified within the Chumash region.

Climatic reconstructions and their relationships to cultural innovations is a topic that clearly deserves serious attention, although a full assessment is considerably beyond the scope of the present work. However, there are two time periods in California that merit some consideration in light of this study, because of an apparent link between climatic patterns and changes in resource management strategies. Bristlecone pine tree-ring information in the White Mountains of California (due east of the southern end of the Sierra Nevada Mountains) indicate that a period of relatively warm, dry conditions came to a close with a sharp decline in temperature about 3300 B.P. (LaMarche 1974; Moratto *et al.* 1978) with a noticeable increase in available moisture within 100 years (LaMarche *et al.* 1974; Moratto *et al.* 1978). These cooler and subsequently wetter conditions continued for several hundred years. Between 2600 and 2200 B.P. the Recess Peak Glacial, of the Central Sierra Nevada advanced (Birman 1964; Curry 1969; Moratto 1978). Temperatures were coolest during the beginning of this glacial. After about 100 years, at about 2500 B.P., the tree rings from the upper treeline in the White Mountains to the adjacent east indicate a sharp increase in temperature which apparently persisted until the end of that glaciation (Moratto *et al.* 1978). Thus, although the subregion experienced extreme conditions, these conditions varied in their severity. In general, a lowering of the treeline, which accompanies glacials in the Sierra Nevada, would probably have correlated in altitudinal reductions and displacements for many organisms. This may well have included humans.

These climatic fluctuations in the Sierra Nevada and the White Mountains are particularly tantalizing because they correspond to cultural innovations identified by research in separate California subregions, including South-Central Sierra Nevada, Southern San Joaquin Valley, Santa Barbara Channel and the San Diego subregion (Moratto 1984). For the Chumash region, King (1982a), working with shell beads, ornaments and other shell artifacts has identified changes in manufacture and reposition that indicate an increase in social complexity related to the rise of an inherited elite. This he deduced from the styles of shell ornaments found with burials and the distributions of specific ornaments in limited cemetery contexts. Based on examination of changes in fishing technology including the addition of plank boats to their equipment, and the frequency of plant processing equipment, King (1981) argued that this time was marked by an increase in social control over food stores and some changes in emphasis of food crops. For plants he suggested a decreased emphasis on small hard seeds and an increase in use of nutmeats, in particular acorns and islay. King notes that at no time was there an elimination of the tools used in processing hard seeds (grinding slabs) and he assumes that the change represents the addition of resources and a change in emphasis rather than full scale replacement (King, personal communication, 1988).

For the South-Central Sierra Nevada, Moratto *et al.* (1978) note increases in population size, use of trade networks, and overall social complexity. For the next 1500 or so years both subregions grow in social complexity, status differentiation, population densities, and craft specialization and increase their trade with other subregions (King 1974; Moratto *et al.* 1978). This trend continues long past the advance and retreat of the Recess Peak Glacier, and continues through gradual warming and drying trends in the overall California climate. The dual pattern in social and technological innovations in these two regions may be linked to changes in climate in the Sierra Nevada, but such a conclusion remains at this time premature. It should be underscored that the catalyst is simply one of climate change, not the actual direction of the change.

Another interesting time period occurred about 1000 B.P. when the prehistoric Pueblo systems were flourishing throughout the Southwest. Scholars have discussed feasible explanations for the behavioral responses identified archaeologically in the Southwest, particularly in relation to the population contraction and subsequent decline about 700 B.P. (Martin and Plog 1973). The most popular explanations are 1) a long drought; 2) intergroup warfare; and 3) a change in precipitation patterns from winter to summer rain (Jennings 1974:311). All explanations are directly or indirectly related to failed attempts to provide resources to a population greater in number than their social, technological and environmental constraints would support. In most of these explanations, changing climatic patterns are taken to be a significant factor.

In the Santa Barbara Channel area, there was no apparent sharp expanse and contraction of cultural traditions at this time, but King (1981) has recognized a significant socio-economic innovation in the established society. The apparent development of the standardized medium of exchange in the form of shell beads occurs at about 1000 B.P. King (1982a) observes that this change allows a greater number of the people in the society to participate more directly in exchange for material wealth. There continued to be elaborate craft specialization; but individuals were able to trade their labor or other resources directly for food or other desired items, such as stored wealth in the form of standardized shell beads. Although the fairly rapid expansion and contraction of prehistoric Pueblo traditions cannot at this time be directly linked to the development of a standardized medium of exchange in Southern Coastal California, this remains an intriguing correlation that merits further inquiry.

The above discussion provides a cursory chronology that highlights important social and technological innovations in the Chumash region prehistorically. The evidence provided fails to support the idea that innovations on the part of the Chumash were in direct response to climatic change. In both cases, if there were correlations, they were more likely to have been indirect responses. If the Chumash did have any changes in behavior related to climate, they perhaps were in response to the adverse effects their neighbors were experiencing. In such instances the Chumash may have benefited by their reliance upon a wide range of resource options. This sort of "banking" (utilizing diverse resources and using shell beads for trade) could have allowed them to benefit at the times of their neighbors' crises. All of the above information is provided to set the stage for more recent times, the late prehistoric/protohistoric/early historic periods which are of primary importance for the current study. This time frame is especially useful because it allows us to draw from archaeological and environmental data sets which are substantially more complete than earlier time periods. It also allows us to draw directly from the historic record, a priceless tool for recent periods.

Historical Ecology of the European Invasion

The introduction of European organisms had a significant impact on the symbiotic relationship maintained between people, plants and animals in the New World. Historic records indicate that by 1550 there were 1,250,000 cattle, 6,250,000 sheep (and goats) and some 55,000 horses and mules in the region of Mexico alone (Simpson 1952; Burcham 1957). The substantial impact of European livestock, plant crops, weeds and vermin initially served to disrupt local co-relationships, causing many local displacements and possibly even local extinctions. For example, Burcham (1957) has suggested there were widespread displacements of native bunch grasses by European annual grasses. In his "historico-ecological study of range resources of California" Burcham (1957:173) argues that the major sources of disruption were "grazing, disturbance of soil for cultivation, and development of urban communities." This new regime of disturbance was initiated with the earliest Euroamerican settlements.

The missionization of Alta California (now the state of California) began with the San Diego mission in 1769 when Rivera landed with nearly 200 head of cattle (Burcham 1957). Font's (1930) journal of the 1776 second Anza expedition reports another 1000 head of domestic animals. Estimates vary (i.e. Forbs 1839; Mofras 1844; Bolton 1917; Burcham 1957), but by 1830 there were probably close to 500,000 head of cattle alone in the mission belt of California. The concomitant reduction in native large mammals (recall the fur and peltry trade to Europe which was well established by the early 1800s) made for a devastating change in animal/plant relationships.

Prescribed burning of grasslands by the California Indians was prohibited by the Spanish Governor of California, Don Jose Joaquin de Arrillaga, in 1793 (Timbrook *et al.* 1982:171). Any incipient or proto-domesticated plants which were dependent (or were becoming dependent) upon native management practices would have been the most vulnerable to these new competitive factors, particularly in light of the concurrent forced neglect by the native inhabitants. In Rindosian terms, plants that were becoming dependent upon a symbiotic relationship with humans for a competitive advantage through cultural selection would have lost that edge with the forced neglect imposed by colonial rule.

Prior to the first contacts with Europeans, the California flora and fauna had adapted to a set of environmental conditions that had existed for some time in the California region. These organisms had coevolved, each developing its own niche in relation to the habitats and behaviors of other organisms with which it came into contact, each responding to established sets of responses to fire, drought and other naturally occurring disturbance factors. This should not be mistaken as a static equilibrium but rather a dynamic equilibrium, in which native organisms had adapted over a long period of time to locally occurring environmental conditions including an existing disturbance regime. The invading European organisms brought about a sudden sweep of new disturbances that radically and rapidly altered the California landscape. According to Burcham (1957:185), "few places on the earth, if any, have had such a rapid wholesale replacement of native plants by introduced species."

There were many reasons why the native vegetation of California was so vulnerable to European taxa. Burcham (1957) has noted that many of the invading plant species were already preadapted to the climate, as much of California coast and plain has counterparts in the Mediterranean belt of Europe, and it is in this region that the invading organisms originated. The initial impact on the landscape was a drastic reduction in certain species, such as the native bunch grasses. Burcham (1957) has noted that the native bunch grasses would have been no competition for European invading species, which were more adapted to disturbance regimes associated with the activities of Spaniards, such as agriculture and raising cattle. Bunch grasses allowed space for the invading species to colonize, and many of the new species were annuals with means of dispersal, propagation, and reproduction that gave them distinct advantages over the California species. Also, many of the invading weedy species were not as palatable to the European livestock as the California species (Burcham 1957:176-177).

There appears to be some historic evidence that certain invading plants initially seemed to have thrived better than they ever had in Europe, given a reduction of competition pressures from an established European flora that was well adapted to Old World disturbance regimes. This is a conceivable outcome of these early interactions, given our current understanding of competition factors; however, a lack of taxonomic expertise (due to training and or current knowledge at the time) may have biased early historic accounts. For example, in 1792 a naturalist and explorer Jose Longinos Martinez noted the following:

> "The common apothecary's mallow which was not known in those countries (Southern and Baja California) has been propagated from some seeds which were mixed with other--so much that it is difficult each year to clear it out. It grows with such vigor that because of it one cannot walk in the immediate vicinity of the missions or through certain grain fields. Each plant looks like a small tree." (Simpson 1939)

At first glimpse, one might assume that Martinez would have recognized such a common European weedy plant and his identification would have been quite accurate. On the other hand, Martinez may have not been aware of the bush mallows *Malacothamnus* spp. which are native to southwestern North America. Also, Munz (1961:36) has observed that the tree mallow (*Lavatera assurgentiflora*), originally from the Channel Islands "became popular among the early Mexican settlers and has escaped from cultivation on the mainland."

Therefore, Martinez could have identified a weedy plant (either European or native) which was thriving in the vicinity of the newly constructed missions and fields, or a fertile or infertile hybrid, or even misidentified the genus completely.

Biases of the reporters must be taken into account when considering which plant taxa were and which were not introduced at the time of European contact. Parish (1890:7) has noted that such evidence "must in many cases be inferential" due to the spontaneity with which many "weedy" species grow voluntarily. Some species, he argued, are of such "world-wide notoriety," that they "may be branded as 'cosmopolitan weeds,' even when detected in the least suspicious places." He further noted that the absence of a species in collections from a given locale is not conclusive, especially for common weeds, because explorers were most likely to ignore well-known plants and tended to collect unusual or more exotic plants.

Preliminary analysis of plant remains from adobe bricks of early Spanish missions in California (Hendry 1931 and 1934; Hendry and Bellue 1935) suggest that many weedy species that are considered introductions from Europe were widespread by the early contact period. Hendry (1931:126) inferred that several plant taxa, including curly dock (*Rumex crispus*) may have been here prior to European contact, due to the early presence of the seeds of this plant in adobe bricks from the mission. On the other hand, Frenkel (1970) has cautioned that such information could alternatively be considered good evidence of such weedy species' ability to invade new areas. It is also important to note that Hendry *et al.*'s technique has come under scrutiny (i.e. Burcham 1957; Frenkel 1970). Apparently the pieces of brick were never demonstrated to be from the earliest walls of their respective missions, and thus cannot be considered evidence of even what was present at the time of the first construction at these mission sites.

The best evidence on these points will come from capped prehistoric sites with no historic or protohistoric components, with good preservation of charred plant remains from good feature contexts. Also a reasonable number of such sites and contexts would be necessary to in order to concretely establish this type of information. Such solid evidence, of the quantity and quality required, is probably over a decade away in California. However, work such as the present research can build toward that goal.

Overall, based on historic accounts it is safe to assume that composition of vegetation adapting and evolving from this exchange was permanently altered. Those areas most vulnerable to continued dominance by introduced species are urban and ruderal areas (Frenkel 1970). Native species in some more remote areas that were less modified by modern activities are now recovering; other areas which were dominated by chaparral were less affected by initial European introduction and have continued to be dominated by native species. Thus recovery from the European impacts and introductions vary significantly by vegetation zone.

The Drought Years at *Talepop*

Local factors determined the impact of European contact on the people residing at any single locus as well. For example, in 1801 Miguel Ortega was given a provisional land grant that included *Talepop*, a Chumash village. Apparently Ortega was "devoted to raising wheat." He tried growing corn one year, but it failed due to lack of water. He dug irrigating ditches, but in 1825 the ditches got so deep it was impossible to get water out of them, and he abandoned his property and returned to the Pueblo of Los Angeles (Edberg 1982). Ortega's ranch was located within the primary research area of the present project. It is possible that severe ditch cutting at the confluence of drainages due south of the *Talepop* site are due in part to Ortega's aborted attempt at irrigation over 115 years ago. Such modifications of landscape due to localized livestock grazing and cultivation practices would have a direct impact on the distributions and frequencies of native species.

Following Douglas (1976) and Palmer (1965), Rowntree (1985) has suggested that droughts of varying intensity occurred during the mission period in the following years: 1777, 1783, 1795, 1803, 1809 and 1820. Using historical accounts collected by Bancroft (1888) and Lynch (1931), Burcham (1957) has observed the droughts of 1809-1810 and an even more severe drought beginning in 1820-1821 which lasted until 1832. During the "great drought" of 1828-1830, in which at least 40,000 horses and cattle perished, there was no rain in the coastal area south of San Francisco for 22 months. We can conclude, that even if Spaniard techniques of land use could have been adopted to the Southern Californian environment, the 1820s were an especially poor time to be farming in that region. It comes as no surprise that the native land use pattern, on the other hand, was apparently well suited to these weather fluctuations.

A DIACHRONIC MODEL OF CHUMASH ECOLOGY

From the above information it is possible to develop a generalized model of subsistence and ecology for the region: Native Chumash were able to maintain one the highest aboriginal population densities in North America by social maintenance of trade alliances, storage (both in the form of food and non-perishable wealth items, in particular shell beads), and increasing the productivity of their naturally diverse and productive resource base through land management practices, such as burning and clearing, which supplemented the non-human disturbance regime.

Based on this model, a series of propositions have been developed:

1) Aboriginal resource management, which in this case appears to have been a rudimentary stage of plant husbandry, may gradually have been altering the morphology of various seeds and nuts (cf. Rindos 1984). Archaeological plant remains may provide evidence of extinct forms, reduced numbers of species, enlarged seed size, or various other types of morphological, geographic or other types of modifications in life histories resulting from selective pressure.

2) Within each subregion, several resource units (patch types) were utilized directly by each local group and several others were exploited indirectly through trade.

3) During the Late Prehistoric Period, Chumash exploitation patterns emphasized locally available resources with supplements from other areas through trade.

4) After European contact, during the early Mission Period, indigenous inhabitants living away from the missions continued to rely on native foods with mission produce supplementing native foods.

5) A drastic decrease in resource management practices during this period and the introduction of Old World plant species and cattle reduced productivity of native resources. Thus, mission foods were a greater dietary supplement than trade items had been before contact.

These propositions are used to approach the problem of obtaining evidence of aboriginal resource management for the Chumash. Two basic types of data are necessary to address these propositions, **archaeobotanical** data from a series of late prehistoric and protohistoric contexts and data from **vegetation sampling**. The latter, when combined with information gleaned from other studies in plant ecology, identifies dynamics affecting the productivity and spatial distributions and frequencies of plant resources economically important to the Chumash. This in turn should provide a more accurate depiction of the native landscape at local and regional levels. In order to fully explore the factors related to this problem, the next chapter describes a sampling strategy that can integrate diverse data sets drawn from archaeology, botany and ecology.

CHAPTER 3

PATCHES, CATCHMENT AND LANDSCAPE DYNAMICS

A key to understanding the dynamics of a disturbance, in particular fire, is the identification of favorable habitats for the species in question, assessment of changes caused by disturbances and specific plant and animal responses to these changes. In order to do this it is necessary to confine the limits of the study area. Here it is useful to apply two heuristic devices, **patch** and **catchment**. Then, drawing ethnographic analogs from two other Californian subregions, I will apply these concepts to landscape dynamics in the Chumash area.

PATCH DYNAMICS

Patch has been described by Wiens (1976:83) as an area "*distinguished by discontinuities in environmental character states from [its] surroundings*." This description has been made flexible intentionally so that boundary conditions relevant for the organism under study can be applied. Patchiness must be **organism defined** (Wiens 1976:83; Winterhalder 1980:152). Patches are discrete enough to be isolated for purposes of study; yet they vary in terms of spatial and temporal qualities and in diversity, density, and productivity. For human groups I may add that patches may be perceived as discrete spaces where specific resources are concentrated.

The concept of patch can be applied across different scales; thus a tree, a grove, a section of wooded land, a valley, a floodplain, a mountain range or even a continent can be perceived as a patch or a specific set of resources that can theoretically be isolated spatially and temporally. An archaeological site or set of sites can constitute a patch. Therefore it is entirely appropriate from an archaeological standpoint to consider "those natural resources lying within economic range of individual sites" (Vita-Finzi and Higgs 1970) to be patches within a catchment.

Definitions

For purposes here, **patch** is defined as a resource unit (i.e. an oak tree, chert outcropping, or tidal pool). Each patch can have one or more resource types in it. Every attempt at delimiting their boundaries must be based on some analysis of their frequency of occurrence. Any recognizable "concentrations" or "clusters" should be given priority in assigning patch units. Plants occurring in such concentrations, be they groves, hillsides or roadsides, are often called **stands** by botanists. In this study sampling units labelled "stands" are considered the scientific researcher's perceived resource units of specific plant taxa. The term "stand" connotes a domination of the site by a relevant food resource plant(s); it is sampled in accordance with the environmental conditions affecting the perceived dominant resource.

Stand is notably different from the notion of **patch** as the latter is necessarily value laden in relation to the collector. My use of "stand" reflects the field sampling collection units, not necessarily the "patch" of choice for the aboriginal inhabitants. One sampling stand could have had many patches in it, and one patch could have been made up of many stands (Figure 3.1).

Data regarding specific plants will be termed **single resource patches** (**SRP**) to distinguish them from composite or **multiple resource patches** (**MRP**). It is likely that most human groups perceive of the landscape as a combination of these two types of patches. The **graininess**, or the degree of coarseness of their response would be according to these perceptions. In other words, they may exploit some patch types, such as an oak grove, in a fine grained manner,

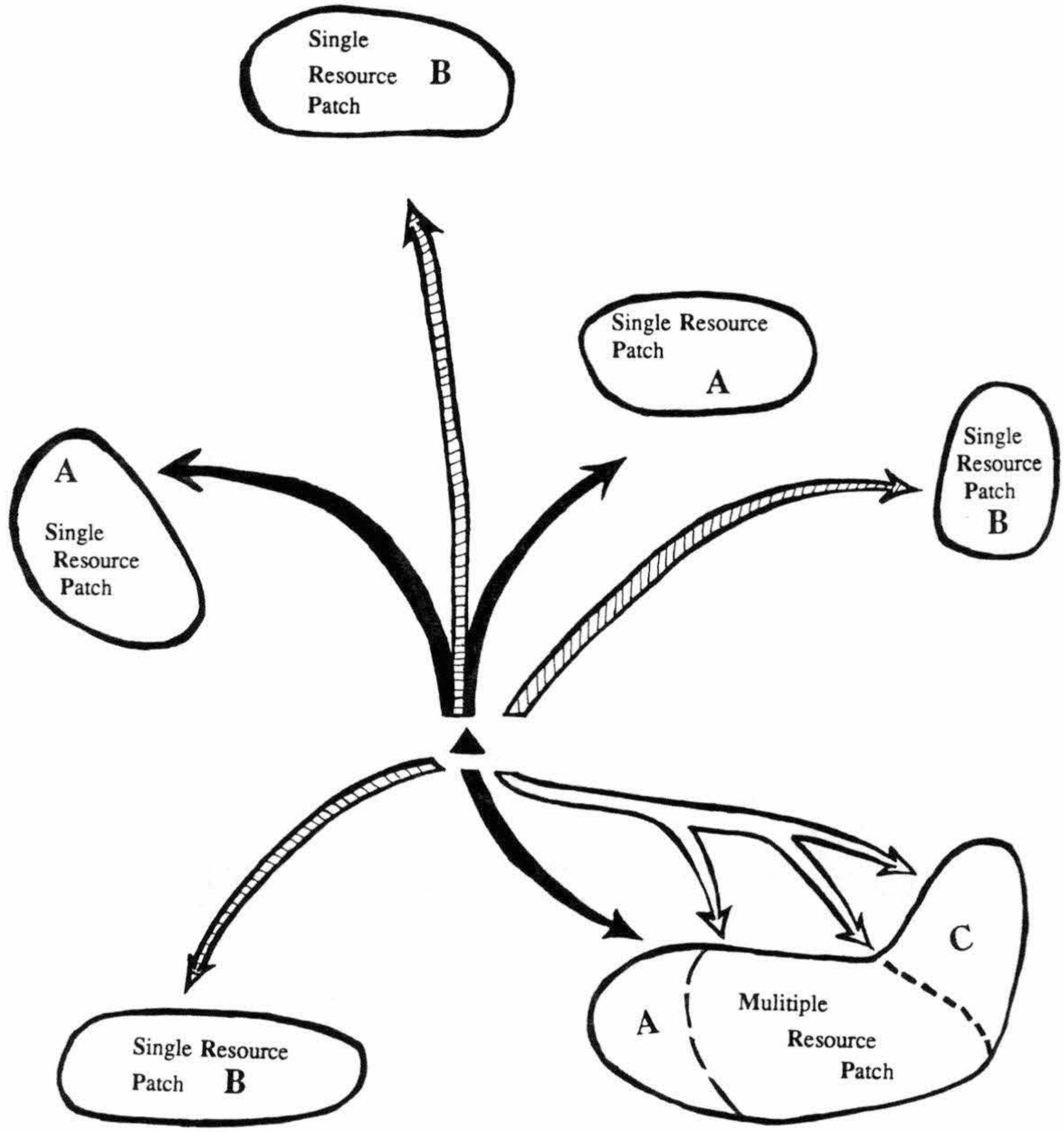


FIGURE 3.1 Schematic of Patch/Catchment Approach.

systematically collecting all the acorns available in a clean sweep. Other resource units could be perceived as MRPs in which only certain resources are collected at a given time. At the same patch visit an action might be taken to monitor, cultivate, or otherwise care for the well being of another resource within the MRP that is to be harvested at a later time. Naturally, the perception of patches, and the subsequent responses or management decisions related to these patches, would be dependent upon the quality and quantity of the resources in the patch.

Past researchers (Smith, 1972; Winterhalder 1980) have noted that multiple, overlapping scales of spatial heterogeneity are possible. From a practical viewpoint, the significance in the distinction of two patch types is that a SRP can actually overlap on some spatial scales with another SRP, whereas MRPs which are bound by more generalized interpretation of boundary principles are less likely to overlap. This distinction could be extremely significant in any mathematical expression of the relationships.

In the current work the distinction between patch types is relevant to studying two data sets, the modern vegetation and the archaeobotany. It is especially useful in the problem of disentangling the biases and assumptions placed upon data retrieval and analysis by the subdisciplines of plant ecology and ethnobotany. In a study such as this, information related to plant resources in ecological patches provides useful data for both fields, anthropology and botany, in particular for research related to the coevolution of organisms. Yet rarely has either specialist collected data with the other specialist in mind. The patch concept serves to alleviate this problem; it is an equally useful tool for either field of study, and technically it allows us to combine methods from the two fields, presumably the best of both worlds.

From an ecological standpoint, a group of resources can probably be studied as a MRP or a series of SRPs, depending upon the ecologist's questions. To identify a past human group's possible perception of patches requires identification of resource use through comparison with archaeological data. A grassy ridge slope, for example, was likely to have been perceived and managed as a general resource place, or MRP; although at different seasons it could have been exploited as a series of SRPs. Clearly human behavior acts upon perceptions along with experience and customs. Thus, as various resources on a slope became ready for harvest, decisions regarding if, when, and how to harvest the slope would have been based on how this slope was perceived and the plants' singular and collective potential for generating an adequate amount of resources relative the cost of harvesting them.

CATCHMENT ANALYSIS

Catchment analysis was introduced into the archaeological literature by Vita-Finzi and Higgs (1970) working in the Mt. Carmel area of Palestine. They proposed it as a tool for studying the economic potential of a site territory, given specific economic and technological conditions. Recognizing that any single micro-environment may not directly coincide with complete resource area utilized by humans, they proposed catchment analysis as "*the study of the relationships between technology and those natural resources lying within economic range of individual sites*" (Vita Finzi and Higgs 1970:5).

Using other studies, Vita-Finzi and Higgs (1972) estimated that modern subsistence farmers would rarely go beyond a radius of 3 or 4 kilometers to obtain resources (Chisholm 1968) and hunter/gatherers would rarely go beyond 10 km (Lee 1969). It should be stressed that these distances apply to fairly flat terrain. Chisholm notes that such distances should be converted to time; rarely would farmers find it beneficial to exploit resources beyond a radius of two hours travel. For hunter/gatherers, two or possibly three hours travel time would be an outside limit, taking into account the difficulty of transporting non-storable resources.

There are several obvious problems with this approach, as it pertains to the current study. Perhaps the most basic is that estimates of travel time should be based on the options available in a local environment. Lee's work conducted among foragers of the Kalahari desert and Chisholm's recapitulation of Von Thunen's study of rural agricultural groups in Great Britain are rather inappropriate analogs to harvesters of the Santa Monica Mountains of Southern California. Furthermore, any gravity model, such as this, is burdened with assumptions regarding how past people might have acted. In the Santa Monicas, only the alluvial flood plain along creek drainages is relatively flat. The mountains rise from sea level to over a kilometer in altitude in a matter of less than a kilometer's distance. This would make studies based on the relatively flat terrain inappropriate for comparisons.

A second problem pertains to the economic base of the Chumash relative to San hunters and gatherers of the Kalahari Desert and the farmers of feudal Great Britain. There is adequate information on native storage structures (L. Gamble 1986) to indicate that the Chumash, like many harvesters of Native California, relied on a storage based economy. Their plant crops, particularly nuts and small seeds, provided substantial storable and tradeable food stuffs that supported them for quite some time after collection and processing of resources were complete. The benefit from these large storable crop yields could easily have outweighed the cost of extending the travel distance for harvests beyond the few kilometers specified above or even a day's travel.

Again the agriculturalists of Great Britain and the foragers of the Kalahari Desert serve as rather poor analogs. Unlike the British farmers, the Chumash did not grow their crops in prepared fields; and their "effective" landscape varied a great deal topographically. The Chumash did harvest substantial storable crops as the British farmers did; but major energy expenditures were more likely invested in obtaining, processing and storing resources, not in the preparation of fields. A certain amount of energy may have been expended in burning and clearing patches, but it is doubtful that this required too much specialized equipment or that a great deal of protracted energy was committed to patch preparation. Timing was more likely the crucial consideration in terms of scheduling (Flannery 1968), and period of investment in terms of travel time and processing time were more critical considerations than preparation time.

Because of topographic relief, multiple storable food resources, and importance of trade, any catchment analysis in the Santa Monica Mountains based on a circumscribed area drawn by analog to the San or the British would be suspect. Flannery (1972) has presented a more inviting approach using the ethnobotanical and archaeobotanical data as a basis for observations. Here I will, as Flannery (1972:103) so aptly put it, "examine the facts and ask them to speak for themselves". Of course, as Flannery knows, "facts" are human creations in of themselves; and they cannot "speak" without human mediation. His technique, however, is less biased by arbitrary and conceptual constructions of the archaeologists and more influenced by what has actually been recovered archaeologically.

Flannery's (1972) own application of catchment analysis in Mesoamerica began from the site loci. First he identified plants that were deposited archaeologically and then he determined the proximity and frequency of these plants on the modern landscape in order to determine the actual catchment area utilized by site inhabitants. In a sense his strategy served to identify the **minimal** probable catchment.

To carry Flannery's strategy a step further the current study explores the variability in habitats of particular species and the responses to specific disturbance regimes, in particular fire. For the current study the site of *Talepop*, CA-LAn-229, was used as datum and species identified historically or archaeologically as significant crop plants are investigated in terms of their proximity to the site datum and the variable conditions affecting their productivity. The coalescence of the catchment and patch concepts allows us to critically examine conditions favoring specific resources, plant and animal, in order to better understand strategies that can be employed by humans to enhance resource productivity (Figure 3.1).

Using this conceptual approach, I will explore factors related to resource management in Native California. It is useful to draw analogous examples from adjacent parts of California in order to gain a wider perspective on the problem and to supplement the information available from the Chumash region.

ANALOGS FROM NATIVE CALIFORNIA

Two of the better documented ethnographic analogies come from adjacent regions, the Cahuilla, non-agriculturalists of the California desert (i.e. Bean 1972; Bean and Saubel 1972; Cornett 1987) and the salmon fishermen of

Northwest Coastal California (Kroeber 1925; Gould 1985). In both cases large groups came together during their respective harvest seasons to collect and process certain storable commodities. Equally important, until the late 1800s and early 1900s, people in both of these areas experienced less disruption of their traditional lifestyles than in the southern coastal area. Hence many traditional experts were still living in these regions when ethnographers arrived in the early 1900s. In fact, many traditional activities were still extant at that time.

The Northwest Coast of California is probably the most appropriate analogy in some aspects because these groups, like Southern Californians, had greater relative wealth and denser populations than those in the Great Basin or the California desert. To a lesser extent, the Cahuilla example may be of use due to their proximity to the Chumash region. Baumhoff's (1963) tripartite diet model (acorns, fish, and deer) for North Central Californians apparently held true, to a degree, for the southern end of the Northwest Coast region as well, which included several groups including the Yurok, Karok, Hupa, Tolowa, Tututni, and Wiyot (Gould 1985). The primary mammals hunted in this subregion were deer and elk, and the most important fish was salmon.

Most, if not all, of these groups had annual or biennial dances in late summer/early fall and in spring. At these dances and associated ceremonies storable food items were redistributed and wealth items were highly visible (Kroeber 1925; Driver 1939; Kroeber and Gifford 1949). The most important dances of this region were (and are) the Jump Dance and the White Deerskin dance. Both are essential elements of the World Renewal Ceremonial Cycle that is necessary in order to "make the world right again" (Winter and Heffner 1978). In both dances highly prized wealth items, including dentalia necklaces, albino or unusually colored deerskins, long obsidian blades and elaborate headdresses adorned with woodpecker scalps and sea lion teeth, were worn, carried and displayed (Kroeber 1925; Gould 1985). The Jump Dance and accompanying rituals were performed specifically to avert famine, disease and other catastrophes (Gould 1985:21). The White Deerskin Dance ensured an abundance of acorn, salmon, deer and other resources (Gould 1985:19).

For these ceremonial occasions wealthy headmen would take their treasures and use them to adorn their poorer relatives who participated in the dances (Gould 1985). Gould has suggested that although many of these prestige items could not be exchanged directly for food and other essential resources, they could be used as bridewealth and thereby acted as an indirect means of obtaining food. A man who could afford several wives would have the labor of these women and their offspring. In such a group the labor force is directly related to the amount of food harvested, processed and stored, particularly during acorn harvests and salmon runs.

Related to this discussion of labor and resource control is the concept of property ownership. Driver (1969: 279) noted that "among the various clans of the Chumash, unimproved hunting land was divided." Unfortunately, except for this brief comment, there is little information available on this subject that is directly related to the Chumash, and I must again draw upon information from other California subregions. Best known of the southern Northwest Coast groups are the Yurok due to the extensive research conducted in the early 1900s by A.L. Kroeber and T.T. Waterman (Gould 1985).

Within the Yurok territory, the most productive acorn and seed tracts were privately owned by individuals or extended kin groups, and occasionally seasonal encampments were made in these tracts (Kroeber 1925:8; Waterman 1920:222). Tobacco and seed plots were sometimes owned jointly, but their ownership was permanent (Driver 1939:317). From the information that

Waterman (1920:223) could collect, he surmised that "grass lands were not owned by individuals, though each village had its own localities and never went elsewhere." Apparently ownership of acorn plots became an important matter only during times of scarcity. At those times it was necessary to pay the owner for permission to collect acorns (Waterman 1920:222). Immediate relatives of a man could use his wife's acorn tract, apparently with no charge (Waterman 1922:223).

Pursuit of game where the resource was mobile and could often be captured (harvested) by an individual hunter involved a somewhat different set of conditions. All hunting lands within one mile of their river based settlements were owned by private individuals. Wealthy men often held several inherited tracts, poor men held only one, and even poorer men held no tracts. Poachers were shot. On the other hand, once an animal was wounded it could be pursued onto anyone's land with the tract owner having no claim to it (Kroeber 1925:34). According to Waterman (1920:222) the tracts were related to snaring-places along game trails and through passes. Hunting with a bow could be practiced anywhere by any individual; it was not considered poaching. Apparently outside the one-mile territory, individuals could set snares or hunt as they chose in "open" lands, so long as they did not violate the next settlement's established property rights.

Like snaring places, fishing-places were owned by individuals. Among the Yurok, rights to fishing-places were "sold, bartered, and bequeathed...and they changed hands quite freely" (Waterman 1920:219). When several men jointly owned a fishing place; the men used a rotation of one or more days depending upon the size of their shares in order to facilitate their partnership (Kroeber 1925:33). Fishing tracts, like other hunting tracts could be inherited, most often from father to son (Kroeber 1925:34). The use of fishing stations could be rented for a share of the catch (Driver 1969:276-277). The practice of establishing a new fishing place was restricted in order to maintain the value of those fishing stations already in existence (Waterman 1920:222). Women also inherited rights to fishing stations (Waterman 1920:223). The Yurok recognized the additional advantage of contracting marriages at some distance from the home village in order in to be able to "claim (rights to) property, in the form of fishing-places and acorn-camps, all over Yurok territory and even beyond it (Ibid.).

The construction of a fishing dam at the important settlement of Kepel, about half way up the Klamath River, demonstrates the relationship between property ownership and the ability to harness energy in the form of labor. During each salmon run, for a period of twenty days, a great deal of energy was invested in this fishing project. The construction and utilization of this dam involved several villages and enlisted the participation of hundreds of people (Waterman and Kroeber 1938). Ten days were spent constructing the dam which amounted to a fishing weir built all the way across the river in ten named sections, each with a respective gate entrance into a discrete enclosure. At least sixty men were required to construct the dam in the specified ten day schedule. Once the dam was constructed, it was only used for ten days, and then it was torn down.

The Kepel Dam harvest event, in which thousands of pounds of salmon were captured and processed for storage, was probably the single most important collection activity of the year (Waterman and Kroeber 1938:50; Yarnell 1959). Kroeber (1925:58) suggested that the Deerskin dance associated with the building of this dam was perhaps the single most famous of all ceremonies among the Yurok. The ceremony associated with the construction and use of the dam was known only by a "formulist," who was required to visit ten sacred places during its construction and restricted to a diet of thin acorn mush during this ritual period. By 1925, the dam and dance had not been made for many years. In Kroeber's opinion this was because not enough men could be assembled for the construction; however, the Yurok felt they could not perform the task and ceremony because no one could recite the entire formula (Kroeber 1925:60).

In all of these ventures, ownership of access to important resources was the key. A wealthy Yurok man and his extended family owned numerous tracts scattered up and down the river for several miles where a variety of resources could be procured. Hence even when resources were mobile, the Yurok had developed techniques that converted their pursuit to more stationary forms of procurement. When the pursuit of game remained a mobile and relatively high risk (low predictability) task, rights of ownership were less insignificant. When the resource was most efficiently harvested by groups rather than individuals, extended kin groups shared property rights. Even so, these rights were carefully maintained, and access to some resources was a great deal more valuable than others. At the same time generosity, like displays of wealth at dances, was a demonstration of prestige and importance and the wealth were expected to shared with the less fortunate members of their communities (Kroeber 1962). Title to these resource rights might better be seen as confirming the right of distribution rather than consumption of the resources themselves (Yarnell 1959). Thus control of access to resources, especially storable foods, was a critical key to wealth and well-being for the Yurok.

The distance that the Yurok were willing to travel varied with the predictability and yield size of the resource. Acorns were rather predictable and localized, and restrictions related to access were most crucial in times of food scarcity. This was probably due to the storability and sheer bulk of this resource. Such a crop could make or break survival through the winter. In the case of deer and elk, apparently ownership or control of an area diminished when travelling distance extended greater than mile from the habitation site. Salmon were captured at specific sites at predetermined times. For annual harvests, hundreds of people travelled from neighboring communities to participate. This is consistent with Waterman's (1920) assessment that "places owned" by individuals or families may be classified roughly in order of importance as 1) fishing-places, 2) "acorn-fields" and 3) snaring-places. Thus salmon which equalled acorns in predictability and storability, apparently superseded the nut crop in abundance and perhaps desirability. These factors determined the energy and time people were willing to invest in the harvests and in maintenance of property rights.

It is important not to infer that the Yurok custom of private ownership was entirely typical of California, because Kroeber (1962) has suggested that on this point the Yurok and their immediate neighbors were the extreme case for California. On the other hand, any evidence either for or against such a situation is totally lacking in the Chumash documentation. Also, as I shall demonstrate, some degree of territoriality or ownership does indeed appear to have been characteristic of California groups in general, and the lack of evidence for the Chumash fails to preclude the possibility of it there.

MODELLING NATIVE CALIFORNIAN LANDSCAPE DYNAMICS

Like the Northwest Coast of California, the Chumash had a socio-political economy that allowed for controlled access to a series of storable commodities. They were able to bank against deprivation with a medium of exchange, in particular shell beads (King 1973). Throughout western North

America dances and other occasions brought large groups together for harvests, trade and other activities which served in part to redistribute food and wealth items.

O'Shea (1981:169) has noted that when exchange and redistribution occurs between corporate groups or communities, "some manner of physical token usually enters the transaction...such tokens can later be re-exchanged for food". These exchanges served as a form of **social storage** in that they provided "insurance against anticipated or unanticipated scarcity", which simultaneously linked different productive units within the same community, and linked one community to another" (O'Shea 1981:169). Hence, social storage can also be considered a "diversifying strategy" (O'Shea 1981) which allows groups and individuals to reduce unpredictable scarcity. In other words, shell beads acted as specialized currency to increase predictability of resource supply.

Unlike the Northwest Coast (Drucker 1955) and the Great Basin (Steward 1938), there is no evidence in the Chumash region of aggregations in large winter villages. In fact the entire Southern Californian ethnographic record lacks any real evidence for seasonal resettlement. Apparently, seasonal fluctuations, particularly severe winter weather, did not necessitate this same resettlement pattern for the Southern Californians. The Cahuilla lived in their villages year 'round, although hunting and foraging parties frequently left for short excursions. Harvests of acorns, pine nuts and other storable commodities required over half a village population to temporarily move to a harvesting camp for weeks at a time. (Bean 1972).

Bean's (1972) study of the Cahuilla of the desert of south central California demonstrates the significance of territoriality and the importance of knowledge regarding their home range. Prior to European invasion, the Cahuilla area was significantly less populated than the coastal areas of

California. Located over eighty miles southeast of the Chumash area, the resources of the Cahuilla were, for the most part, less diverse, and distributed further apart geographically. Nevertheless, Bean's research in a less populated area where knowledge of traditional customs and subsistence activities had been retained more completely may be useful as one example of how Native Southern Californian groups perceived territories and home ranges.

The 2400 square miles of the Cahuilla territory were subdivided into ten or twelve distinct areas, which were controlled in perpetuity by sibs (two or more lineages related by a common mythical ancestor). Boundaries (*hemtewataxwa hivay*) of these territories were marked by petroglyphs, rock cairns, or geographic features. Oral tradition confirmed ownership, and sib members were willing to physically defend their areas. Access to resources in the territory was restricted; permission for use of the area was required for all outsiders (Bean 1972:125). Within these territories, each of the two lineages held ownership to specific resource "patches" such as oak groves, pinyon forests, mesquite stands, obsidian quarries and hillsides covered with cacti or yucca. Members of other lineages within the sib were required to obtain permission for use from the lineage head (Bean 1972:126).

Dyson-Hudson and Smith's (1978) model predicts that territoriality occurs where resources are predictable and dense. Where resources are less abundant, but still predictable, they postulate that groups would resort to maintaining home ranges where they would forage but would not invest in the expense of defending territories where resources were unpredictable annually. They use as their examples Basin-Plateau groups including Western and Northern Shoshoni and the Southern Paiute of Owens Valley, the Northern Objibwa of Canada, and the Karimojong of Uganda.

If their model fits the behavior of Native California groups, then one might infer (because territoriality occurred in the more hostile desert environment of the Cahuilla), the recognition and enforcement of territorial boundaries was even more elaborate in the resource rich area of Coastal California. But why were these desert dwellers territorial at all? A consideration somewhat side-stepped by Dyson-Hudson and Smith (1978) was the spatial character of the resources that were exploited. Apparently the Cahuilla collected many resources that tended to be clustered as well as predictable. The notion of clustered resources is directly related to "patchiness" and heterogeneity (or graininess) of the exploitation pattern. Thus, although they may have travelled several miles between resource units (patches), these areas of resources were sufficiently discrete spatially (patchy), and their cycles of productivity were adequately understood for predicting sufficient productivity to support this desert based society with territorial organization.

At the time of contact with Europeans, Chumash settlements were located well within 10 km of their neighbors. This suggests that the concept of territoriality, and perhaps ownership of property and/or resources, was likely to have come into play at both local and regional levels for more dense coastal populations. Chumash travel time for obtaining resources may have been reduced as their population size and home range knowledge increased and their use of fire management and other food production strategies intensified. Access to substantial coastal resources probably also enhanced their inclination toward territoriality. More basically, as patchiness of available resources or populations increased, the tendency toward territoriality presumably increased. Graininess of the exploitation pattern is related to perceived heterogeneity of the landscape and not the actual frequency of resources over the entire area (Winterhalder 1980). Predictability of resources was ascertained by perceiving of resources in patches, exploiting them in a coarse grained fashion, and attempting to guarantee their availability through territoriality and through long term home range knowledge including management strategies.

It is apparent that considerable attention was paid to controlling access to resources--especially storable resources in Native California. The value of "resource rights" was dependent upon the predictability of the access and the production of resources, which in turn are dependent upon time and energy investments. Predictability then, is tied to both social maintenance and resource management. But in non-agricultural archaeological contexts, can one account for home range knowledge? Specifically, how is **local knowledge** discerned and what steps might have been taken to enhance predictability of the Chumash harvests? Can intentional management and harvesting strategies be identified? The first step is to distinguish between the evidence for human intervention and the evidence for non-human processes of disturbance.

The Role of Human Intervention

The concepts of patch and catchment can now be utilized to characterize patch types indicative of selective disturbance regimes. The next step is to isolate anthropogenic characteristics. Determining the role and extent of prescribed burning Southern California is particularly difficult because much of the vegetation has such a high tolerance for fire. It has been argued that the chaparral has evolved in a high frequency fire regime (Aschmann 1959). The fire-adapted characteristics of chaparral include: 1) the accumulation of dead debris in the canopy; 2) presence of highly flammable terpenes in the leaves; 3) resprouting from root crowns for several shrub species; 4) rapid growth rate immediately following a burn (Hanes 1971; Menke and Villasenor 1977).

There has been some debate over the lightning-set fire regime in California. Based on an analysis of historical documents and fire scars in tree rings in the Sequoia National Forest, Kilgore and Taylor (1979) have argued that the frequency of lightning-set fires in their study area between 1921 and 1972 (three in 51 years) is insufficient to have maintained the short intervals between fires that occurred prior to 1875 (one every 8 to 18 years). Kilgore and Taylor (1979:139) asserted the following:

> "Lightning ignitions have presumably not changed significantly in our study area over the years, while numbers of Anglos increased and numbers of Indians decreased dramatically during the last half of the 1800s. The sharp decline of fire scar occurrences after the early 1870s in our study area suggests that native Indians may have been a significant ignition source."

Their interpretation is that Indian-set fires in the Sequoias were initially replaced in the historic period by fires set by ranchers and herders.

Related to their observation is the current theoretical work in ecology regarding the **intermediate disturbance hypothesis** (Connell 1978) which suggests that *the highest diversity is maintained at intermediate levels of disturbance*. Connell's hypothesis was generated based on work on a coral reef, however, many disturbance ecologists consider this theoretically robust hypothesis to be applicable and certainly testable in a much wider range of ecosystems (Pickett and White 1985). For the current work, this corollary is proposed: *the highest degree of evidence for fire in the form of tree scars would be generated and maintained at intermediate levels of disturbance*. Extremely light fires would leave very little burn evidence, whereas catastrophic fires would destroy most trees completely, also leaving very little evidence in the form of tree scars. Thus our best tree scar evidence may be derived primarily from fires of intermediate intensity. As intensity tends to depend somewhat on frequency of fire (the lower the frequency, the greater the fuel load and the greater the likelihood of catastrophic fire), it is safe to suggest that our evidence would be derived for the most part from intermediate frequencies of fires. With these predictions in mind, Kilgore and Taylor's assertion regarding the sharp decline in fire scar occurrences after 1870 may indicate not only a reduction in fires but also a reduction in medium-level fires.

In general, various types of natural disturbance increase the heterogeneity or patchiness of the ecosystem. A relatively small disturbance such as a tree fall has an effect on many organisms in the general vicinity. Ecologists have noted that such a disturbance opens an area of the forest from the forest floor to the treetop canopy. This space is called a "canopy gap", and it has an important role in ecological rejuvenation of the affected area. Rejuvenation is often associated with changes in availability of other resources, namely light and soil nutrients which affect the general makeup of biotic communities. This in turn affects the heterogeneity of the site (Denslow 1985:310-311). On the other hand, major catastrophic disturbances such as volcano eruptions or large wildfires can lead to greater homogeneity, that is, large areas having the similar environmental types of conditions such as soil type and plant and animal distributions. Therefore the scale of natural disturbance, both temporal and spatial, the ability of various species to exploit the gap, and other environmental factors may affect habitat heterogeneity as well (Denslow 1985).

Connell (1979) further argues that species diversity at a given place and time is likely to be more directly related to the frequency, size and intensity of disturbance than to the rate of competitive replacement of species. This idea has major implications for the study of human modified landscapes. Humans beings, by their most basic activities, often disrupt local environmental settings. It would appear that humans have done more in their history to alter the earth's landscape than any other species. The site of virtually any human activity is to a certain extent "disturbed" by deliberate and unintentional surface and subsurface alterations, movements and actions. The frequency (periodicity), size, intensity, duration and type of various past disturbances initiated by humans could well have distinct archaeological manifestations.

Can anthropogenic disturbances be identified and isolated from non-anthropogenic disturbances? In the case of former habitations sites, it is possible to distinguish materials that have been moved, modified and produced by human activity. But what other types of archaeological situations are conducive to isolating past anthropogenic disturbances, in particular non-agricultural resource management strategies? The next chapter will develop a technique for arriving at an answer to this question. First it is necessary to characterize the disturbance dynamics of the landscape within the study region, and then to determine how human caused disturbances may be qualitatively or quantitatively distinguished from non-human causes.

For the mountains of Coastal Southern California, Vogl (1977) proposes a similar frequency of lightning-set fires of about one every 20 years. According to Keeley (1977) the number of lightning-set fires is dependent upon fuel build up which in turn may be dependent upon the fire intervals between human set fires, therefore, comparisons between human-set and lightning-set fires can be misleading. Keeley (1977) also demonstrated in Southern California national forests that lightning-set fires are correlated with elevation. Comparing a known lightning frequency with tree ring data (where available) and macrobotanical evidence may be the most adequate technique for reconstructing the actual role of lightning. This in turn may lead to the determining the frequency of human-set fires.

Humans may manage patches in order to enhance their net productivity. In terms of patch dynamics, the anthropogenic ecosystem becomes a **shifting mosaic** (Borman and Liken 1979; Heinselman 1981) of patches of various degrees of human and nonhuman derivation and maintenance. Pickett and White (1985:5) have noted that the term shifting mosaic connotes "*a uniformity of patch distribution in time and space such that an overall* landscape equilibrium *of patches applies*." They argue that such equilibria are to be expected: 1) where feedback occurs between community characteristics and disturbance events; 2) where patch size is small relative to the homogeneous landscape unit; and 3) where disturbance regimes are stable.

Pickett and White (1985) caution that this overall landscape equilibrium inferred from the mosaic concept would occur rather rarely in nature; changing disturbance regimes would be more common, particularly for the last ten thousand or so years in North America. Nevertheless, they assert that such a mosaic is important theoretically:

> "size class distributions of disturbance patches would be invariant. Disturbance regimes could be calculated from either the temporal or spatial distribution of disturbance patches because these two aspects of disturbance would be directly linked" (Pickett and White 1985:5).

Minnich (1983) has proposed that without human intervention (meaning suppression of fires or setting of fires), southern California chaparral would have a natural fire regime that reflected a shifting mosaic of patches. It has been argued by several authors (i.e. Timbrook *et al.* 1982; Minnich 1983) that the periodicity and variability of fires in Native Californian chaparral and coastal sage communities created a mosaic or **tessellation** of patches in essentially a stable state. Individual parts of the landscape changed, but the overall frequency of varying post-fire age tracts (or patches) remained relatively constant. Minnich further argued that such a mosaic was in **dynamic equilibrium** between event frequency, fuel turnover and fire size.

Using Landsat images, Minnich (1983) has been able to reconstruct the patterns of fires (based on areal extent and year of burn) in Southern and Baja California. He has estimated that in the chaparral of Baja California, where fires are less subject to suppression, the median size of fires has been 1000-2000 hectors and the normal interval between fires has been 30-50 years. In Southern California, where in recent history fire suppression has been the primary management strategy, fire intervals have been substantially longer and burned tracts of chaparral substantially larger (up to 80 years between fires and more than 10,000 hectors burned in some fires).

This possible discrepancy at temporal and spatial scales between what California ecologists and what Pickett and White (1985) might consider a dynamic equilibrium is partially due to the spatial scale at which independent researchers perceive of the landscape, and partially due the unique fire histories of chaparral and other similar Mediterranean biomes. Some authors have even discussed unique meteorological characteristics of what they have termed **fire climates** (McCutchan 1977; Pyne 1984) to demonstrate the primary importance of fire in the ecology of some ecosystems. Such environments are characterized by an interplay between prevailing meteorological conditions and fire.

How can aboriginal burning be detected if their management strategy was based on replicating or intensifying an already existing regime? Wiens (1985) has noted the role of vertebrates in inadvertantly producing their own patches. Vertebrates typically exhibit a variety of behaviors such as burying caches of seeds, grazing, or borrowing that create or modify distinctive patterns of revegetation which "may thus contain a mosaic of patches of differing ages and successional status, increasing tremendously the heterogeneity of the vegetation as a whole" (Wiens 1985:187).

For the present study, the difference between human and non-human initiated patches would be a matter of scale. If a humanly maintained landscape in the Santa Barbara region did exist prehistorically in a state that could be considered in "dynamic equilibrium," it most likely would have had the following characteristics: 1) Due to an increase in the periodicity of burning, human patches would have been smaller than the 1000-2000 ha norm found by Minnich; 2) Prescribed burning by humans probably accentuated an intermediate fire interval that actually increased species diversity and availability of species considered to be valuable resources, especially near occupation sites or collecting areas; 3) An increase in fire interval in localized areas near human settlements would have served as a buffer to protect their settlements and resource patches from the direct and indirect effects of catastrophic fires. Of course not all of the Santa Monica Mountains, or other chaparral areas were entirely managed by prescribed burning or other human management practices. The extent of human intervention was probably most extensive in the vicinities of settlements and in important resource patch areas.

This prehistoric anthropogenic environment probably served to enhance productivity of selected resources. On the other hand, unmanaged fires set by modern day humans (i.e. pyromaniacs), if left uncontrolled, (and particularly if set on a windy day in July or August when fire conditions are at their optimum), could have the complete reverse effect. Based on the above information the following hypothesis has been developed:

> *The direct effect of aboriginal resource management (in particular burning and clearing) has been to increase heterogeneity (or patchiness) in the proximity of occupation sites and the adjacent landscape in order to diversify available food resources and to increase productivity of fruits, nuts, seed crops and game.*

If this was achieved by varying intermediate level disturbances, then both spatial and temporal scales were manipulated in order to maintain high degrees of diversity and richness of species. If so, resource managers reduced intervals between fires and the patch size of areas burned in order to increase predictability, productivity and availability of significant resources.

Considerable attention must be given to environmental factors that indicate changes in scale of landscape structure and level of disturbance, in particular changes that may have been the result of human occupation and intervention. Ethnobotanists have recognized the importance of identifying herbaceous species, called **fire followers** (Sweeney 1956), that can indicate an increased periodicity of fires. Based on their ethnohistorical research, Bean and Lawton (1976) proposed that there may have been several incipient domesticates (plants that were beginning to become dependent upon the management practices of humans for their survival) of the small seeded type being exploited aboriginally. Timbrook *et al.* (1982) found historic references to over 30 species of small seeded herbaceous plants that were utilized by the Chumash. They hypothesized that the productivity of these and many root crops was enhanced in the coastal plain areas by a rotational process of burning off "patches" every few years. Of the 70 genera of food plants they found documented, 35 occur after fire and 15 reach peak abundance after a fire (see Chapter 4). Thus, a pattern of "prescribed burning" may have artificially stimulating a higher productivity of food resources, than would occur without human intervention, by managing a tessellation of microhabitats (mosaic of patches) almost indefinitely, except where soil erosion was excessive.

It is also possible that certain chaparral shrub plants with edible seeds increase their seed production (total yield and/or seed size) after a fire. Yet little of this information is available from previous studies in plant ecology due to the way productivity typically is measured by plant ecologists (growth rates and increases in foliage). For chaparral plant species, Menke and Villasenor (1977) have characterized these general habitat changes following a fire:

TABLE 3.1: HABITAT CHANGES FOLLOWING A CHAPARRAL FIRE

Years Following Fire	Observed Response
1-3 years	Ground cover of annual and biennial herbaceous species, shrub seedlings and sprouts;
3-5 years	Loss of herb understory and dominance of shrubs
15-30 years	Intermediate shrubs (i.e. *Ceanothus*) die out and longer lived species (i.e. *Arctostaphylos* and *Adenostoma*) dominate;
35-40 years	Vitality and productivity of stand decreases as stand enters decadence, increases in dead material accumulation, fuel load adequate to carry a substantial fire.

Increased production of sprouts and other browse during the years immediately following a fire would have attracted game animals, and this would have benefited humans; yet there may have been other incentives in terms of fruit production that more directly benefited humans. Regrettably there is minimal information on this latter aspect of production.

Thus, vegetation sampling of specific known food plants in tracts of varying post-fire age is crucial in order to supplement existing documentation of vegetation responses to various fire regimes. Only in this way can the affect of fire on fruit production be determined. The ideal test case for this research problem simply does not exist in the modern world of multiple disturbance caused landscapes; nevertheless, the vegetation sampling portion of the present study establishes a technique for accumulating additional relevant ecological data and does contribute preliminary findings based on this field work. The results are not offered as a final step in resolution of this research problem, but I hope they will spark more refined questions regarding the role of anthropogenic disturbance in Native North America.

SUMMARY

Several concepts from disturbance ecology (Pickett and White 1985) have been introduced in order to develop an integrative approach for analyzing botanical, historical and archaeological data. **Patch** has been defined as a resource unit perceived by the collector. This has been distiguished from vegetation **stands** designated by plant ecologists and other researchers. **Catchment** has been described as the area surrounding a given settlement from which specific resources are obtained.

Connell's (1978) **intermediate disturbance hypothesis** has been introduced to characterize the temporal and spatial scales at which speices diversity and richness are greatest. A corollary has been proposed that intermediate levels of disturbance generate the highest degree of evidence of disturbance. Thus the majority of archaeological evidence for fires would be from intermediate levels of fire.

Finally a non-agricultural scheme that enhanced productivity of native resources would replicate or intensify the preexisting disturbance regime. For the Chumash, prescribed burning would have reduced the frequency of fires and reduced areas burned, thus creating a shifting mosaic of patches of varying ages of maturation.

The next chapter investigates plant and fire ecology in the Santa Monica Mountains. Several important Chumash plant resources are assessed in terms of their productivity in response to fire. Herbaceous plants that are especially indicative of burning activity are also identified.

CHAPTER 4

VEGETATION SURVEY OF THE SANTA MONICA MOUNTAINS

A vegetation survey of the Santa Monica Mountains was undertaken to explore the responses of several plant species to differing fire regimes. The choice of field sites and plant species to be sampled was based on previous archaeological work at the Century Ranch Archaeological Site Complex (CRASC) conducted in 1961 by the UCLA Archaeological Survey (King, Blackburn and Chandonet 1968) and again in 1980/81 (King *et al.* 1982). The latter research demonstrated the richness and high degree of preservation of plant remains recovered from this southern interior Chumash site. The quality and quantity of plant remains recovered from *Talepop* are discussed in detail in the next chapter.

Previous studies indicate that several plants were important to the Southern Interior Chumash. They include the fruits of chaparral plants including islay (*Prunus ilicifolia*), manzanita (*Arctostaphylos* sp.) and the immature flower stalks of yucca (*Yucca* sp.), woodland and species including oaks (*Quercus* sp.), toyon (*Heteromeles arbutifolia*), elderberry (*Sambucus mexicana*) and walnut (*Juglans californica*), and several herbaceous species including sage (*Salvia* sp.), grasses (Poaceae), composites (Asteraceae), legumes (Leguminosae), and various bulb and corm producing plants (Liliaceae and Amaryllidaceae). This chapter describes the vegetation survey conducted in April and July of 1988, the site areas visited in the Santa Monicas, the methods employed to study various species of plants, and the findings of this survey. Where appropriate, other plant ecological studies are discussed to provide a more complete assessment of the relevant taxa.

VEGETATION SURVEY STRATEGY

The procedure described below was developed during fieldwork in the spring and summer of 1988 in the Santa Monica Mountains at the southeastern end of the Chumash territory. Vegetation sampling was carried out in Malibu Creek State Park, Paramount Ranch and, to a lesser extent on various other accessible lands within the bounds of the Santa Monica Mountain National Resource Area (SMMNRA). Upon reaching the Santa Monica Mountains in April of 1988, the aerial photos at the headquarters of SMMNRA were examined. The Century Ranch Archaeological Site Complex (CRASC) in the heart of the Santa Monica Mountains was pinpointed and chosen the primary datum locale for the study project. The area around this locus was then examined for suitable study sites for obtaining information related to aboriginal resource management and/or fire ecology. Two crucial maps were consulted, the map of historic fires included in the 1986 Fire Management Plan of the SMMNRA by Robert Plantrich of the NPS, and the 1987 revised map of the "Land Protection Plan" of the SMMNRA which indicates current and proposed land holdings. From this assessment, sampling tracts were located for vegetation survey, both for in-depth sampling and roadside study. These sampling techniques are described in more detail below.

DESCRIPTION OF THE RESEARCH AREA

The Santa Monica Mountains are the result of the coalescence of sedimentary, metamorphic and igneous formations, where the east/west running Transverse Range meets the north/south running Coast Range. Within view of CRASC are the creeks of Malibu, Liberty, Stokes, and Las Virgenes (Figure 4.1). Three drainages, Liberty, Malibu and Las Virgenes

LIST OF VEGETATION STUDY FIELD STATIONS:

1. Soka University
2. Malibu Creek State Park Campground
3. Century Ranch
4. Reagan Ranch
5. Paramount Ranch
6. Malibu Canyon
7. Little Sycamore Canyon
8. Big Sycamore Canyon
9. Liberty Canyon
10. Cheeseboro Canyon
11. Castro Peak
12. Triunfo Pass

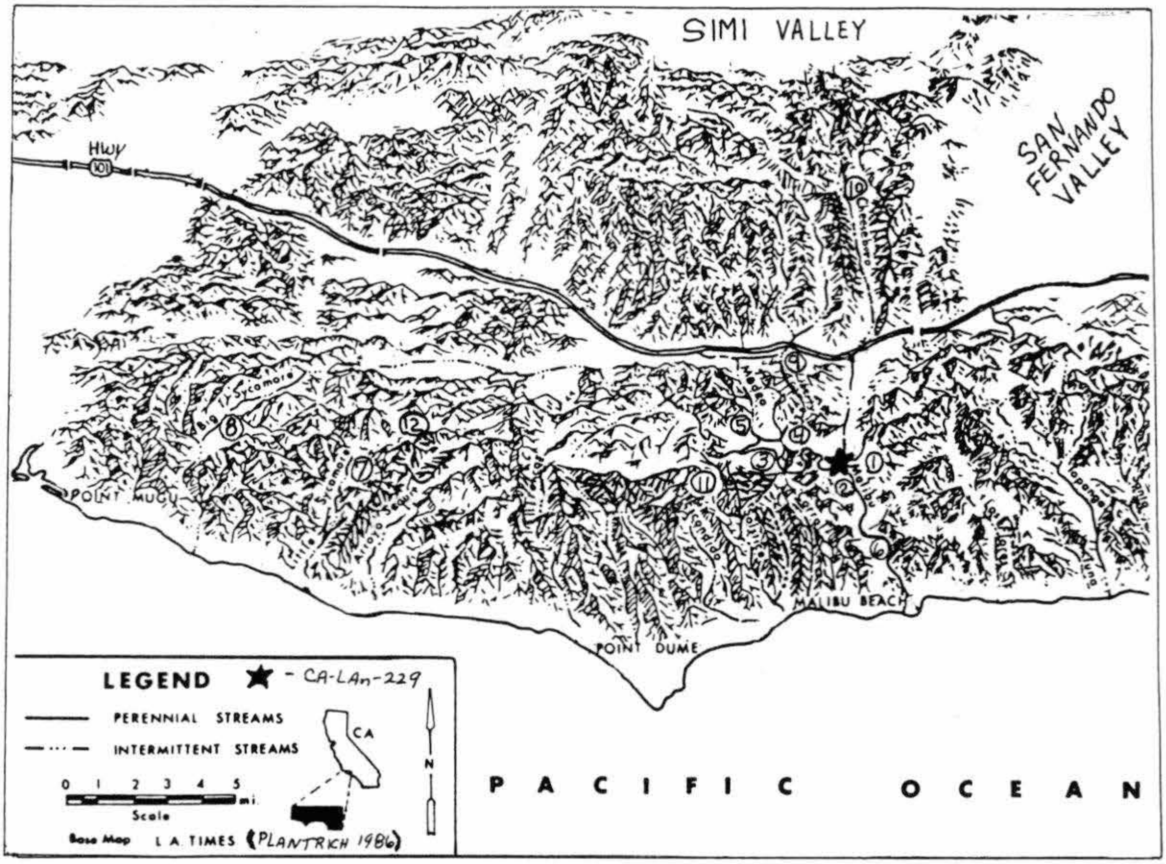


FIGURE 4.1 Map of Vegetation Study Field Stations in the Santa Monica Mountains.

Creeks, originate in the San Fernando Valley; Stokes Creek originates to the east in an igneous formation of the Santa Monicas. All come together to form a flood plain that feeds into Malibu Creek drainage at CRASC, which includes the village of *Talepop* (CA-LAn-229). Below the site complex, this drainage feeds into a significantly deeper part of Malibu canyon that continues for 5 miles to open its mouth at the present community of Malibu, named for the former Chumash village there which was called *Humaliwu*.

Talepop, site CA-LAn-229 of CRASC, was chosen as the primary datum for the vegetation field survey, with the plan in mind that analysis of archaeobotanical remains recovered from this site would be compared to the information obtained in this vegetation survey. A series of field vegetation sampling locations were selected based upon their 1) proximity to *Talepop*, 2) property ownership (public lands, roadsides, or permissible private holdings), 3) accessibility (access by roads, trails, or foot paths, with no unnecessary hardship, peril or injury risked for the researcher or the study site), and 4) fire histories.

Public access areas of native vegetation where fires had been recorded within last 10 years were given highest priority. This was because previous studies indicated that plant and animal responses to disturbance were most evident within the first seven years following a fire. Aerial photography data and the composite maps of fire history and land ownership were analyzed in terms of potential study plots. Fire boundaries and dates were transferred to 7.5 minute U. S. Geological Survey topographic maps.

The study region was divided into several main **vicinities**. For five of these vicinities a field station was established, and key plants were located and observations were made regarding their health, habit, productivity and proximity to datum (CA-LAn-229). Special attention was given to the spatial relationships between important "crop" plants in order to assess and characterize potential resource patches that could have been exploited in the past. Sampling units within field stations are characterized as vegetation sites of mixed species composition, or **stands** of specific plant taxa (researcher's perceived resource units) as compared to **patch** (resource unit according to classification scheme of actual native practitioner--see Chapter 3).

Field stations were established at: 1) **Soka University** across Las Virgenes Road from *Talepop* (Figures 4.1 and 4.2); three areas in Malibu Creek State Park including 2) **MCSP Campground** due south and across Malibu Creek from the CRASC, 3) **Century Ranch**, and 4) **Reagan Ranch**; and 5) **Paramount Ranch** (National Parks Service) located northwest of Reagan Ranch (Figure 4.3). Seven other vicinities were quickly traversed (roadside survey, or direct walk through sampling) and limited notes and photos were taken. These included 6) **Malibu Canyon** just above the present community of Malibu; 7) **Little Sycamore Canyon**, 8) **Big Sycamore Canyon**, 9) **Liberty Canyon**, 10) **Cheeseboro Canyon**, 11) **Castro Peak** and 12) **Triunfo Pass**. Vegetation sites located in the latter seven vicinities were recorded and photographed only when a particular plant association or food plant merited note. For example a stand of unusually tall chia (to 1 meter high) was noted up on top of Triunfo Pass (Site 26); a "tree" of *Prunus ilicifolia* standing 35 feet tall was sighted in Little Sycamore Canyon (Site 25).

A total of 64 vegetation sites were visited; forty-one were studied in April, and nine were revisited and twenty-three new sites were recorded in July of 1989 (Table 4.1). Although general observations were made for each vicinity, most information was recorded by plant resource.

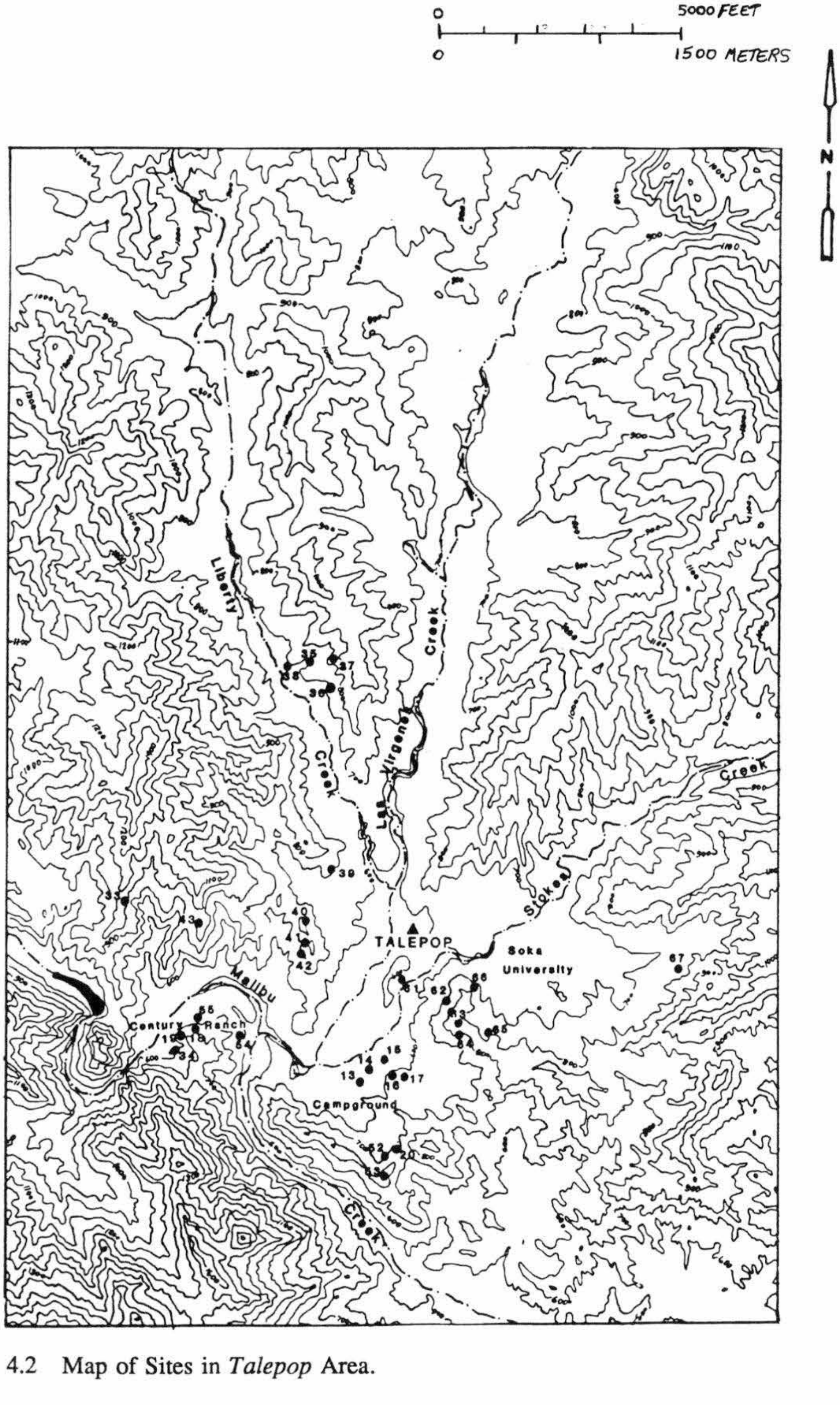


FIGURE 4.2 Map of Sites in *Talepop* Area.

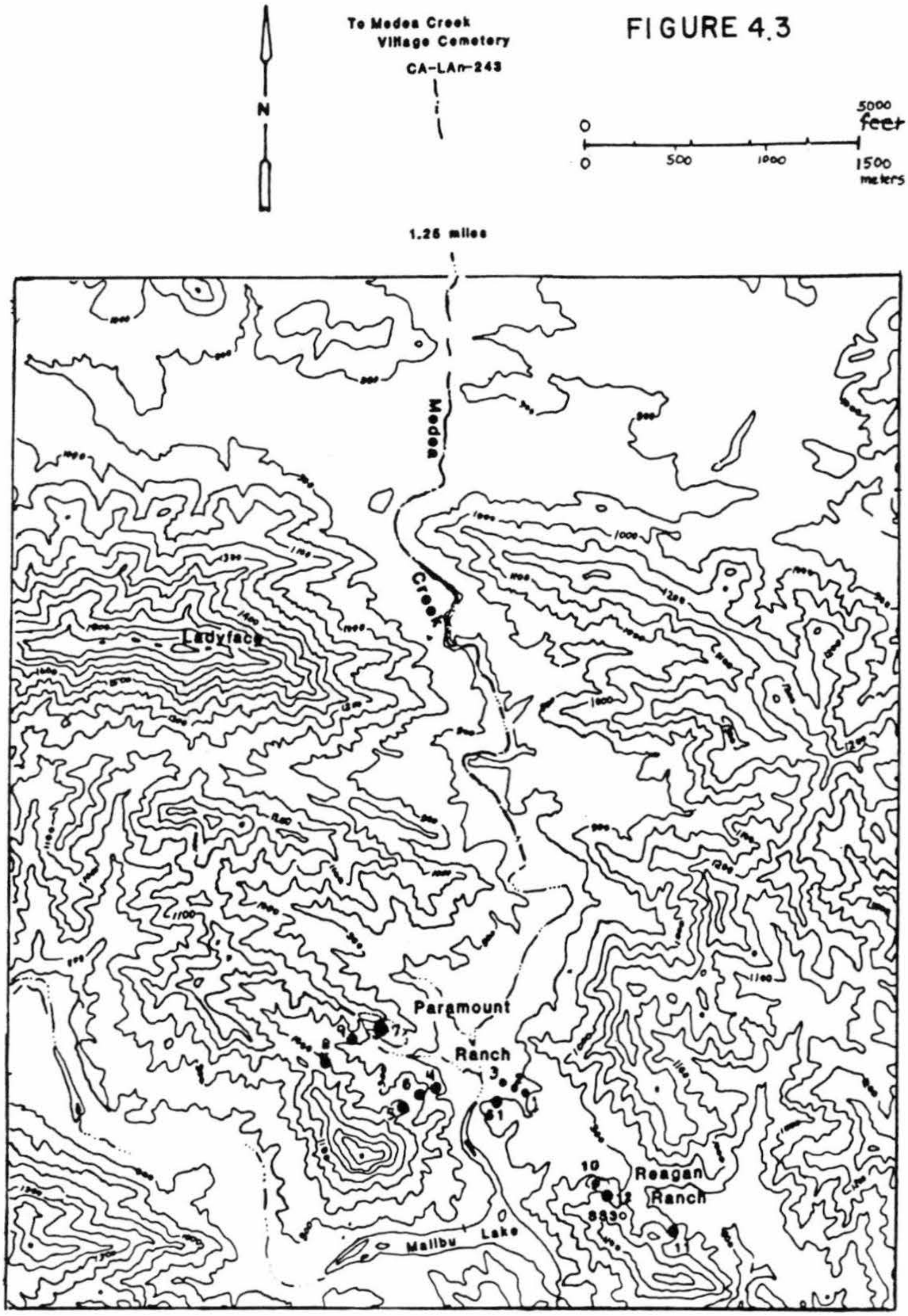


FIGURE 4.3 Map of Sites in the Paramount/Reagan Ranch Area.

TABLE 4.1: VEGETATION SITES VISITED DURING 1988 FIELD SEASON

SITE #	INTENT OF STUDY	DATE(S) VISITED	ELEVATION (FEET)	SLOPE	YEAR OF LAST BURN	PREVIOUS BURN	EXPOSURE	SAMPLING AREA	"PATCH" TYPE	FRUIT SET	VEGETATION TYPE	IMPORTANT ECONOMIC SPECIES (OR OTHER DOMINANTS)
1	PHOTOS	4/2/88	800	25-35	1982	1978	E/SE	PARAMOUNT R.	MRP	-	OAK/GRASS	PHACELIA, BLACKBERRY, POPPY VALLEY OAK
2	PHOTOS	4/2/88	800	0-25	1982	1978	SOUTHEAST	PARAMOUNT R.	MRP	-	OAK/GRASS	WILD OATS, LUPINES, BLUE DICKS, POPPIES, V. OAK
3	PHOTOS	4/2/88	800	25	1982	1978	NORTH	PARAMOUNT R.	MRP	-	OAK/GRASS	COMPOSITES, WILD OATS
4	PHOTOS	4/4,4/8/88	850	20-30	1982	1978	SW	PARAMOUNT R.	MRP	+	GRASSLAND	WILD OATS*, LILY BULBS, CHIA, CHAMISE, YUCCA
5	PHOTOS	4/4/88	1025	20	1982	1978	HILLTOP	PARAMOUNT R.	MRP	-	GRASSLAND	CHAMISE, INTRODUCED GRASSES
6	SAMPLING	4/4,4/8/88	950	20	1982	1978	SE	PARAMOUNT R.	SRP	+	CHAPARRAL	PRUNUS STAND
7	PHOTOS	4/6/88	900	25-30	1982	1978	SOUTH	PARAMOUNT R.	MRP	+	CHAPARRAL	YUCCA, CHAMISE, BULBS, CEANOTHUS
8	SAMPLING	4/6/88	1000	35-40	1982	1978	NORTH	PARAMOUNT R.	SRP	+	CHAPARRAL	PRUNUS STAND
9	SAMPLING	4/7/88	950	20-30	1982	1978	SOUTH	PARAMOUNT R.	MRP	+	GRASSLAND	CHIA, WILD OATS, MUSTARD
10	PHOTOS	4/8/88	950	20-25	1982	1958	N/NE	REAGAN RANCH	MRP	+	OAK WOOD	OAK, REDBERRY, ELDERBERRY, POISON OAK
11	PHOTOS	4/7/88	950	20	1982	1958	NORTH	REAGAN RANCH	SRP	+	OAK WOOD	OAK, POISON OAK
12	PHOTOS	4/8/88	1000	20	1982	1958	NW	REAGAN RANCH	MRP	+	OAK WOOD	BURNED OAK W/ SUNFLOWER AT BASE
13	PHOTOS	4/9/88	450	0	1982	1970	VALLEY FLOOR	M. CAMPGROUND	MRP	+	OAK WOOD	OAKS, WILD OATS, THISTLES, POISON OAK
14	SAMPING	4/9/88	475	100	1982	1970	SE	M. CAMPGROUND	MRP	+	OAK WOOD	BLUE DICKS, WILD OATS, GRASSES
15	SAMPLING	4/9/88	600	HILLTOP	1982	1970	HILLTOP	M. CAMPGROUND	MRP	+	OAK WOOD	REDMAIDS
16	PHOTOS	4/9/88	650	30	1982	1970	HILLTOP	M. CAMPGROUND	MRP	+	OAK WOOD	FIRE WEED, S. APIANA, CHIA
17	PHOTOS	4/9/88	650	30	1982	1970	NORTH	M. CAMPGROUND	MRP	+	OAK WOOD	CHIA
18	SAMPLING	4/9/88	700	20	1982	1970	NORTH	CENTURY RANCH	SRP	-	CHAPARRAL	MANZANITA
19	SAMPLING	4/19/88	750	15	1982	1970	NORTH	CENTURY RANCH	SRP	+	CHAPARRAL	MANZANITA
20	SAMPLING	4/9/99	750	30	1982	1970	NORTH	G. CAMPGROUND	SRP	+	CHAPARRAL	PRUNUS
21	PHOTOS	4/10,7/19/88	1350	25	1978	1978	NW	CORNELL ROAD	SRP	+	CHAP./ROAD	PRUNUS
22	PHOTOS	4/10,7/19/88	1500	30	1978	1978	NORTH	CORNELL ROAD	SRP	+	CHAP./ROAD	PRUNUS
23	PHOTOS	4/10/88	1550	25	1977	1978	NE	CORNELL ROAD	SRP	+	CHAP./ROAD	WILD OATS, CEANOTHUS
24	SAMPLING	4/11/88	100	50	1956	NO INFO	WEST	L. SYCAMORE	SRP	+	CHAP./ROAD	PRUNUS
25	PHOTOS	4/11/88	150	50	1956	NO INFO	NW	L. SYCAMORE	SRP	+	CHAP./ROAD	PRUNUS
26	SAMPLING	4/11/88	2100	0	1956	NO INFO	HILLTOP	TRIUNFO PASS	SRP	+	GRASS/ROAD	CHIA
27	PHOTOS	4/11/88	2000	VARIABLE	1985	1956?	OVERVIEW	TRIUNFO PASS	N/A	N/A	CHAP./ROAD	N/A:OVERVIEW SHOTS OF 1985/56 FIRE OVERLAP
28	PHOTOS	4/12/88	1800	50	1985	NO INFO	EAST	ROCKY SLOPE	SRP	+	CHAP./ROAD	SUNFLOWER
29	PHOTOS	4/12/88	1800	0	1985	NO INFO	EAST	SM. DRAINAGE	SRP	+	CHAP./ROAD	ELYMUS
30	SAMPLING	4/11/88	1050	40	1982	1958	N/NE	BULLDOG ROAD	SRP	+	CHAPARRAL	PRUNUS
31	SAMPLING	4/11/88	1600	20-30	1982	1956 OR '58	NORTH	CASTRO CREST	SRP	+	CHAPARRAL	MANZANITA (A. GLAUCA AND A. GLANDULOSA)
32	PHOTOS	4/11/88	2050	0-10	1982	1956 OR '88	HILLTOP	CASTRO CREST	SRP	+	GRASS/ROCK	ELYMUS
33	PHOTOS	4/15/88	900	25	1982	1956?	E/SE	MULHOLLAND H.	SRP	+	GRASSLAND	BUSH POPPY
34	PHOTOS	4/17/88	600	20-25	1970	1970	WEST	CENTURY RANCH	MRP	+	GRASS/CHAP.	STIPA, OTHER NATIVE GRASSES
35	PHOTOS	4/17/88	750	0-15	1982	1970	NORTH	LIBERTY CYN	SRP	+	OAK/GRASS	ELYMUS
36	PHOTOS	4/17/88	750	0-10	1982	1970	NORTH	LIBERTY CYN	SRP	+	OAK/GRASS	ELYMUS
37	SAMPLING	4/17/88	850	20-25	1982	1970	S/SW	LIBERTY CYN	MRP	+	OAK/GRASS	YUCCA, WILD OATS, ELDERBERRY, ELYMUS
38	PHOTOS	4/17/88	750	0	1982	1970	VALLEY FLOOR	LIBERTY CYN	SRP	+	OAK/GRASS	VALLEY OAK
39	PHOTOS	4/17/88	700	20-25	1982	1970	SOUTH	LIBERTY CYN	MRP	+	OAK/GRASS	WILD OATS, STIPA PULCHRA
40	PHOTOS	4/17/88	800	0	1982	1970	RIDGETOP	CENTURY RANCH	MRP	+	OAK/GRASS	NATIVE BUNCH GRASS, LIVE OAK, MIMULUS, MUSTARDS
41	PHOTOS	4/17/88	800	0-10	1982	1970	RIDGETOP	CENTURY RANCH	SRP	-	OAK/GRASS	UNKNOWN WOODY SHRUB
42	PHOTOS	4/17/88	900	10-15	1982	1970	SW	CENTURY RANCH	SRP	- •	OAK/GRASS	UNKNOWN WOODY SHRUB
43	PHOTOS	4/22/88	950	0-10	1982	1970	EAST	CENTURY RANCH	MRP	+	OAK/GRASS	MIMULUS, CALOCHORTUS, COMPOSITE, BLUE DICKS, OXALIS
44-49	NUMBERS NOT ASSIGNED											
50	PHOTOS	7/15/88	SEA LEVEL	0	1956/8	1935/6	E	MALIBU	N/A	N/A	URBAN	N/A: OVERVIEW OF MALIBU
51	SAMPLING	7/15/88	800	30	1982	1978	N	PARAMOUNT R.	MRP	+	CHAPARRAL	REDBERRY, ELDERBERRY, LIVE OAK
52	TRANSECT	7/16/88	700	20-30	1982	1970	W	G. CAMPGROUND	MRP	+	CHAPARRAL	CHAMISE, CEANOTHUS, TOYON, L. OAK, POISON OAK, PRUNUS
53	PHOTOS	7/16/88	850	VARIABLE	1982	1970	RIDGETOP	G. CAMPGROUND	N/A	N/A	CHAPARRAL	PRUNUS, CHAMISE, MONKEYFLOWER, SAGE
54	PHOTOS	7/18/66	650	25	1982	1970	E/NE	CENTURY RANCH	SRP	+	OAK WOOD	COFFEEBERRY
55	PHOTOS	7/18/88	650	20-25	1982	1970	N	CENTURY RANCH	MRP	+	OAK GRASS	NATIVE GRASSES, WILD RYE, STIPA, AND OTHERS
56	PHOTOS	7/25/88	100	VARIABLE	1985	1970	E	MALIBU CYN	N/A	+	CHAPARRAL	CEANOTHUS, RHAMNUS, BUCKWHEAT, BLACK SAGE
57	PHOTOS	7/25/88	100	0	1985	1970	VAL.FLOOR	MALIBU CYN	MRP	+	RIVERINE	GRASSES, TREE TOBACCO, BUSH MALLOW, WILLOW
58	PHOTOS	7/25/88	150	0-10	1985	1970	VAL.FLOOR	MALIBU CYN	MRP	+	RIVERINE	GRASSES, CALOCHORTUS, CHLOROGALUM
59	PHOTOS	7/25/88	350	20	1985	1970	NE	MALIBU CYN	MRP	+	GRASSLAND	COMPOSITES, WILD OATS
60	PHOTOS	7/25/88	50	0	1985	1970	VAL.FLOOR	MALIBU CYN	MRP	+	RIVERINE	BUCKWHEAT, SAGES, WILLOW
61	PHOTOS	7/26/88	600	30-35	1982	1970	S/SE	TALEPOP	MRP	+	OAK/GRASS	STIPA, WILD OATS, VALLEY OAK, THISTLE
62	PHOTOS	7/27/88	700	25-30	1970	1958?	W	SOKA UNIV.	MRP	+	OAK/GRASS	GRASSES, MUSTARDS, VALLEY OAK
63	PHOTOS	7/27/88	750	25	1970	1958?	N	SOKA UNIV.	MRP	+	OAK/GRASS	GRASSES, COMPOSITES
64	PHOTOS	7/27/88	800	VARIABLE	1970	1958?	OVERVIEW	SOKA UNIV.	MRP	N/A	OAK/GRASS	N/A OVERVIEW OF HINDU TEMPLE
65	SAMPLING	7/27/88	900	35-40	1970	1958?	N	SMALL DRAW	N/A	+	CHAPARRAL	PRUNUS, MANZANITA
66	PHOTOS	7/27/88	700	25-30	1970	1958?	N	SOKA UNIV.	MRP	N/A	CHAPARRAL	CEANOTHUS, SCRUB OAK
67	PHOTOS	7/27/88	800	0-15	1970	1958?	VARIABLE	MULHOLLAND H.	N/A	+	CHAP./ROAD	PRUNUS
68	PHOTOS	7/27/88	450	15-25	1989	1955	N	BIG SYCAMORE	MRP	+	OAK/WOOD	FIREWEED, LEGUMES, GRASSES
69	PHOTOS	7/27/88	500	30-50	1989	1955	N/NE	BIG SYCAMORE	MRP	+	CHAPARRAL	GRASSES

FIELD SITE DESCRIPTIONS

A general description of field stations and general site vicinities is provided to assist the reader in orienting themselves to the landscape prior to discussion of the observations of plant resources. These descriptions are organized by their proximity to *Talepop* (CA-LAn-229), gradually moving from east to west geographically.

SOKA UNIVERSITY (Figure 4.2) is located due east of the site *Talepop* in the same creek plain. The part of the flood plain is mostly cleared, developed or under cultivation. Along the creek grow sycamores. Soka University is to the north of the creek; to the south are north-facing slopes and a ridge running from the edge of the south end of *Talepop* to the northeastern edge of the Stokes/Liberty floodplain. The southern slopes are dominated by live oaks (*Quercus agrifolia*) with a general understory of wild oats (*Avena* sp.), sage (*Salvia* sp.) and other herbaceous plants. At the base of these slopes grow scrub oaks and other small shrubs including chamise and ceanothus. At the southeastern corner of the Soka campus is a north/south draw that supports stands of both islay and manzanita. These stands were both sampled. No other important Chumash crops were sampled at this vicinity. The Soka campus and its southern slopes were last burned in 1970.

As an aside, this property is particularly intriguing anthropologically, not only for purposes of the current study, but because of its "spiritual" history over the past two decades. This property has been 1) a seminary for Claretians; 2) the home of Summit University, Day Care and Radio and Television School (affiliations of the religious cult following the visions and teachings of Elizabeth Clara Prophet); and is now 3) the American home of Soka University (a Buddhist group). Due south of the rather rustic wooded setting of this campus and just over a small hill is an exquisite, extremely detailed Hindu temple which is apparently an exact replica of a temple in India. The attraction of such a wide breadth of religious groups to one specific location in the Santa Monica Mountains is a landscape question that certainly merits some anthropologist's future study.

Just north of *Talepop* are **LAS VIRGENES** and **LIBERTY CANYONS** (Figure 4.2), two parallel drainages running southward into Malibu Canyon. Five miles north of *Talepop* is the Ventura Freeway, Highway 101. The Liberty Canyon drainage feeds into Las Virgenes Creek just a few hundred meters north of *Talepop*. The length of Liberty Canyon south of the freeway (approximately 5 miles long) was surveyed via a well established foot path that runs along the east side of the drainage and skirts the section of private property situated in the heart of the canyon. Liberty Canyon was burned in 1982; one valley oak (*Quercus lobata*) tree in particular bears the scars (Site 38). Dominant plants along this path and the eastern slopes of the canyon include valley oaks, yucca, and grasses (especially wild oats). The western canyon slopes are covered by an overstory of live oak (*Q. agrifolia*) a middle-story of woody shrubs, and a scant understory of herbaceous plants such as sage. That side of the canyon was not traversed due to its lack of accessibility. At the southern end of Liberty Canyon, where it joins Las Virgenes, a stand dominated by a native bunch grass (*Stipa* cf. *lepida*) was noted (Site 39). This stand of *Stipa* sp. was located at the base of the low ridge bordering the western side of Liberty Canyon. No in-depth sampling was conducted at this vicinity.

Eight to ten miles north of this highway, Las Virgenes Creek begins in the Simi Hills. Running parallel to Las Virgenes coming out of the Simi Hills is **CHEESEBORO CANYON** (Figure 4.3). The latter canyon was patrolled with Bob Plantrich using a National Park Service vehicle. Our inspection confirmed his claims that these hilly grasslands were still dominated by introduced grass species such as wild oat, although a *Stipa* grass was occasionally noted in the understory near the back of the canyon under the Valley Oaks. Cheeseboro Canyon was burned in 1982 and there have also been subsequent controlled burn experiments conducted there to a very limited extent by the Parks and other resource managers (Plantrich 1988, personal communication) but recent budget constraints have restricted these studies and their findings. No in-depth sampling was conducted at this vicinity.

CENTURY RANCH (Figure 4.2) is located at the heart of Malibu Creek State Park at a major bend of Malibu Creek as it comes through the hills before it joins the other creeks below. This area was burned over along with the M*A*S*H set (of motion picture and television fame) located above and to the northwest and the *Talepop* site to the northeast during the 1982 fire. The open area along the creek to the east of Century Ranch has been significantly altered by recent motion picture and television filming. Except for the edge of the active creekside where some riverine species (i.e. willow, rushes, sedges, grasses) grow, most plants in this open area are introduced from the Old World.

Along the south slopes of Century Ranch, in particular above the bulldozed terrace where debris from motion picture productions remains, the landscape appears relatively intact. Along this slope, manzanita and grasses were sampled. Control soil samples were also collected at the crest of the small ridge (Soil Sites 1 and 2) south of Century Ranch to determine the presence/absence of charred plant remains. This ridge top was also burned in the 1982 fire.

To the east and south of Century Ranch is the **MCSP MAIN CAMPGROUND** (Figure 4.2). Due south of this--over a relative low, well vegetated ridge covered with chaparral shrubs, oaks and poison oak--is the

MCSP GROUP CAMPGROUND. Both flat areas are highly disturbed; however, the slopes are fairly intact. To the north of the campground, grassy knolls were covered with several herb and grass species (Sites 14-17). The slope to the east of the group campground produced a productive and accessible stand of *Prunus* plants (Site 20). Soil at this vicinity was also sampled (Soil Sites 4-6) for presence/absence of charred plant remains. This site marked a point at the edge of the 1982 fire.

REAGAN RANCH (Figures 4.3) is located southeast of the corner of Mulholland Highway and Cornell Road. This property is currently the site of MCSP headquarters. Reagan Ranch was on the western border of the major 1982 fire. Although the north facing slopes behind the Ranch show extensive evidence of the fire, the ranch itself was spared, presumably due to the fire fighting equipment which is stored there. The large oaks on the slope show the scars of the 1982 fire. The north-facing slope behind Reagan Ranch was sampled for grasses, composites and other herbs and several chaparral shrubs. Also soil sample were collected from a hill (Soil Site 3) due south of Reagan Ranch headquarters.

PARAMOUNT RANCH (Figure 4.3), located northwest of the corner of Mulholland and Cornell is just above where Medea Creek joins Malibu Canyon. This field station includes a high crest of rocky slopes to the south and west with several deep and narrow canyons. Paramount Ranch also burned in the big 1982 fire, although the live oaks at this field station avoided the extensive scars seen on the Reagan Ranch oaks. On the other hand, the woody shrubs situated on the exposed slopes do show extensive evidence of burning, indicating the "patchy" way that the fire probably swept through this area. A survey of the canyon at the western end of the property produced two *Prunus* stands (Sites 6 and 8) and sites of composites, grasses, chia, small bulbs and yucca. Several of these sites were subjected to in-depth sampling.

To the south and west of the campgrounds, **MALIBU CANYON** (Figure 4.4) becomes a deep gorge. South about three and a half miles below, the canyon opens into an eighth of a mile (two hundred meter) wide floodplain that extends for about two more miles, until the creek pours into the ocean. The top of this floodplain and its canyon sides, situated about a mile above the community of Malibu were studied on a walk-through survey; no in-depth sampling was conducted. Grasses and herbaceous plants were the most intriguing plants at this vicinity, which was burned in 1985.

Southwest of the Century Ranch settlement, the Santa Monica Mountains rise to a height of 2800 feet at Castro Peak, a few thousand feet due west of the **CASTRO CREST** vicinity (Figure 4.5) which is under joint management of state and federal park departments. This crest was traversed in a State Park vehicle. The area, which was partially burned in 1982, supported many very productive islay plants. At an elevation of 1600 feet, about a mile and a half east by northeast of Castro Peak on a dry north facing slope, I encountered the most productive manzanita patch seen in the study region (Site 31; see below).

Ten miles due west of *Talepop* is one the highest passes in the Santa Monica Mountains, **TRIUNFO PASS** (Figure 4.6) at 2200 feet. It is bordered one half mile to the southeast by Triunfo Lookout at 2658 feet, and one mile to the northwest by Sandstone Peak which is 3111 feet high. Numerous places along this road and Mulholland Highway to the east were surveyed for evidence of important food plants. Those observed included islay, elderberry, grasses, chia, and oaks. The chia growing on Triunfo Pass (Site 26; see below) was the

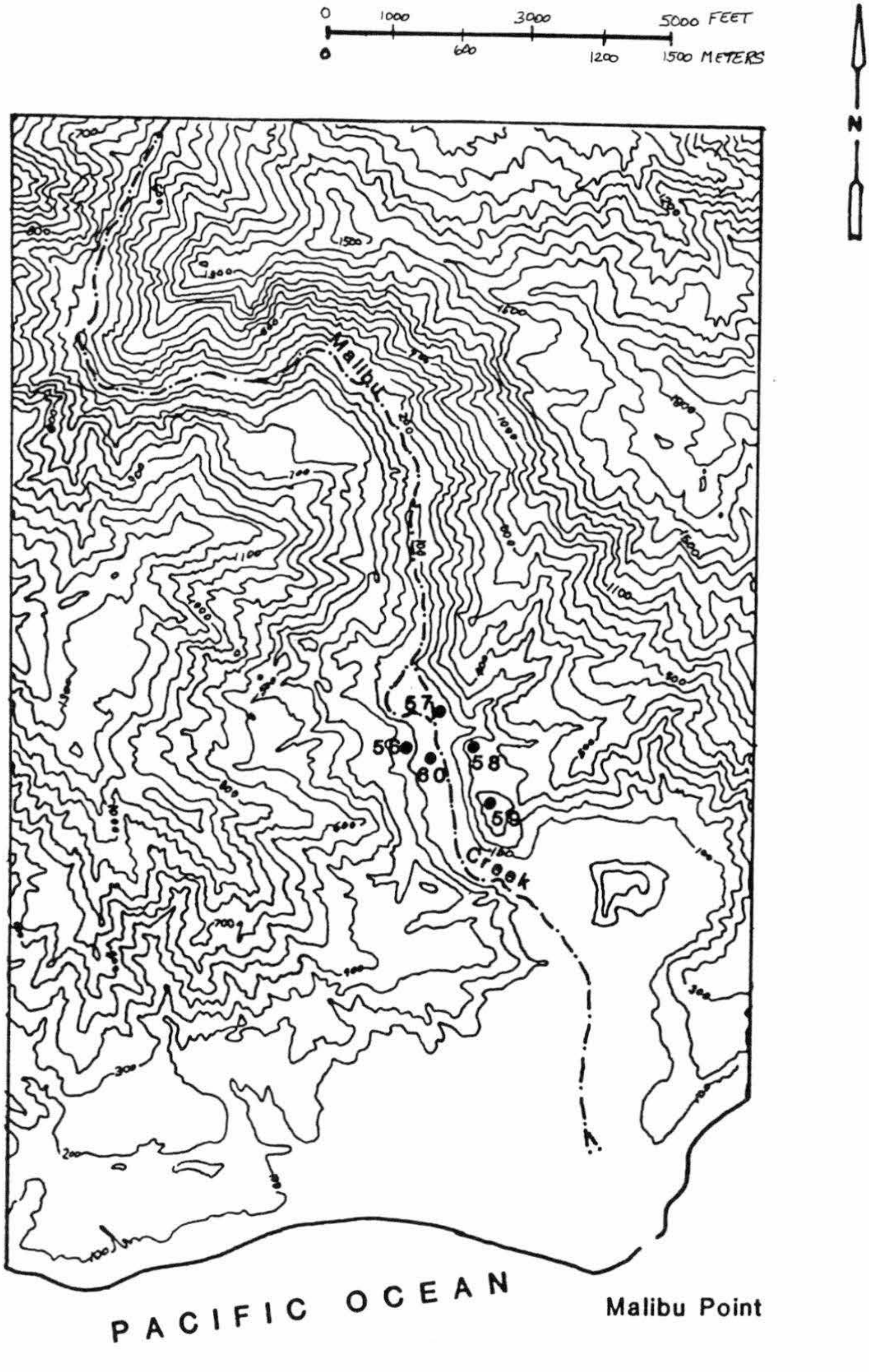


FIGURE 4.4 Map of Lower Malibu Canyon.

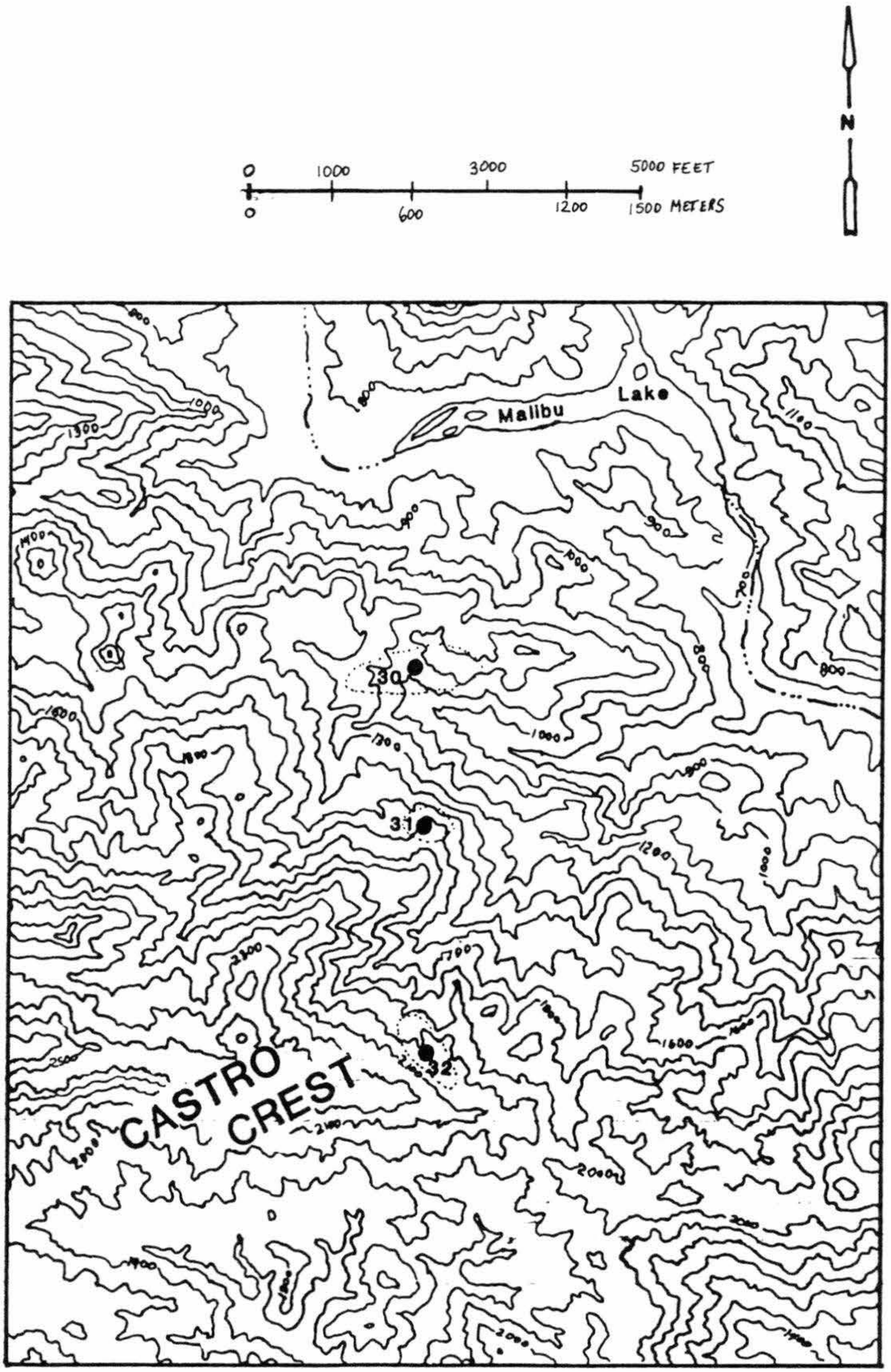


FIGURE 4.5 Map of Castro Crest Vicinity.

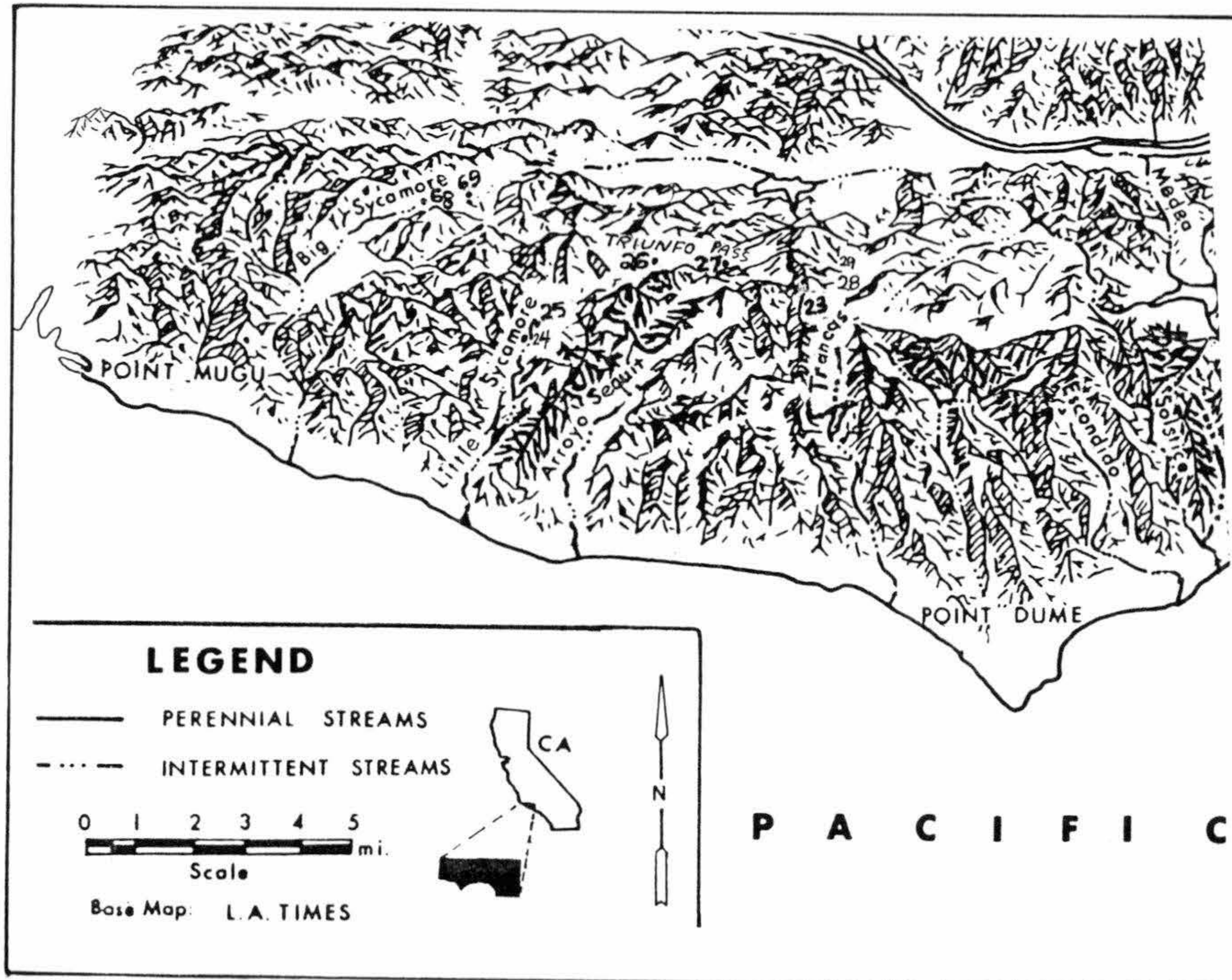


FIGURE 4.6 Map of Triunfo Pass/Sycamore Canyon.

tallest stand observed during the fieldwork. No in-depth sampling was conducted at this vicinity.

Southwest of Triunfo Pass is **LITTLE SYCAMORE CANYON** (Figure 4.6), which provided information about islay in particular and mature chaparral in general. In this canyon an islay "tree" was noted, the only non-shrub native *Prunus* plant noted during the field work. Due west of Little Sycamore is **BIG SYCAMORE CANYON**, which experienced a small fire during April of 1988 (Figure 4.6). In July the newly burned area was surveyed for evidence of increased plant food productivity. The most notable food plants enhanced by the burning were yucca, grasses, composites, and other herbs. No in-depth sampling was conducted in either Big or Little Sycamore Canyons.

FIELD SAMPLING METHOD

The field sampling method was designed to identify current distributions of Chumash food plants in terms of topographic relief, exposure, and local fire history, and relationships with other plants as they occur over the general landscape of the Santa Monica Mountains. This was done in order to characterize potential resource "patches" and to attempt a reconstruction of likely distribution patterns prior to the current levels of modern disturbance and introduced species. Based on criteria described above, sampling tracts were selected for vegetation field survey, both for in-depth sampling and roadside study.

In-depth Sampling

Two woody shrub plants, islay (*Prunus ilicifolia*) and manzanita (*Arctostaphylos* sp.) along with one herbaceous plant, chia (*Salvia columbariae*) were chosen for the most detailed level of analysis, due to their central importance to the Chumash diet and to the lack of work carried out related to these crops. Oak, another significant woody plant resource, is somewhat better understood (i.e. Merriam 1918; Gifford 1936; Wolf 1945; Bean 1972), so less time was allotted to observing this genus. In general, yucca, grasses, and most herbaceous plants, including those producing both edible small seeds and bulbs, were sampled to a lesser extent than the woody shrubs and chia. This decision was based on two factors. First, a wealth of literature was available on many herbaceous species, particularly fire followers (i.e. Sweeney 1956; S. Keeley 1977; MacBride and Jacobs 1980; Timbrook *et al.* 1982). Secondly, there were certain logistical difficulties related to the large size of these tracts (for yucca), and difficulty in finding stands where introduced plants did not dominate (for the grassland taxa). As a test case to refine my sampling strategy for grassland species, I arbitrarily chose chia (*Salvia columbariae*) along with specific bulb/corm plants observed growing in association with chia. The limits and biases implicit in this introduced species-dominated plant association were noted and evaluated. The majority of the field time available for this pilot study was devoted to more "pristine" stands in chaparral dominated parts of the study region.

Within the sampling tracts, plant resource units were demarcated based on the spatial distribution limits of the primary plant type present (i.e. manzanita, chia, islay). The procedure for delimiting resource units (stands) was based on an assessment of 1) their geographical distributions, 2) the total area covered by the resource, 3) the relationship between this unit and other components of the landscape, and 4) the specific type of aboriginal harvesting technique(s) employed for that plant type. Distributions of any other known economically important plants found in the tracts or their immediate vicinity were noted.

For example yucca (*Yucca whipplei*) resource units (stands) were usually recorded as the entire ridge where they occurred; whereas islay (*Prunus ilicifolia*) stands were rarely more than 30 meters wide. This is consistent with Bean's (1972:126) discussion of "owned" resource units (patches) in the Cahuilla area, such as "an acorn grove, a pinyon forest, a clump of mesquite, a hillside covered with cacti or yucca." Stands of islay and yucca species would rarely overlap because these two habitually prefer different exposures: islay in the study area grew most often on northeastern slopes and yucca grew most often on southern facing slopes, thus their stands tended to be discrete by their growth habit.

The demarcation of stands of herbaceous plants was somewhat more arbitrary than for shrubs or yucca. For example, chia (*Salvia columbariae*) could be found on the same southern exposed slope as yucca. Yucca clearly occurred in higher frequency nearer the rockier ridge top, whereas chia plants were more common down lower on the deeper talus slope. Such a hillside could support yucca, chia, grasses and bulb crops including blue dicks (*Dichelostemma pulchellum*) and mariposa lilies (*Calochortus* sp.) spread throughout. In rare cases, it was necessary to distinguish a zone of decreasing frequency of a taxon which would indicate where a boundary could be drawn. Although these in-field determinations were somewhat arbitrary, every attempt was made to be consistent between stands of the same taxon. Notes were taken regarding any variability in zonation.

Typically, discrete "resource units" could be discerned on the landscape for plant foods under study, and their likelihood of being a "multiple resource patch" (MRP) or "single resource patch" (SRP) was noted. Also the structure and dynamics of study taxa could be characterized. The bias implicit in this technique, which was based on only one researcher's intellectual and field perceptions should also be noted. But these observations are a critical precursor to any more empirical studies such as nutrient or calorie analyses or quantification of harvest yields/area that might follow in future research.

Once plant stands had been demarcated, photographed and described, sampling strategies followed from categories of resource types: nuts from trees or woody shrubs, berries from woody shrubs, small seeded plants such as grasses and herbaceous plants and herbaceous plants producing small bulbs, corms or tubers. These categorical distinctions appeared to adequately characterize each resource unit in terms of its growth habit which related to knowledge of relevant harvesting technique(s) both related to my own sampling strategy. The exception to this generalized strategy of categorizing the resources was yucca, which is sufficiently different from the other plant foods to have required a different harvesting and sampling strategy. I decided that yucca could not be effectively and efficiently sampled by a lone researcher and should be left to a future project. The in-depth sampling sites were used in order to obtain basic food production information: particular conditions of the species relative to its available fire history.

Roadside Study

To supplement the information obtained through in-depth sampling, most of the accessible (public) roads in the Santa Monica Mountains were traversed. Frequent stops for photo opportunities and note taking were made. These additional observations were useful for providing knowledge of important Chumash plant resources. These road trips emphasized visits to vicinities that were different geographically from the in-depth study areas, and also special circumstance trips into areas where normal access was restricted for a variety of reasons.

PLANT RESOURCES, THEIR HABITATS AND CONDITIONS

For the field stations and site vicinities described above, sites were sought with particular plant taxa in mind. Sampling strategies of plant taxa were determined by the general growth habits of plants and review of previous research. Relevant data from previous studies in plant ecology and range management were integrated into the taxa profiles being established; my work emphasized taxa and information relevant to resource management questions that previous researchers had ignored. Different sampling strategies were developed for shrub and herbaceous species. Shrub/trees studied include islay (*Prunus* sp.), manzanita (*Arctostaphylos* sp.), oak (*Quercus* sp.), and to a lesser extent elderberry (*Sambucus mexicana*) and walnut (*Juglans* sp.). Herbaceous plants and subshrubs include mariposa lilies (*Calochortus* sp.), blue dicks (*Dichelostemma pulchellum*), soaproot (*Chlorogalum pomeridianum*), chia (*Salvia columbariae*), red maids (*Calandrinia ciliata*) and common sunflower (*Helianthus* sp.), legumes (Leguminosae) and grasses (Poaceae). Although the vegetation sampling data collected thus far are preliminary, they begin an important data source for future work.

Woody Shrubs and Trees

Fire and plant ecologists working with chaparral shrubs have demonstrated the important role of fire for rejuvenating certain dominant species, although little attention has been focused on *Prunus* sp. and *Arctostaphylos* sp. Furthermore, most literature on these genera (i.e. Hanes 1971; Menke and Villasenor 1977) emphasizes production of foliage, not fruits. Hence much of my vegetation field survey work focused on understanding the conditions affecting fruit production of these two genera.

Prunus ilicifolia **(Islay or Holly-leaved Cherry)** is a large woody chaparral shrub in the genus that includes apricot, plum and cherry species. *P. lyonii* (**Catalina Cherry**) which is more arboreous, has larger leaves and fruits, and easily hybridizes with *P. ilicifolia* (Munz 1968:791), is considered by some botanists to be a subspecies of *P. ilicifolia*. Both taxa were harvested for the nutmeat or kernel inside the seed hull of the cherry which was hulled, leached and ground much like oak acorns. The fleshy part of these cherries is negligible.

Prunus lyonii is considered to be endemic to Santa Cruz, Anacapa and Santa Rosa Islands (McMinn and Maino 1963:229-23), although it occasionally escapes from cultivation on the mainland (Munz 1968:791). The more common species, *P. ilicifolia*, occurs in chaparral and coastal sage communites on the mainland away from the immediate coast (Raven and Thompson, and Prigge 1986). Islay is a rootcrown sprouter (Hanes 1971:44), meaning it has the capacity to sprout new stems from the latent buds in the rootcrown following a fire. Because of this a typical plant may have many growing branches as well as several dead branches that are left from a fire that occurred several years before.

In the study area, islay was found in small stands totalling one to ten individual plants. The slope and exposure of each site and height, length and width of individual plants were recorded (Table 4.2). To obtain productivity counts, plants selected for sampling were divided into quadrants using a compass and flagging tape. A quadrant was selected based on accessibility and whether it appeared (at first glance) to be representative for the plant. A different directional quad was selected for each plant sampled in a given stand in order to increase reliability of the measurements. For all living branches originating in the selected quad, an estimate of the percentage of buds, flowers,

TABLE 4 2 CENTURY RANCH VEGETATION STUDY, PRUNUS STANDS

PRUNUS STANDS VISIT DATES	SITE	DEGREE SLOPE	SITE EXPOSURE	ELEV (FEET)	LAST BURN	PREVIO BURN	PLANT #	HEIGHT (m)	WIDTH (m)	LENGTH (m)	QUANDRANT SAMPLED	BURNED BRANCHES #	BURNED BRANCHES CIRCUMFERENCE (cm)	NEW BRANCHES #	NEW BRANCHES CIRCUMFERENCE (cm)	FLOWERING STATE BUDS	FLOWERING STATE BLOSSOMS	PERCENTAGES FRUIT SET	FRUIT QUANTITY INITIAL #	FRUIT QUANTITY REVISIT #	COMMENTS
4/3/88 7/15/88	6	20	NORTH	950	1982	1978	1	2	2	2	SW*	1	19	1	14	0.00%	5.00%	95.00%	340	94	FIRST VISIT NOTES PLANT 1) ONLY SOUTHERN SIDE OF PLANT
											SW			2	10	0.00%	5.00%	95.00%	72	31	IS FLOWERING/FRUITING
							2	3	3	3	NW			+	-	30.00%	70.00%	-	0	+	PLANT 2) NO FRUITS SETTING YET
							3	4	4	3	*			+	-	NO MEASUREMENTS TAKEN			0	+	PLANT 3) MIDDLE OF PLANT BURNED OUT
							4	2	2	2	*			+	-	30.00%	70.00%	-	0	+	PLANT 4) NO FRUITS SETTING YET
																					SECOND VISIT NOTES
																					ALL 4 PLANTS NOW FRUITING.
																					MOST FRUITS ON #'S 1-3 STILL GREEN
																					PLANT #4 ACROSS DRAW IS MORE EXPOSED;
																					HAS MOST MATURE FRUIT CROP
4/6/88 7/24/88	8	35-40	NORTH	1000	1982	1978	1	2	2	2	SW	1	10	1	10	33.00%	33.00%	33.00%	103	132	
											SW			2	9.5	25.00%	50.00%	25.00%	90	113	
											SW			3	7	20.00%	50.00%	30.00%	65	2	
											SW			4	7.5	20.00%	50.00%	30.00%	8	3	
											SW			5	8	20.00%	50.00%	30.00%	133	170	
											SW			6	10	10.00%	60.00%	30.00%	210	8	
							2	3	2	2	SE	1	11	1	15	10.00%	70.00%	20.00%	543	251	
											SE	2	21	2	12	10.00%	70.00%	20.00%	446	282	
											SE			3	14	10.00%	70.00%	20.00%	523	211	
							3	2	2	3	NE	1	24	1	7	20.00%	20.00%	60.00%	43	1	
											NE	2	24	2	14	20.00%	20.00%	60.00%	107	268	
											NE			3	14	20.00%	20.00%	60.00%	105	144	
							4	3	2	2	NW	1	6.5	1		10.00%	30.00%	50.00%	105	0	
											NW	2	23	2		10.00%	30.00%	50.00%	280	30	
											NW			3						130	
											NW			4						820	
4/5/88 7/16/88	20	30	NORTH	750	1982	1978	1	3	3	3	NE	1	8	1	5.5	5.00%	90.00%	5.00%	851	50	
											NE	2	11	2	9.5	5.00%	90.00%	5.00%	674	164	
											NE	3	22	3	6	5.00%	90.00%	5.00%	1369	30	
											NE			4	11	5.00%	90.00%	5.00%	3450	142	
											NE			5	11	5.00%	90.00%	5.00%	4370	283	
ROADSIDE SURVEY																					
4/10/88	21	25-30	NORTHWEST	1350	1978	NO INFO		NO MEASUREMENTS, BUT MANY PHOTOS TAKEN													
4/10/88	22	30-35	NORTH	1500	1978	NO INFO		NO MEASUREMENTS, BUT MANY PHOTOS TAKEN													
4/10/88	23	25-30	NORTHEAST	1550	1978	NO INFO		NO MEASUREMENTS, BUT MANY PHOTOS TAKEN													
4/11/88	24	50	WEST	100	1956	NO INFO		4	4	4	NO OTHER MEASUREMENTS TAKEN								SETTING FRUITS		RATHER DRY LOCATION
4/11/88	25	50	EAST	150	1956	NO INFO		10	3	3	NO OTHER MEASUREMENTS TAKEN								SETTING FRUITS		PRUNUS "TREE"
7/19/88	30	30-40	EAST	1050	1982	1958	1	8	8	12	NO OTHER MEASUREMENTS TAKEN								LOADED WITH FRUIT		
			EAST				2	8	8	8									LOADED WITH FRUIT		
			EAST				3	1	1	2									LOADED WITH FRUIT		
7/27/88	65	20	WEST	900	1970	1958?	1-10	2	10	20	NO OTHER MEASUREMENTS TAKEN								LOADED WITH FRUIT		LOCATED IN SMALL NORTHWARD RUNNING DRAINAGE
7/27/88	67	OVERLOOK	NORTHWEST	800	1970	1958?	1-4	NO MEASUREMENTS, BUT MANY PHOTOS TAKEN											LOADED WITH FRUIT		LOCATED NEAR MULHOLLAND HIGHWAY OVERLOOK

and set fruits was recorded. Fruits that had already set were counted. Measurements on the length of the branch and its circumference at the point where it grows from the plant stump were also tabulated. Each site was sampled at two times, April and July, to observe the survival rate from blossoms to maturing fruit. At least one further sampling time in August/September would have been desirable but was not possible. The bases of dead branches predating the last fire that originated in each sampling quad were also measured. Usually the only measure possible for these dead branches was stalk circumference. When possible, the length of the branch before the fire was estimated to determine the full size of the plant prior to burning.

To a certain extent, the measurements collected were similar to those developed for two independent research projects in San Diego County (Keeley and Keeley 1977; Wakimoto 1977). Wakimoto's (1977) study was designed to assess fuel loads for several chaparral shrub genera, including chamise, scrub oak, manzanita and ceanothus. Because of the different goals of his study, he paid no attention to evaluating fruit productivity. Also, he cut his sample plants off at ground level and transported them in their entirety back to his lab where he weighed them. For "exceptionally large plants" he "subsampled" by harvesting only a "representative" portion of the plant (Wakimoto 1977:415). A quadrant sampling technique was developed for a field study related to studying energy allocation patterns in manzanita (Keeley and Keeley 1977). In this study, terminal branchlets were removed and transported to their lab to weigh reproductive parts in order to determine allocations of biomass to reproduction. Although their sampling strategy had a lower impact than Wakimoto's (1977), it still would have an obvious effect on the current year's fruit production and would not allow the researcher to revisit the same location later in the season. Obviously my technique, which was developed with the intention of preserving the integrity of the existing plants, has a substantially lower immediate impact than either of the other studies and allows follow up studies to be conducted a few months later. Of course, without harvesting plants or their parts it is impossible obtain weight for samples (which were necessary for the former two sets of studies). For purposes of the current study, counts were considered adequate and, given the reduction in impact to the stands, preferable.

Islay was most often sighted in open areas such as road cuts or on the slopes of steep draws. These sightings include Paramount Ranch (Sites 6 and 8), the Group Campground of Malibu Creek State Park (Sites 20, 52 and 53), Soka University (Site 65) and road cuts on Mulholland Highway (Site 67), Cornell Road (Sites 21-23), Bulldog Road on the way to Castro Crest (Site 30), and Little Sycamore Canyon Road (Sites 24 and 25). All shrubs were located on steep slopes relative to those of other food plants and all were situated on north- or east-facing slopes. Three sites, two in Paramount Ranch (Sites 6 and 8) and one near the MCSP Group Campground (Site 20), were subjected to more in-depth sampling.

Results indicate that there is great variability in time of budding and ripening, rate of bud production (number of buds per overall area of plant), and survival rate of fruits (number of mature fruits per number of buds) (Table 4.2). These variables merit a great deal of further investigation. It is likely that these variables are subject to microenvironmental variation such as temperature or available moisture.

The comparison between pre- and post-fire branch measurements suggests that although the branches are fully productive, few of the new branches have reached their full pre-fire growth, even those with high yields of fruits. This documents their ability to resume production from new branch shoots, but fails to provide us with an idea of the age of the burned branches at the time of the fire or to generate information on the productivity of these older branches immediately preceding the fire.

One basic characteristic of flower production observed for all productive members of this taxa sampled during field work is that only the top meter of plant area that was exposed to sunlight produced any flower buds, no matter how big or small the overall plant. All the understory portion of the islay plant, whether it is one meter or 10 meters in height produces no blossoms. The part of the shrub that grows beneath the one meter flowering crown appears to be vegetatively productive, not reproductive.

It is prudent to note that all of the sites that were intensively sampled were previously burned only four years before the last burn. This underscores the caution necessary in studying the history of previous burns; the larger dead branches that were measured during this study could have been killed in either the 1978 or the 1982 fire. It is quite certain that they did not sprout and mature in the four year interim.

The field sampling of islay produced limited empirical results, but some significant observations have been made and they have generated important new variables and problems to be studied further. One example is an unusually tall specimen, growing as a tree on Little Sycamore Canyon Road (Site 25) about 1100 feet above the beach. Although it is characteristic for islay shrubs to be at least as wide as they are tall, this one, located roadside at a sharp drop off, was only three meters wide and over 10 meters high. It was located beneath a power line running alongside the road and wears scars in evidence that its branches were clipped by road crews at some time in the past. Another possibility is that it is an accidental or deliberate planting of *P. lyonii* (Catalina

Cherry, endemic to the Channel Islands). The likelihood of the latter event is rather low, due to its fairly remote placement relative to the coast or any human constructions. The two lane road and the power lines running through the branches of the *Prunus* tree are the only direct evidence of human intervention within half a mile. This *Prunus* "tree" at Site 25 shared the 1 meter exposure rule observed in other specimens, although, it's tree-like habit allowed a greater area on the road side of the plant to be exposed than in many shrub forms.

Observations of *Prunus* plants were limited by access; it is difficult to penetrate thick mature undisturbed chaparral. Nevertheless some observations were made by crawling under chaparral following game trails for a distance until a vantage viewpoint such as a rock outcrop of bluff could be reached. My observations indicate that islay plants at least are occasionally able to reach the upper canopy. Contrary to Hanes (1978) suggestion that *Prunus* is shade tolerant, the overstory parts of these plants do actively compete with other plant taxa for canopy gap exposure. This may not negate the need for an initially shaded place for these plants to get established. It does, however, suggest that burning or clearing could have functioned to expand areal exposure to sunlight. Overall my observations provided ample evidence that the islay plants in the study region had recovered from any stress related to the fire that occurred six years previously, and were producing a good crop of fruits.

Manzanita (*Arctostaphylos glandulosa* and *A. glauca*) is another economically important genus of woody chaparral shrub. Manzanita berries were crushed and mixed with water and then drunk as a cider throughout much of southern and central California. Manzanita plants tend to be smaller and more sun-loving (Hanes 1971) than the islay plant. Four stands of manzanita were sighted during the field study, two behind Century Ranch (Sites 18 and

19), one Bulldog Road near Castro Crest (Site 31), and one in a draw at the southeast edge of Soka University campus (Site 65). In general manzanita plants were found in small stands on open north facing slopes with *Cercocarpus* sp. and other low growing shrubs. The period of recovery for these plants following a fire is still poorly understood. Fruiting manzanita were rare in the project area during the period of study. Because of this, fruit counts were extremely low, and the data were considered inadequate for any significant observations (Table 4.3). Overall, the recording procedure was patterned after that established for islay, although only limited information was obtained from the manzanita stands.

The only productive stand of manzanita observed during the survey was Site 31 near Castro Crest. This stand was particularly notable because both species, *A. glandulosa* and *A. glauca* were present, and both were bearing fruit. The peak time for fruit ripening appeared to have fallen prior to the July revisit. This fact and time limitations precluded sampling these specimens in quadrants. Nevertheless, this stand is a good place for any subsequent research that might be conducted in the future.

Another interesting observation was that some kind of fungus or blight is affecting the leaves of two stands (Sites 31 and 65). The effect of this invader is that the leaves of the shrubs are becoming curly and red. At Site 31, branches with this ailment did appear less productive than those without the condition. It is not known what, if any, deleterious role this condition might have on overall fruit production. It is possible that this is a degenerative condition that can be eliminated or contained with periodic burning, so this question remains for further inquiry.

Crucial questions to be addressed in future investigations involve why these two species of manzanita coinhabit the same stand and why this stand is

TABLE 4.3: CENTURY RANCH VEGETATION STUDY, ARCTOSTAPHYLOS STANDS

MANZANITA STANDS

STUDY DATES	SITE #	DEGREE SLOPE	SITE EXPOSURE	ELEV. (FEET)	LAST BURN	PREVIOUS BURN	PLANT no.	OLD HEIGHT (m)	PRESENT HEIGHT (m)	WIDTH (m)	LENGTH (m)	QUADRANT SAMPLED	BURNED BRANCHES #	BURNED BRANCHES CIRCUMFERENCE (cm)	NEW BRANCHES #	NEW BRANCHES CIRCUMFERENCE (cm)	FRUIT QUANTITY
4/9/88	18	20	NORTH	700	1982	1970	1					ALL FOUR	1	5	1	5	0
							2					ALL FOUR	1	9	1	4	0
													2	6	2	5	0
							3					ALL FOUR	1	3.5	1	3	0
						1970	1	1.5	1	1.5	2	SOUTHEAS	1	9	1	5	4
												SOUTHEAS	2	7	2	5	2
							2	1.5	1.5	1.5	1	ALL FOUR	1	6.5	1	4	0
													2	7			
							3								1		24
							4-20	NO MEASUREMENTS TAKEN									4-6 TOTAL

so much more productive than other patch locations. All other stands located in the Santa Monica Mountains were limited to *A. glandulosa*. In a three year study of these two cohabitating species of manzanita (*A. glandulosa* and *A. glauca*) in San Diego County, Keeley (1973) derived these fruit counts for a 90 year old stand:

TABLE 4.4: MANZANITA FRUIT COUNTS IN A 90 YEAR OLD STAND

Year	*Arctostaphylos glauca*	*A. glandulosa*
1972	3.8	10
1973	1.6	0
1974	349.5	916.8

KEY: Number of fruits/meters square of areal coverage

These data reflect dramatic annual fluctuations in productivity. Overall the two species appear to share a similar pattern of successful fruit productivity, but the factors contributing to this pattern are not clear. Keeley and Keeley (1977) attribute it to moisture availability, citing chaparral shrubs' sensitivity to drought conditions (Harvey and Mooney 1964), and noting that the amount of rainfall during the 1972-1973 season was above average (Keeley 1973) for that vicinity.

The significance of these two manzanita species coinhabiting these successful stands suggests that they share many important edaphic and physiographic conditions that are more central to their immediate survival than to their reproductive strategy. This is crucial to managing/or predicting harvest yields for these species. Like *Prunus ilicifolia*, *Arctostaphylos glandulosa* is a stump sprouter, but *A. glauca* is not (Sampson and Jespersen 1963). The latter, an obligate seeder (can only reproduce by seedling; it cannot regenerate vegetatively), is widely accepted by chaparral plant ecologists to be a later evolutionary strategy for this genus (Sampson and Jespersen 1963; Wells 1969; Keeley and Keeley 1977). This duality of reproductive strategies between species is most pronounced in the two chaparral woody shrub genera *Arctostaphylos* and *Ceanothus* (Wells 1969; Keeley and Keeley 1977). Other genera of chaparral woody shrubs and trees can sprout branches from their stumps (Sampson and Jespersen 1963). Competitive exclusion arguments predict that eventually one taxon's strategy will be better adapted to prevailing environmental conditions than the other. Despite the phenotypic and habitat similarities between these two species, their reproductive strategies may be different enough to offset superficial similarities in evolutionary terms.

Plant reproductive strategies are a significant variable in fruit production and thus worthy of more extensive discussion here. Wells (1969) has argued that these two different reproductive strategies are adaptive responses to different fire regimes. The non-sprouting obligate seedling strategy is probably a response to a recurrent fire regime that results in greater frequency and intensity of selection (Wells 1969:266). Frequently recurring fires could preclude the capacity to reproduce vegetatively (Wells 1969:264). Wells further suggested that non-sprouting species produce more seeds than stump sprouting species although he failed to document this claim. According to the argument, stump sprouters have an advantage over non-sprouters following a fire due to the buds produced in the swollen root-crown or burl at the base of the stem (Jepson 1916; Sampson and Jespersen 1963). *A. glandulosa* begin resprouting within a few weeks after a fire (Sampson and Jespersen 1963; Hanes 1971), and quickly regain their original size (Jepson 1916; Keeley and Keeley 1977). However, few of their seedlings become established, so these stands maintain their genotypic integrity for periods of time (Wells 1969). Although the seedlings of the non-sprouting species *A. glauca* require ten to twenty years to regain their pre-fire stand size (Jepson 1916; Wells 1969), these obligate seeders produce immense quantities of seeds, which face each new fire cycle with a new phenotype, and thus through rigorous selection, speed up their rate of change (Wells 1969; Keeley and Keeley 1977).

Following Wells (1969), researchers Keeley and Keeley (1977) hypothesized that the stump sprouting species, *A. glandulosa*, would generate less "reproductive biomass" (flowers, blooms and fruits) annually than the non-sprouting obligate seeder, *A. glauca*, and that younger stands would dedicate greater effort to producing seed than older stands. They studied two stands of the coinhabiting species that were 23 and 90 years old respectively. There was no statistical difference in reproductive biomass between the two species in the 23 year old stand, nor did their data indicate that a reduction of fruit production was correlated with increased age. Actually their data suggested a positive correlation between increased productivity and increased age, particularly for *A. glauca* which was tested to be significant with $P < .05$ (Keeley and Keeley 1977:6). In the 90 year old stand (raw counts cited in table above), *A. glandulosa* outnumbered *A. glauca* in the number of fruits in two out of three years studied. However, they noted this does not account for the difference in the size of the fruits of the two species: *A. glauca* has significantly larger fruit (Figure 4.7). In 1974, the mean oven-dry weight of *A. glauca* fruits' (per meter square areal coverage) collected outweighed *A. glandulosa* by over two to one.

The data generated by Keeley (1973) and Keeley and Keeley (1977) fail to support the claims that *A. glauca* invests more energy into its reproductive effort than *A. glandulosa*, nor do they demonstrate that younger stands are geared more toward reproduction than older. What their data do indicate is

FIGURE 4.7 Manzanita Fruits.

the annual fluctuations in successful reproductive effort do occur for both species, and that 1974 was a good year for manzanita berries in their study area. Why 1974 was a good year at their study site in San Diego County and why 1988 was a bad year in the Santa Monica Mountains for many stands of manzanita may be related to several factors. These may include available moisture, the interval of years following a fire, and yet other unidentified contributing factors. The relationship of the two cohabitating species is an equally intriguing avenue for future research as well.

Productivity studies of oak species have been conducted by Wolf (1945). His data will be cited below where relevant, however, the short duration of his study and the variability in yields between stands that he observed, indicate that oak trees must be sampled over many years because the periodicity of large acorn crops ranges from two to seven years depending upon the species. Hence the oaks were not sampled systematically during my fieldwork, although outstanding or unusually burned specimens were photographed.

The three main species of oak that occur in the area include *Quercus lobata* **(valley oak)**, *Q. agrifolia* **(California live oak)**, and *Q. dumosa* **(scrub oak)**. The scrub oak has the ability to hybridize with both of these tree oaks. The two tree oaks vary in their habitat preferences. The valley oak (*Q. lobata*) prefers the deep soil of the gentle hill and valley lands common in much of the interior part of California. This species ranges in valleys between Sierra Nevada and the coast, from Shasta County in the north to Los Angeles County in the south. The area of the current study is at the southernmost tip of the current geographic range of *Q. lobata* (Miller and Lamb 1985: 272-274). The live oak (*Q. agrifolia*) prefers the shady, rocky north facing slopes, and is distributed throughout the Coast Ranges from Sonoma County in the North to the San Predo Martin Mountains of Baja, California (Miller and Lamb

1985:299). Whereas *Q. lobata* grows singularly with mature trees having canopies of twenty meters or more in diameter, the live oak (*Q. agrifolia*) grows in clusters (groves), most often near permanent or perennial drainages.

Specimens of both tree oaks in the study site demonstrated remarkable ability to withstand heat and flames during the 1982 and 1985 fires. Such observations, although unsystematic, do demonstrate that mature oaks have an ability to survive and thrive when understory fires sweep through their habitats. In several cases trees bore scars and other evidence of acute fire damage on their trunks and lower limbs. These were particularly prevalent in the live oak growing on the hillside south and southeast of Reagan Ranch headquarters. In most cases, upper oak limbs revealed no evidence of stress. In remarkably few cases did the fires prove fatal. One valley oak on the trail through Liberty Canyon (Site 38) showed evidence of extensive damage to the western (drainage facing) side of its trunk so severe that this side of the trunk was only a shell, but overall the tree appeared to be healthy (Figure 4.8).

Very little regarding what is known about acorn production is directly related to fire ecology. Wolf's (1945) classic study entitled *California Wild Tree Crops* provided significant baseline information regarding fruit production for the two species of oak trees found in the Chumash region, *Q. lobata* and *Q. agrifolia*. His basic fieldwork was carried out over two years. The first year, 1943, *Q. agrifolia* failed to produce acorns over the species' entire region, except for a variety, *Q. agrifolia* var. *oxyadenia*, that is distributed in San Diego County and adjacent parts of Riverside County. The next year, 1944, *Q. agrifolia* produced bumper crops in various parts of Ventura County, Riverside County, and Orange County. For example, in the 160 acre Orange County Park, he estimated that nearly 100 tons of acorns were produced. Some areas of the park produced a ground cover averaging 175 acorns (1+ lbs.) per square foot.

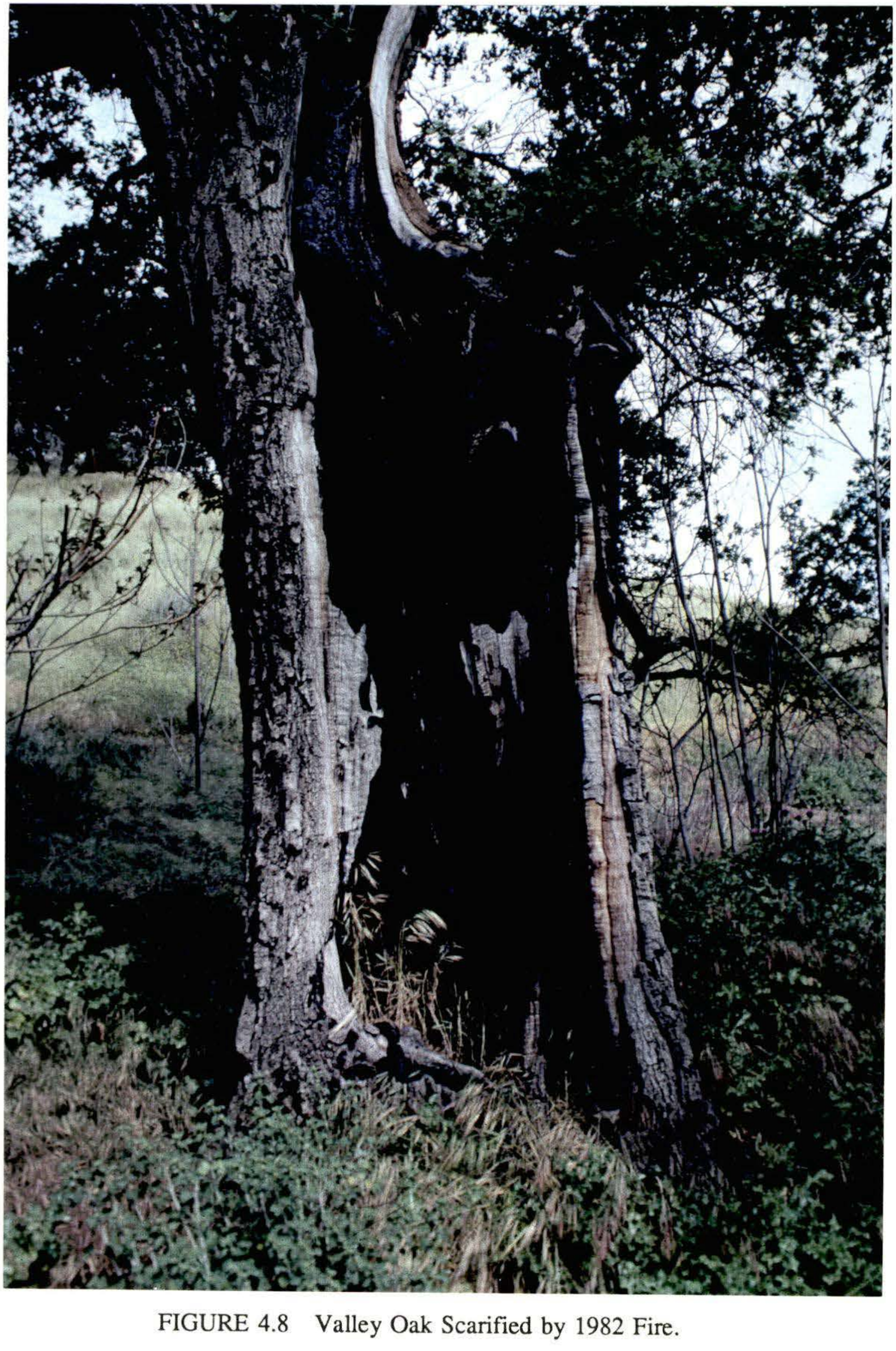


FIGURE 4.8 Valley Oak Scarified by 1982 Fire.

Based on his fieldwork, Wolf (1945:43) concluded that the acorns of *Q. agrifolia* were probably the most valuable of all California oaks' because of the large quantities produced and due to their high oil content, relative to other acorns. Based on his sample, he estimated that *Q. agrifolia's* periodic crops "amounted to thousands of tons (perhaps 100,000 tons) in a single season" (Wolf 1945:43). On the other hand, Wolf (1945:26-27) found the valley oak acorns easier to harvest and to clean. He estimated that *A. lobata* acorns could be hand collected with no special equipment at a rate of 75 lbs/hour with a yield ranging between 500 and over 1000 lbs. per tree; he collected *Q. agrifolia* acorns by hand at a rate between 30 and 30 lbs. per hour (Wolf 1945:35). Roughly, his yields per square foot of area coverage for these two species of oaks were approximately 1-2 lbs. per 15.7 sq. ft.. for *Q. lobata* and 2 lbs. per 1 sq. ft. for *Q. agrifolia*. *Q. lobata* produces a good crop every two to three years (USDA 1974) and individual trees may live for up to 400 years (Miller and Lamb 1985:272). *Q. agrifolia* and *Q. dumosa* (scrub oak) produce some acorns annually (Bean and Saubel 1972) although the intervals between good crops is not known.

Several authors have discussed preferences for the different acorn species found among various Native California groups (Barrett and Gifford 1933:142; Baumhoff 1963:163; Bean and Saubel 1972:123). At a primary level, all preferences were biased by geographic distributions--they were constrained by resource availability within their subregions, but there were many other considerations affecting their preferences and harvesting selections. J.P. Harrington's Chumash informant Fernando Librado specified that *Q. agrifolia* (California Live Oak) was the most preferred species in their region (Jan Timbrook, personal communication, 1981). Baumhoff (1963:162-163) noted that *Q. agrifolia* had a markedly high protein content relative to other species of

California oaks (6.3% vs. 3.9-5.5%) and *Q. agrifolia* along with *Q. kellogii* (California Black Oak) had substantially higher fat contents than other California species (18% and 16% respectively, vs. 4.5-8.7%).

The content of *Q. lobata*, the other tree oak in the Santa Monicas study region, is only 4.9% protein and 5.5% fat (Wolf 1945:63). Based on work with the Miwok of the Yosemite region, Barrett and Gifford (1933:142) noted that although *Q. lobata* acorns made "excellent food" they were ranked lower than *Q. kellogii* and *Q. wislizenii* (Interior Live Oak) "because of difficulty in hulling." Apparently, the acorns of *Q. lobata* have a greater tendency to mash when opened in a hammerstone than other acorn species and were, therefore, "usually hulled with the teeth" (Ibid.). Apparently in all regions where there is information, the scrub oak (*Q. dumosa*) was one of the least preferred (Barrett and Gifford 1933: Baumhoff 1963: 163; Bean and Saubel 1972: 123) and was typically used only "as an additive to other types of acorn meal when there were shortages of the more favored varieties (Bean and Saubel 1972:123).

In the Cahuilla area, *Q. kellogii* acorns were said to be preferred because they had "outstanding flavor and the most gelatin-like consistency when cooked, a prerequisite for good acorn mush" (Bean and Saubel 1972:123). The Cahuilla were willing to travel long distances to collect the acorns of this species, even though other oaks were "often within a short walking distance of a village" (Ibid.). Heavy stone processing equipment was left at the acorn sites so that "greater quantities of acorn meal could be transported back to the villages in the burden baskets" (Bean 1972:37).

Apparently preferences in taste and texture, along with estimated yields and processing time, were important factors that could override the consideration of travel distance. Related to this decision making process would have been those management considerations affecting the predictability of the crop and ensuring a good harvest. According to Bean (1972:37) the Cahuilla's entire acorn harvest matured during a two-to-three week period in October or November:

> "Acorn groves were monitored to time the collection so that rainfall, or animals, birds, and other natural predators would not reduce the harvest. At the right time, the total available labor force of men, women, and children acted together to make a rapid and efficient collection" (Bean 1972:37).

While there is a wealth of information regarding acorn production and cultural preferences, little of it is tied directly to management considerations or disturbance responses. Indeed, the limited information available indicates at least tolerance of fire; a fire stimulated response for the species has not been identified, although from the harvesting standpoint, a clearing of litter and low-growing vegetation would benefit collection efficiency. In some stands, especially along sheltered drainages, *Q. agrifolia* groves often accumulate a leaf/twig/acorn litter that can be several inches thick. In more open areas, where the ground is clear, or where the trees are located on slopes so that fallen acorns roll downhill and accumulate in "large piles", the acorns are easily harvested (Wolf 1945:35). *Q. lobata* is usually located an open hill with a grassland understory. In both cases controlled periodic burning would have reduced the litter, making collection of acorns more efficient, and reducing the likelihood that catastrophic fires might severely damage the trees. Increasing harvest efficiency, among other management considerations, resource access, crop periodicity, and a suite of other factors (including taste and texture preferences and food content) presumably were all taken into account in decision making related to where, how and when individual groups would concentrate their harvesting efforts.

Elderberry *(Sambucus Mexicana)* and **walnut** *(Juglans californica)* trees commonly occur along creek drainages and roadsides in the area. They typically have high productivity in most habitats where they are found, therefore, it would seem that management strategies in the form of clearing or burning to enhance productivity would be of minor importance relative to their value for other woody taxa.

Of some interest is a walnut tree in the yard of the Sepulveda Adobe just to the north and across Las Virgenes Creek from *Talepop*. This is the only specimen of *Juglans hindsi* found in the area and it is believed to have been planted in conjunction with the activities at the adobe, which was originally built in the 1860s (Edberg 1982). The fruits of *J. hindsi* are characteristically 15 mm longer and 10 mm wider than fruits of *J. californica* trees growing along the nearby creek bank. All other specimens of walnut seen in the study region appear to be *Juglans californica*, the only other native walnut of California. This one specimen of *J. hindsi* is completely out of the normal geographic range for this species.

Juglans hindsi is considered by Munz and Keck (1970) and Jepson (1970) to be a larger, more tree-like variety of *J. californica*. *J. hindsi* is said to be found "about old Indian campsites" in central California (McMinn and Maino 1963:157; Munz and Keck 1970:909). This observation does indicate that this larger sized walnut species may have shared a mutualistic relationship with native inhabitants of Central California, however, direct evidence of the dynamics of this relationship are lacking.

The walnut and elderberry trees were not subjected to in-depth sampling during this pilot study. Similarly, other woody shrub/trees known to be of some economic value to the Chumash, but not considered essential staple foods, were not sampled extensively. However, all of these plants were recorded when identified in sampling tracts.

Herbaceous Plants and Subshrubs

In general plants producing edible small seeds, bulbs, corms or tubers were studied in less depth than the woody shrubs. As noted above there is a considerable information available (i.e. Sweeney 1956; Timbrook *et al.* 1982) regarding "fire followers", small herbaceous plants, typically annuals, that occur in higher frequency in the few years following a fire. Table 4.5 synthesizes relevant data from Sweeney's (1956) extensive work with fire followers in the chaparral of the Lake County area about 30 miles north of the San Francisco Bay Area. Sweeney visited ten sites covering a range from one to seven years following a burn. The table is limited to species that have been documented to have been used by California Indians (Timbrook *et al.* 1982; King 1988). The table lists the frequency of Sweeney's ten sites on which the species was seen, and where information was available, the species' relative abundance at sites by year after burn. Sweeney's more general observations regarding relative abundance on burned sites overall, on areas adjacent to burns and edge areas are also recorded. Unless otherwise specified, Sweeney's annotated lists indicated that adjacent areas tended to be open and/or disturbed areas, and edge areas were edges of burns. A few genera stated to be fire followers by Timbrook *et al.* 1982, but not identified by Sweeney (1956) are also listed.

In the current study area, I observed **Blue dicks** *(Dichelostemma pulchellum)*, **mariposa lilies** *(Calochortus sp.)*, and **soaproot** *(Chlorogalum pomeridianum)* on several grassy slopes in association with **chia** *(Salvia columbariae)*. Site slope and exposure, and area of stands were noted. Site 4, where chia, blue dicks, and mariposa lilies were all present, four 1 X 1 meter quads were selected and the frequency of each genus was counted (Table 4.6). Overall these native bulb and seed plants were rather rare. This is likely due to competition with introduced annual plants, in particular grasses which have

TABLE 4.5: HERBACEOUS SPECIES FOUND ON 10 CHAPARRAL BURNS BY SWEENEY (1956)

	# SITES (N/10)	YEARS AFTER BURN 1	2	3	4	5	6	7	ALL YEARS STUDIED	ADJACENT TO BURNS	EDGE AREAS	ETHNOGRAPHIC CITATION
PAEONICACEAE												
Paeonia sp.	(T)											[T]
RANUNCULACEAE												
Ranunculus californicus	7	-	-	-	-	-	-	-	-	A	R	[T],K
Delphinium nudicaule	3	-	-	-	-	-	-	-	R	-	C	[T,K]
D. uliginosum	1	A	A	(Stream Edge)			-	-	A*	-	A* (Stream)	
D. variegatum	1	R	R	(Burn Edge)			-	-	-	A	R*	
MALVACEAE												
Sidalcea maevaeflora	(T)											[T],K
GERANIACEAE												
Erodium cicutarium (I)	9	R/C	C	C	C/A	C/A	-	-	-	A	-	[T]
LOASACEAE												
Mentzelia dispersa	8	C/A	O	C	C	-	-	-	-	R	-	[K]
M. micrantha	5	C	O	C	O	R	-	-	-	R	-	
HYPERIACEAE												
Hypericum concinnum	9	-	-	-	-	-	-	-	C	C	-	[K]
PAPAVERACEAE												
Eschscholzia caespitosa	3	C	C	C	C	-	-	-	C*	C	-	[T,K]
CRUCIFERAE												
Erysimum asperum	4	-	-	-	-	-	-	-	-	-	R/C	[T]
Lepidium nitidum	7	R	R	C/A	C/A	C/A	-	-	-	C/A	-	[T],K
Sisymbrium altissimum (I)	2	-	-	-	-	-	-	-	R	C	-	[T]
Thysanocarpus elegans	6	C	C	C/A	A	A	-	-	C/A	C	-	[T,K]
CARYOPHYLLACEAE												
Silene antirrhina	7	C	O	C/O	C/O	O	-	-		-	-	[T]
S. californica	5	R	O	O	O	-	-	-	R/O	C	-	
Stellaria nitens	(T)											[T],K
PORTULACACEAE												
Calandrinia breweri	5	C	C	-	-	-	-	-	-	R	-	[T,K]
C. ciliata	3	C	R	R	R	-	-	-	-	C/A	-	T,K
Montia gypsophiloides	3	A	A	C	C	C	-	-	C	C/A	-	[T,K]
M. perfoliata	7	C/A	C/A	C	C	C	-	-	C/A	C	-	
M. spathulata	3	-	-	-	-	-	-	-	-	C	-	
CACTACEAE												
Opuntia sp.	(T)											[T,K]
POLYGONACEAE												
Chorizanthe clevelandii	3	R	R/C	C	C	C	C	-	-	C/A	-	[T]
C. polygonoides	1	C	C	C	-	-	-	-	-	A	C	
Eriogonum hirtiflorum	4	C/A	C/A	A	C	-	A	-	C/A*	C	-	[T]
E. nudum	7	-	-	-	-	-	-	-	C	C	-	
E. vimineum	9	C/A	C/A	A	C/A	-	C	-	C/A	C*	-	
PRIMULACEAE												
Anagallis arvensis (I)	4	R	R/F	F/C	-	-	-	-	-	C/A	-	[T]
Dodecantheon clevlandii	(T)											[T],K

TABLE 4.5, CONTINUED

PLANTAGINACEAE												
Plantago erecta	7	F	C	C	C	-	-	-	-	C	-	[T]
ASCLEPIADACEAE												
Asclepias cordifolia	5	-	-	-	-	-	-	-	C	C	-	[T,K]
POLEMONIACEAE												
Gilia capitata	9	C	A	-	F	-	-	-	-	-	-	[T],K
G. giloides	7	C/A	C	C	C	-	-	-	-	R/C	-	
G. tricolor	1	-	-	-	-	-	-	-	R	R/C	-	
Linanthus acicularis	5	C/A	C/A	C/A	-	-	-	-	-	A	-	[T]
L. bicolor	5	R	R/F	F/C	-	-	-	-	-	C	-	
Navarretia atractyloides	1	-	-	-	-	-	-	-	R	C	-	[T,K]
N. intertexta	1	C	C	-	-	-	-	-	-	C	-	
N. jepsonii	2	C	C	-	-	-	-	-	-	C	-	
N. mellita	8	C	-	-	-	-	-	-	-	C/A	-	
N. pauciflora	1	A	-	-	-	-	-	-	-	C	-	
N. viscidula	3	C	A	C	A	O	R	-	-	C	-	
HYDROPHYLLACEAE												
Phacelia heterophylla	4	A	A	C	C	-	-	-	-	R	-	[T,K]
P. imbricata	1	-	-	-	-	-	-	-	-	C	-	
P. suaveolens	1	A	R	R	-	-	-	-	-	R	-	
BORAGINACEAE												
Amsinckia intermedia	4	-	-	-	-	-	-	-	R	C	-	[T,K]
A. lynaris	1	-	-	-	-	-	-	-	R	C	-	
Cryptantha muricata	7	C/A	C/A	A	C/A	C/A	-	-	-	C/A	-	[T,K]
C. torreyana	9	C/A	A	A	A	A	O	-	-	C/A	-	
Plagibothrys glyptocarpus	1	C	C	-	-	-	-	-	-	C*	-	[T,K]
P. nothofuluus	5	C	C/A	A	A	-	-	-	R	C	-	
P. tenellus	8	C	C/A	A	A	-	-	-	R	C	-	
SOLANACEAE												
Nicotiana sp.	(T)											[T]
Solanum umbelliferum	5	-	-	-	-	-	-	-	O	O	-	[K]
SCROPHULARIACEAE												
Castelleja foliolosa	2	R	R	R	-	-	-	-	R	C*	-	[T,K]
Collinsia greenei	3	R/F	R/F	R	R	-	-	-	-	C	-	[T]
Mimulus bolanderi	9	C/A	O/C	O	O	O	-	-	-	F/C	-	[T,K]
M. guttatus	1	R	R	-	-	-	-	-	-	-	A* (Creek)	
M. kelloggii	1	R	R	R	R	-	-	-	R	C*	-	
M. layneae	6	C	C	C	C	C	C	-	C	C	-	
M. nudatus	1	C	C	-	-	-	-	-	C	-	A* (Creek)	
M. pulsiferae	1	R	O	O	-	-	-	-	R	-	-	
M. rattanii	5	C/A	R	R	R	-	-	-	-	F/C	-	
M. tricolor	1	A	A	A	(Burn Edge)			-	-	A*	A*	
Orthocarpus purpurascens	4	-	-	-	-	-	-	-	R	C/A	-	[T,K]
Penstemon breviflorus	1	-	-	-	-	R	-	-	-	-	-	[T]
P. heterophyllus	9	C/A	C/A	C	-	-	-	-	C	C	-	
OROBANCHACEAE												
Orobanche fasciculata	5	-	-	-	-	-	-	-	C	C	-	[K]
LABIATAE												
Monardella viridis	2	-	-	-	-	-	-	-	C*	C	-	[T,K]
Salvia columbariae	3	R	O	O/F	-	-	-	-	-	C	-	T,K
S. sonomensis	5	R	O	O/F	-	-	-	-	-	C/A	-	

TABLE 4.5, CONTINUED

CRASSULACEAE												
Sedum radiatum	1	-	-	R	-	-	-	-	-	R	-	[T]
LEGUMINOSAE												
Astragalus gambelianus	1	-	-	-	-	-	-	-	R	C*	-	[T]
Lotus grandiflorus	4	C	C	C	-	-	-	-	C	C	-	[T,K]
L. humistratus	9	C/A	A	C/A	C/A	C/A	-	-	-	C	-	
L. purshianus	1	C	C	-	-	-	-	-	-	C	-	
L. scoparius	8	-	-	-	-	-	-	-	C	C	C (Chaparral)	
L. subpinnatus	7	C	C/A	O/C	A	C/A	C	-	-	C	-	
Lupinus bicolor	3	-	-	-	-	-	-	-	R	C	-	[T,K]
Psoralea physodes	3	-	-	-	-	-	-	-	C*	C*	-	[K]
Trifolium bifidum	1	-	-	-	-	C	-	-	-	A	-	[T,K]
T. microcephalum	1	R	R/O	O/C	C	-	-	-	-	A	-	
T. olivaceum	1	C	-	-	-	-	-	-	-	C/A	-	
T. tridentatum	3	R	O	C	C/A	-	-	-	-	C/A	-	
URTICACEAE												
Hesperocnide sp.	(T)											[T]
ONAGRACEAE												
Clarkia concinna	8	C	C	C	C	C	C	-	-	C	-	[T,K]
C. purpurea	9	R	-	-	-	-	-	-	-	R/C	-	
C. rhomboidea	6	C/A	O	O/C	O	-	-	-	-	C	-	
Epilobium minutum	9	C	C	A	A	A	A	-	-	C	-	[T,K]
Camissonia micrantha	9	C/A	O	O	O	-	-	-	-	R/C	-	[T,K]
APIACEAE												
Apiastrum angustifolium	3	R/C	R/C	C/A	A	-	-	-	-	C	-	[T,K]
Caucalis microcarpa	1	R	R	R	R	-	-	-	R*	R*	-	[T]
Daucus pusillus	7	R/O	R/O	O/C	F	C	F/C	C	-	C	C (Chaparral)	[T]
Lomatium dasycarpum	7	-	-	-	-	-	-	-	R/C	C	-	[T,K]
L. repostum	1	R/O	C	O/C	-	-	-	-	C*	C	-	
Sanicula bipinnatifida	1	-	-	-	-	-	-	-	-	C (Shade)	R*	[T,K]
S. crassicaulis	6	R	R	-	-	-	-	-	R/C	C (Shade)	-	
RUBIACEAE												
Galium andrewsii	4	C	C/A	C	C	-	-	-	C/A*	C/A*	-	[T]
G. aparine	5	F	C	C	C	C	-	-	-	C	-	
G. californicum	6	C	C	C	C	C	O	-	C	C	-	
G. nuttallii	9	C	C	C	C	C	-	-	C	C	-	
CUCURBITACEAE												
Marah fabaceus	4	-	-	-	-	-	-	-	C	C (Chaparral)	-	[T,K]
ASTERACEAE												
Achillea borealis	4	-	-	-	-	-	-	-	C	C	-	[T]
Agoseris heterophylla	5	F	C	C	C/A	-	-	-	F/C	C/A	-	[T]
Anthemis cotula	6	R/F	F	F/C	-	-	-	-	-	C	-	[T]
Chaenactis glabriuscula	1	F	-	-	-	-	-	-	-	-	-	[T],K
Conyza sp.	(T)											[T]
Erigeron sp.	(T)											[T]
Eriophyllum lanatum	9	C	C	C	C	O	-	-	C	C	-	[K]
Gnaphalium sp.	(T)											[T]
Haplopappus sp.	(T)											[T,K]
Hemizonia sp.	(T)											[T,K]
Hypochoeris glabra	6	R	C	C	C	-	-	-	-	C	-	[T]

TABLE 4.5, CONTINUED

ASTERACEAE, CONTINUED												
Layia sp.	(T)											[T,K]
Madia anomala	9	F/C	C	C/A	A	A	-	-	-	C	-	[T,K]
M. exigua	9	C	A	A	A	A	-	-	-	C	-	
Malacothrix clevelandii	1	C	-	-	-	-	-	-	-	R*	-	[T,K]
M. floccifera	9	A	C	C	C	C	-	-	-	C	-	
Perezia sp.	(T)										-	[T]
Senecio greenei	2	C/A	C/A	-	-	-	-	-	C/A	C	-	[T,K]
S. vulgaris	1	-	-	-	-	R	-	-	-	C*	-	
LILIACEAE												
Calochortus amabilis	9	-	-	-	-	-	-	-	C	C	-	[T,K]
C. tolmiei	1	-	R*	-	-	-	-	-	R*	-	-	
Chlorogalum pomeridianum	10	A	A	A	A	A	-	O	A	A	-	[T],K
Fritillaria phaeanthera	2	C	C	C	-	-	-	-	C*	C*	-	[T,K]
Zygadenus micranthus	7	C	C/A	C	C	A	O	-	C/A	C	-	[T,K]
AMARYLLIDACEAE												
Allium amplectens	2	C	C	C	-	-	-	-	C*	C	-	[T,K]
A. falcifolium	9	C	C	C	-	-	-	-	C*	C	-	
Bloomeria crocea	(T)											[T],K
Brodiaea congesta	2	-	-	-	-	-	-	-	R	C	-	[T,K]
B. elegens	1	R	R	(Burn Edge)			-	-	-	A	R*	
B. laxa	3	-	-	-	-	-	-	-	R/C*	C	-	
B. peduncularis	3	C	C	(Burn Edge)			-	-	-	A	C*	
Dichelostemma pulchellum	7	-	-	-	-	-	-	-	R/C	C/A	-	T,K
IRIDACEAE												
Sysyrinchium bellum	1	-	-	-	-	R	-	-	R*	C	-	[T]
JUNCACEAE												
Juncus latifolius	1	C	C	C	-	-	-	-	C*	C/A	-	[T,K]
CYPERACEAE												
Carex sp.	(T)											[T]
POACEAE												
Avena fatua (I)	6	R	C	C	C	-	-	-	-	-	-	[T]
Bromus mollis (I)	8	R/C	A	A	A	-	-	-	-	A	-	[T,K]
B. rigidus (I)	8	C	C	C	C/A	C/A	C	-	-	C/A	-	
B. rubens (I)	9	C	A	C/A	A	A	-	-	-	C/A	-	
B. tectorum (I)	3	R	R/C	C	C	C	C	-	R/C*	C	-	
Elymus sp.	(T)											[T,K]
Festuca californica	1	O	O	-	-	-	-	-	O*	-	O/F	[T,K]
F. megalura	9	C	C	C	A	A	-	-	-	A	-	
F. octoflora	6	C	F/O	O	F/O	-	-	-	-	C	-	
F. reflexa	6	C	C/A	C/A	C/A	C	-	-	-	C	-	
Hordeum sp.	(T)											[T,K]
Melica californica	1	R	R	R	R	-	-	-	R*	C	-	[T]
M. torreyana	2	C	C	C	C	-	-	-	C*	C	-	
Poa howellii	7	R/C	C/A	C/A	C/A	A	-	-	-	C/A	-	[T,K]
P. scabrella	1	-	R	-	-	-	-	-	R*	-	-	
Sitanion hystrex	1	O	O	-	-	-	-	-	O*	C	-	K
Stipa cernua	1	-	O	-	-	-	-	-	O*	-	-	[T,K]
Trisetum canescens	1	C	C	C	C	-	-	-	C*	C	-	[K]

KEY: *-ONLY LOCAL (LIMITED) SPATIAL DISTRIBUTIONS; R-RARE; O-OCCASIONAL; F-FREQUENT; C-COMMON; A-ABUNDANT; I-INTRODUCED FROM EUROPE; []-GENUS LEVEL ONLY; (T)-LISTED IN TIMBROOK ET AL. (1982) AS FIRE FOLLOWER--NOT INCLUDED IN SWEENEY (1956); T-TIMBROOK ET AL. (1982); K-KING (1988)

TABLE 4.6: CENTURY RANCH VEGETATION STUDY, HERBACEOUS PLANTS

GENUS	VISIT DATES	SITE #	SITE SLOPE	SITE EXPOSURE	ELEV. (FEET)	LAST BURN	PREVIOUS BURN	AREA OF STAND	SAMPLING PLOT (1X1 METER) PLOT #	SLOPE	# PLANTS	COMMENTS
DICHELOSTEMMA PULCHELLUM (Blue Dicks)	4/2/88	2	0-25	SOUTHEAST	800	1982	1978	5M X 5M	N/A	N/A	N/A	ALSO GRASSES, LUPINES, AND POPPIES
	4/4/88; 4/8/88	4	20-30	SOUTHWEST	850	1982	1978	20M X 25M	1	22	0	ALSO YUCCA, CHIA, LILIES, WILD OATS, CHAMISE, GRASSES, PURPLE AND WHITE SAGE
									2	27	3	
									3	30	0	
									4	23	1	
	4/9/88	14	VARIABLE	SOUTHEAST	475	1982	1970	1M X 2M	N/A	N/A	FREQUENT	ALSO GRASSES, WILD OATS, AND THISTLES
	4/22/88	43	0-10	EAST	950	1982	1970	5M X 5M	N/A	N/A	COMMON	
CALOCHORTUS SP. (Mariposa Lilies)	4/4/88; 4/8/88	4	20-30	SOUTHEAST	850	1982	1978	20M X 25M	1	22	0	ALSO YUCCA, CHIA, BLUE DICKS, WILD OATS, CHAMISE, GRASSES, PURPLE AND WHITE SAGE
									2	27	1	
									3	30	0	
									4	23	0	
	4/22/88	43	0-10	EAST	950	1982	1970	5M X 5M	N/A	N/A	COMMON	ALSO, LILIES, OXALIS SP., MONKEY FLOWERS, WILD OATS, AND YELLOW COMPOSITE
CHLOROGALUM POMERIDIUM (Soap Root)	4/4/88	4	20-25	SOUTHWEST	850	1982	1978	20M X 25M	N/A	N/A	FREQUENT	ALSO BLUE DICKS, CHIA, YUCCA, WILD OATS, GRASSES, AND PURPLE AND WHITE SAGE
	7/27	69	30-50	N/NE	450	1989	1955	NOT MEASURED	N/A	N/A	FREQUENT	ALSO YUCCA AND GRASSES
HELIANTHUS SP. (Sunflower)	4/8/88	12	20	NORTH	1000	1982	1958	1M X 2M	N/A	20	1 CLUMP	CLUSTER OF PLANTS AT BASE OF BURNED LIVE OAK
	4/12/88	28	50	EAST	1800	1985	NO INFO.	NOT MEASURED	N/A	50	NOT MEASURE	STAND OF PLANTS ON STEEP SLOPE
											# CYMES	
SALVIA COLUMBARIAE (Chia)	4/4/88; 4/8/88	4	20-30	SOUTH	850	1982	1978	20M X 25M	1	22	175	ALSO BLUE DICKS, MARIPOSAS LILIES, SOAPROOT, YUCCA, AND GRASSES
									2	27	66	
									3	30	135	
									4	23	140	
	4/7/88	9	20-30	SOUTH	950	1982	1978	15M X 30M	N/A	_	COMMON	ALSO YUCCA, MUSTARD,
	4/9/88	16	30	SOUTHWEST	650	1982	1970	3M X 4M	N/A	N/A	4	WILD OATS, FIRE WEED, RED MAIDS, AND WHITE AND PURPLE SAGE
	4/9/88	17	25-30	SOUTH	650	1982	1970	10M X 10M	N/A	N/A	COMMON	
	4/11/88	26	0	HILLTOP	2100	1956	NO INFO.	10M-30M	N/A	N/A	ABUNDANT	ROADSIDE STAND AT TRIUPHO PASS PLANTS ARE VERY TALL; MANY CYMES

invaded these habitats. It is quite probable that their current numbers represent only a small remnant of their prehistoric quantities in the Santa Monicas, but this will be difficult to verify.

Chia, the only annual sage occurring in this region, typically grows as a small single stalked herb, having basal leaves and purplish clusters of flowering bracts (cymes) at one or more nodes of the stalk and at the top of the stalk. Each cyme may contain over a hundred seeds. The ripe seeds are dispersed from the flowers by wind or any action that may cause the stalk to move, such as a brush with an animal. The Chumash collected these seeds with baskets and seed beaters. The typical height for this plant is between 10 and 30 cm (Spellenberg 1979) although Site 26, a roadside near the summit of Triunfo Pass supported a stand of chia with many stalks growing up to one meter in height. This grassy site had full exposure to the sun with no obstructions. Like chia, the small bulb plants such as mariposa lilies and blue dicks begin to flower in March and a few new plants on shady slopes continue to bloom until May. In the sites where these plants coexisted all three were blooming at once. Although the bulb plants are present in lower densities over the landscape, they appear to occur in a greater number of microhabitats, suggesting that the impact of Euroamerican disturbance was more devastating on chia than the bulb plants. Also typically windy and cooler conditions of this site may have reduced competition.

Another plant with small seeds, *Calandrinia ciliata* (**red maids**), known to have been important economically to the Chumash, is now relatively rare in the study area. Apparently in 1980 a healthy stand of *C. ciliata* was seen on a shallow hill slope in a small valley just north of the Paramount ranch study area (E. Wohlgemuth, personal communication 1991). According to the historic fire map of this region (Plantrich 1987) this locale was burned in 1978. This substantiates Sweeney's observations regarding the common occurrence of red maids in the first two years following a fire.

Large caches of red maids have been found in association with burials across the creek bank from *Talepop* (Wheeler 1989), at Medea Creek Cemetery, CA-LAn-243 (L. King 1982) and at sites on at least two Channel Islands. The lack of their relative abundance on the landscape today, and the evidence that their productivity may have been dependent upon frequent grassland fires suggests this may have been one of the taxa most seriously affected by the direct and indirect impacts of Euroamericans.

Common sunflower (*Helianthus* cf. *annuus*) was growing on two sites, (12 and 28). Both sites were located in recent burn areas. The more prolific site was in a narrow draw of a open and steep cliff edge along Mulholland Highway near Decker Road. Both sites had substantial evidence of recent burns in the form of burned and ashen earth beneath and an overstory of fire charred and scarred woody plants.

Legumes were not studied systematically, although they were frequently noted as an understory constituent in many recent burns.

In a study conducted on coastal scrub in the Santa Monica Mountains, Westman's (1981a:180) research indicated a seven year interval for **legumes** (three species of *Lupinus*, and two species of *Lotus*). Seven years following burns, the legume cover is his study sites had declined from 11.5% of the total foliar cover to 1.5%.

Similarly, **grasses** were not studied in detail, because no "intact" stands of native grasses were found. Nevertheless, some native grasses were observed in presumably remnant situations. These were recorded in a qualitatively consistent, yet unquantified manner. Typically slope and exposure were recorded, and voucher specimens were collected. The most common species observed were *Stipa* sp., *Elymus* sp., and *Avena* sp., but these observations were not made systematically. Future work should focus on the few remaining remnant stands of grasslands in the Coastal mountains. A few botanists with the state and federal parks departments are doing systematic studies with burned grasslands, some even studying native grasses in particular, but very few of these multiyear projects are completed and even fewer are published.

Overall, the preliminary study discussed here and numerous published accounts of other studies related to herbaceous plants and subshrubs (i.e. Sweeney 1956; S. Keeley 1977; Westman 1981a, 1981b; Manlanson and Westman 1985) indicate that typically the maximum herb cover is obtained the first year following a fire and never is as high again until a subsequent fire, in spite of adequate moisture (Keeley 1977:390). Subshrubs, such as *Encelia* sp, sunflowers and the perennial sages, all can resprout after a fire, (like many woody shrub species) and can dominate localized areas of the terrain within a few years after a fire. Westman (1981b) has characterized this distribution as "medium-scale patchiness" and has suggested that its occurrence typical for floristic associations within the coastal sage scrub type vegetation. In general, subshrubs tended to reach their peak coverage in three to ten years following a burn (S. Keeley 1977:388). The large variation in this timing is due to a number of variables aside from disturbance including slope, exposure, moisture availability, substrate and the presence/absence of allelopathic properties and/or rodent predation.

<u>Yucca</u>

Yucca was noted when encountered. Four stands (Sites 7, 9, 37, and 69) were observed (Table 4.7), noting general topographic aspects for each site. Where possible the area covered by the greatest concentration of yucca plants

TABLE 4.7: CENTURY RANCH VEGETATION STUDY, YUCCA

VISIT DATES	SITE #	DEGREE SLOPE	SITE EXPOSURE	ELEV. (FEET)	LAST BURN	PREVIOUS BURN	AREA OF STAND	QUANTITY BLOOMING	% OF STAND IN BLOOM	COMMENTS
4/6/88	7	20-30	SOUTH	900	1982	1978	100M X 330M	20	30	
4/7/88	9	25	SOUTH	950	1982	1978	20M x 3OM	12	50	SALVIA COLUMBARIA, WILD OATS, MUSTARD, CHAMISE, COMPOSITES, AND WHITE AND PURPLE SAGE
4/17/88	37	20-30	S/SW	850	1982	1970	130M X 300M	NO COUNTS	COMMON	
7/27/88	69	30-50	N/NW	450	1989	1955	NO MEASUREMENTS TAKEN		ABUNDANT	ALSO GRASSES AND SOAPROOT

was estimated, although due to the tendency of yucca to be dispersed over extensive areas, these areas should not be considered discrete "patches", but rather general collecting areas. For example, in late April, while driving through Lancaster Pass in the San Gabriel Mountains northeast of Los Angeles (about 40 miles northeast of the research area), I noted a stretch of highway where virtually every southern facing slope for twenty miles was covered with flowering yucca. Thus Table 4.7 records tendencies for the Santa Monica Mountain study area, not absolutes. No attempt was made to count the individual number of plants during the pilot study.

Further study and the addition of more yucca sites in the future are necessary before an assessment of the number of plants per area of stand can be made. A further refinement would involve counting flowering (fruiting) versus non-flowering plants to assess the potential harvest and to determine factors related to temporal and spatial variability.

ABORIGINAL PLANT FOODS AND RESOURCE PATCH TYPES

Overall, observations of specific crop plants provided information regarding the conditions under which these plants lived, their habitats, and their habits. Some plant foods, notably perennial small seed and bulb plants, occurred in heterogeneous patches on grassy slopes. Many such plants, although different in their growth habits and micro-environmental preferences, thrive under conditions of good sunny exposure and disturbance in the form of burning or limited soil movement due to burrowing rodents.

These stands could be considered multiple resource patches (MRP) and could have been harvested repeatedly as different crops ripened. I suspect that such harvests were not restricted by species; bulb crops were harvested in early spring with digging sticks and in the summer seed crops were collected together in basketry trays with seed beaters. Such patches could have benefited both from aeration of soil through the use of digging sticks in the early spring, and from small burns. It would be difficult to destroy these stands by overburning. Indeed the reason these stands are no longer extant in their pristine form is due to the invasion of introduced annual plants and the overgrazing of introduced cattle in earlier times. That these stands have partially recovered is a testimony to the fit of their adaptation to the Santa Monicas' climate over time; nevertheless annual grasses remain as a persistent reminder of the contamination that has occurred in the past.

Tree and shrub resource units appear to be more appropriately designated as single resource patches (SRP). In the case of islay, manzanita and the live oak, it would appear that these crops would have been harvested as stands, with several individuals of a singular taxa occurring in each patch. Valley oak and elderberry both tend to grow as solitaire plants with each individual producing a great deal of fruit, There is sufficient space between individuals to restrict the harvesting of too many individuals at one time. Nevertheless, given an adequate labor force, a harvest of several acres of valley oaks could be performed in a very limited time period. It is likely that these individual trees were harvested as single patches, much the way groves of live oaks would have been harvested. I should reemphasize that these "patch" designations are heuristic devices for interpretation of archaeological data and are based purely on a review of the literature and field observations made by this researcher. As heuristic devices they may be of some value, although I do not expect them to accurately reflect the complex perceptions of prehistoric inhabitants except at a very simplistic operational level.

Adult islay plants were demonstrated to benefit from intermediate levels of burning and clearing by the reductions of other competition. Any stress that might result from the immediate effects of burning was absent within two years of the fire. It was noted that the top one meter of the shrubs canopy was the only part that produced buds (and fruits), so that calculations of productivity must be derived from this measure not the total areal coverage.

Manzanita remains poorly understood, not because of previous research but because of the paucity of good productive study sites within the Santa Monicas. Previous studies have failed to identify the critical variables regarding fruit production in response to fire, although past work on coinhabiting species of manzanita has been intriguing and thought provoking.

Like the manzanitas, there is insufficient evidence for isolating the environmental factors contributing to successful acorn production (crop variability) particularly in relation to frequency of good harvest and the feasibility of management practices. Preliminary observations have indicated that light clearing of understory and low intensity fires did not appear to negatively affect study oaks.

The information in this chapter has provided a base from which to better interpret our findings archaeologically. As specific sites are discussed the importance of these baseline studies should become more apparent. This vegetation survey is most relevant to the analysis of archaeobotanical materials recovered from *Talepop*, the datum of this regional vegetation survey.

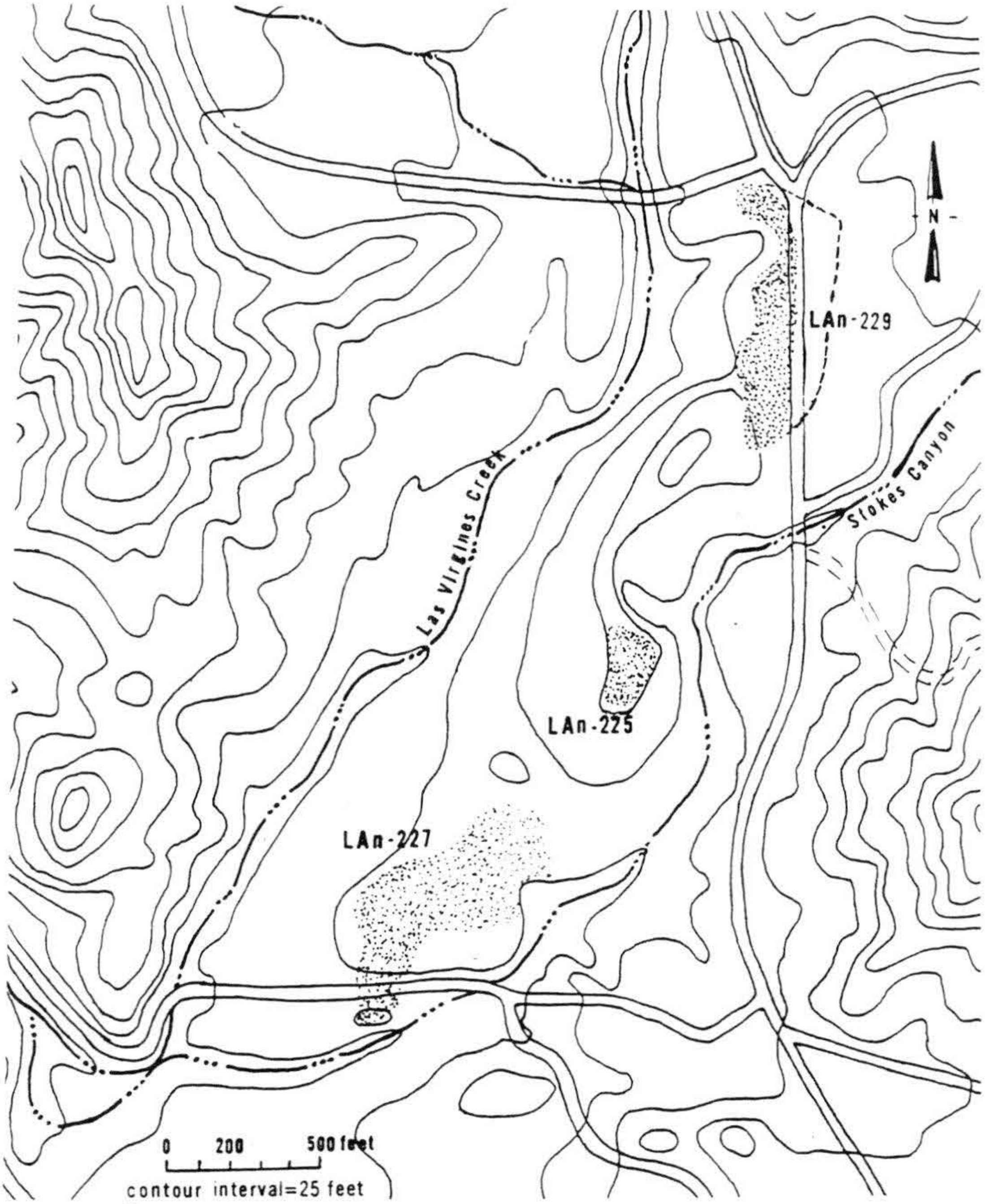
CHAPTER 5

ARCHAEOBOTANY OF *TALEPOP* (CA-LAN-229)

BACKGROUND

The Century Ranch Site Complex contains a set of three discrete occupation areas (Figure 5.1). CA-LAn-225 was inhabited during the Early Period (ca. 6000-1400 B.C.); CA-LAn-227 was occupied during the Middle Period between 500 B.C. and A.D. 1300 and was then reoccupied in the Late Period after A.D. 1650 and before 1780 (King 1982b:7-73); CA-LAn-229 was inhabited from early in the Late Period until around A.D. 1800. The latest occupation at CA-Lan-227 apparently overlapped with the earliest occupation at CA-LAn-229 (King 1982b:6-75). The deposits at site CA-LAn-229 produced shell beads dating to between A.D. 1000 and A.D. 1820s (King 1982b). After thirty years of archaeological work in the catchment area of the CRASC, CA-LAn-229 remains the most likely candidate for the historically documented village of *Talepop* (Edberg 1982:4-20). Over forty archaeologists have worked or visited in the study area over the last three decades, but no site with cultural materials appropriate and contemporaneous to the early historic occupation at *Talepop* has been located.

The inhabitants of *Talepop* and adjacent residential site localities had knowledge of nearby habitation sites, especially centers such as *Humaliwu*. Mission register research (Edberg 1982) has demonstrated that *Humaliwu* was historically near the southeastern extent of the territorial boundary between the Chumash and the Gabrielino and that the political leader at *Talepop* was related to the leaders at other Chumash communities, including the chief at *Humaliwu* (Edberg 1982). According to ethnohistoric research conducted for the Santa Monica Mountains (i.e Bowers 1897: King 1969; Edberg 1982), the



Source: King, Blackburn, and Chandonet 1968

FIGURE 5.1 Overview Map of Century Ranch Site Complex.

village of *Talepop* was within the political "province" of *Humaliwu* (named after its "capital"). All communities of the province spoke a similar dialect, referred to as "Fernandeno" in mission records and Harrington's notes. The province of *Humaliwu* belonged to a larger so-called "federation" that united different provinces for special religious ceremonies every five years. The federation leader, the *Kwaiyin*, resided at *Simomo*, near *Muwu* (Edberg 1982:4-3). Whitley and Clewlow (1979:157) have suggested that an incipient chiefdom was just emerging there at the time of historic contact.

At a larger scale, *Talepop* was apparently right on the boundary between Hokan speakers to the west and Uto-Aztecan speakers to the east. According to mission records, the Ventureno-speaking Chumash had close economic ties with their Fernandeno-speaking Gabrielino neighbors to the east. Indeed, along this cultural corridor at least one bi-ethnic village (*Huam*) did exist (King 1982b:6-78).

This corridor which connected *Humaliwu* to San Fernando mission during the early historic period may have been an important artery for exchange during late prehistoric times as well. Excavations at *Talepop* revealed the presence of a type of steatite that was quarried on Santa Catalina Island, south of *Humaliwu* and was traded into San Fernando Valley. *Talepop* which was located between *Humaliwu* and San Fernando Valley may have had a vital role in this trade at least at some time during the last 4,000 years.

Another important archaeological find, indicating much longer distance trade, was a single Black-on-White pottery sherd from Chaco Canyon in New Mexico. This sherd was recovered from site CA-LAn-227, a domestic component lying southwest of *Talepop*. CA-LAn-227 was occupied between 500 B.C. and A.D. 1300 and was then reoccupied after A.D. 1650 and before 1780 (King 1982b:7-73). This single sherd provides time depth for exchange between Hokan and Uto-Aztecan speaking groups within this catchment area at their shared cultural boundary.

Archaeological constituents of shell beads and lithic materials indicate that there was a degree of difference in the relative wealth and the political power of families at *Talepop*. Dates from King's (1982a) shell bead chronology indicate that the most high-status families did not settle there until ca. 1650-1750 (King 1982:21). Feature locations and cultural materials recovered from the excavations at *Talepop* indicate that house areas were located on two knolls, designated Areas 1 and 2 (Figure 5.2). Area 3 was heavily affected by road grading prior to the 1980 excavations although artifacts recovered from this area indicated that it was occupied ca. A.D. 1700-1805 (King *et al.* 1982: 3-10). Areas 4 through 7 were places away from houses where special activities occurred such as butchering, eating, and stone tool use and manufacture. By far the bulk of charred plant materials came from inside and around houses in Areas 1 and 2.

ARCHAEOLOGICAL RECOVERY METHODS

The site CA-LAn-229 (*Talepop*) was test excavated three times during the last thirty years (Figure 5.2; Table 5.1). The first excavations in 1960/61 were conducted by Chandonet and King (King, Blackburn and Chandonet 1968) through UCLA. At that time five test pits (5 foot square) were excavated in the western end of the site. A six inch square column profile was collected from one corner of each unit for subsequent research. These were stored for the future in the labs at UCLA. Unfortunately, in 1981 each of these samples was reduced from the 6 inch cube of recovered soil to about one liter. Although the plant information recovered from these excavations is negligible,

FIGURE 5.2: CA-LAn-229

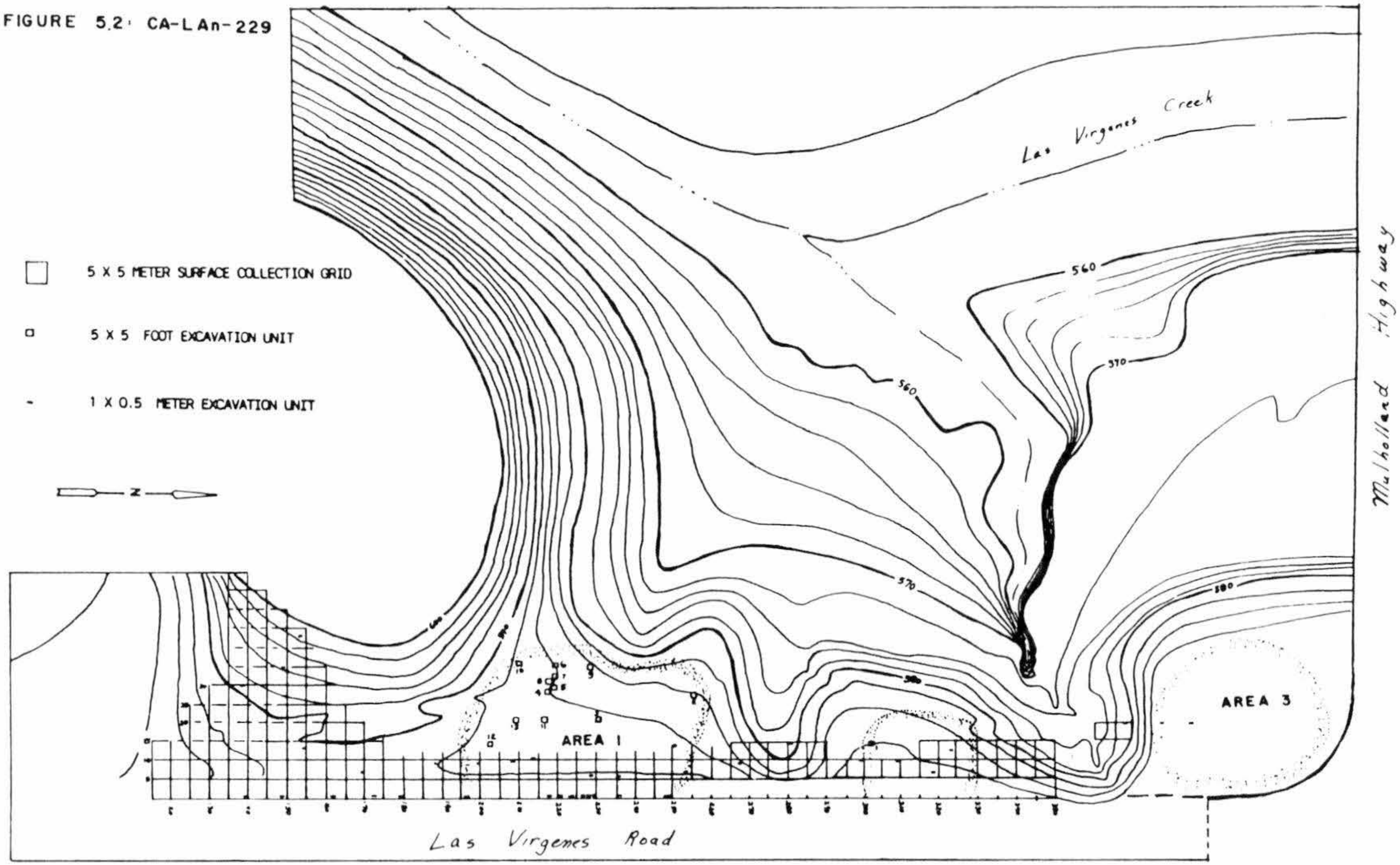


TABLE 5.1: CA-LAN-229 EXCAVATION UNITS BY FIELD SEASON

1960/61 SEASON

UNIT #'S 1 THROUGH 12

1980/81 SEASON	1987 SEASON
N113W31	N140W2
N114W54	N149W2
N122W11	N162W2
N139W30	N173W2
N154W43	N180W2
N155W13	N197W2
N170W7	N218W2
N188W9	N221W2
N200W9	N224W2
N209W10	N227W2
N214W11	N230W2
N229W6	N236W2
N236W6	N248W2
N241W11	N249W2
N251W13	
N267W8	
N281W14	
N300W10	
N310W10	
N318W7	
N324W13	
N368W20	
N378W20	
N386W20	

NOTE: 1960/61 EXCAVATIONS: 5 X 5 FEET UNITS
SUBSEQUENT EXCAVATIONS: 1 X 0.5 METER UNITS,
PROVENIENCES N5.1ORTH AND WEST OF SITE DATUM

researchers did obtain important information related to other artifact classes and intra-site organization.

During the 1980/81 fieldwork, all soil excavated from test units was put through a water separation process. During the course of the field work, the flotation technique was improved. The final six units excavated were processed using these improved standardized techniques (Figure 5.3). The initial technique involved excavation into buckets and then skimming off the light fraction through a 1/40" (.6 mm) mesh screen, agitating and skimming again. Then the heavy fraction was water screened through 1/8" (3.2 mm) mesh screen.

The improved technique put all excavated materials through a skimming/decanting process by which the slushy liquified mud suspended between the water and the bottom sludge was poured through a 1/40 mesh screen, then the bucket was filled with water again, agitated and the process was repeated. The effect of the improved technique (I) is evident in the bar graphs comparing light and heavy fractions for all units. For example, compare unimproved technique in units N200W9 and improved technique unit N209W10 in Figure 5.4. It is probably safe to assume that the greater light fraction bar length relative to the heavy fraction bar represents an increased recovery of all plant materials. Ideally all plant materials should be recovered from flotation and the heavy fraction should be negligible. Naturally denser, heavier remains such as nutshell tend to be recovered in the heavy fraction, nevertheless in general the greater the percentage of the total sample recovered in the light fraction, the more effective the overall recovery of plant remains. When improved recovery was utilized across a site during the later 1987 phase, heavy fraction sample was multiplied by a factor of 10 in order to

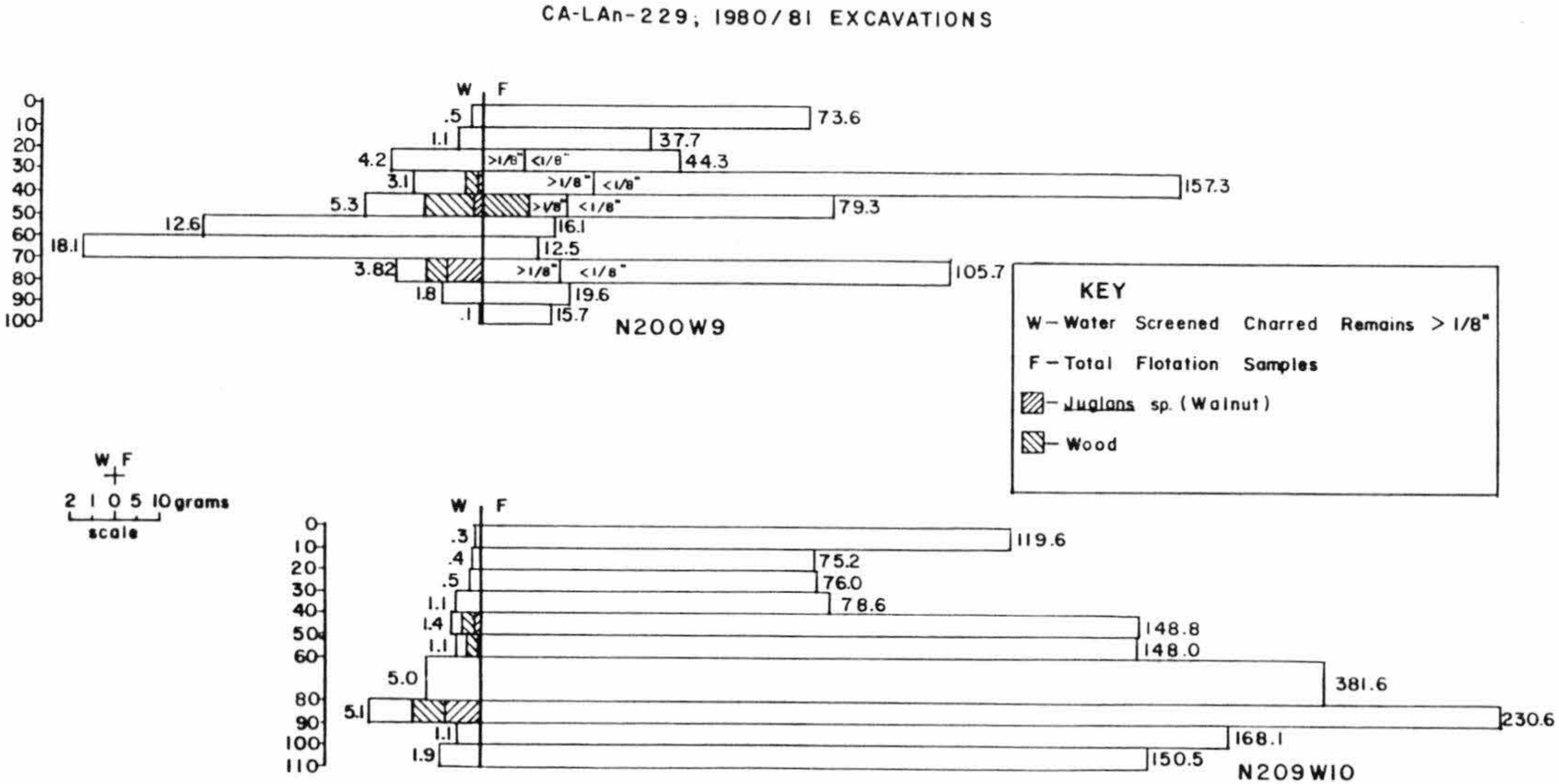


FIGURE 5.3 Weight of Charred Plant Remains by Excavation Unit.

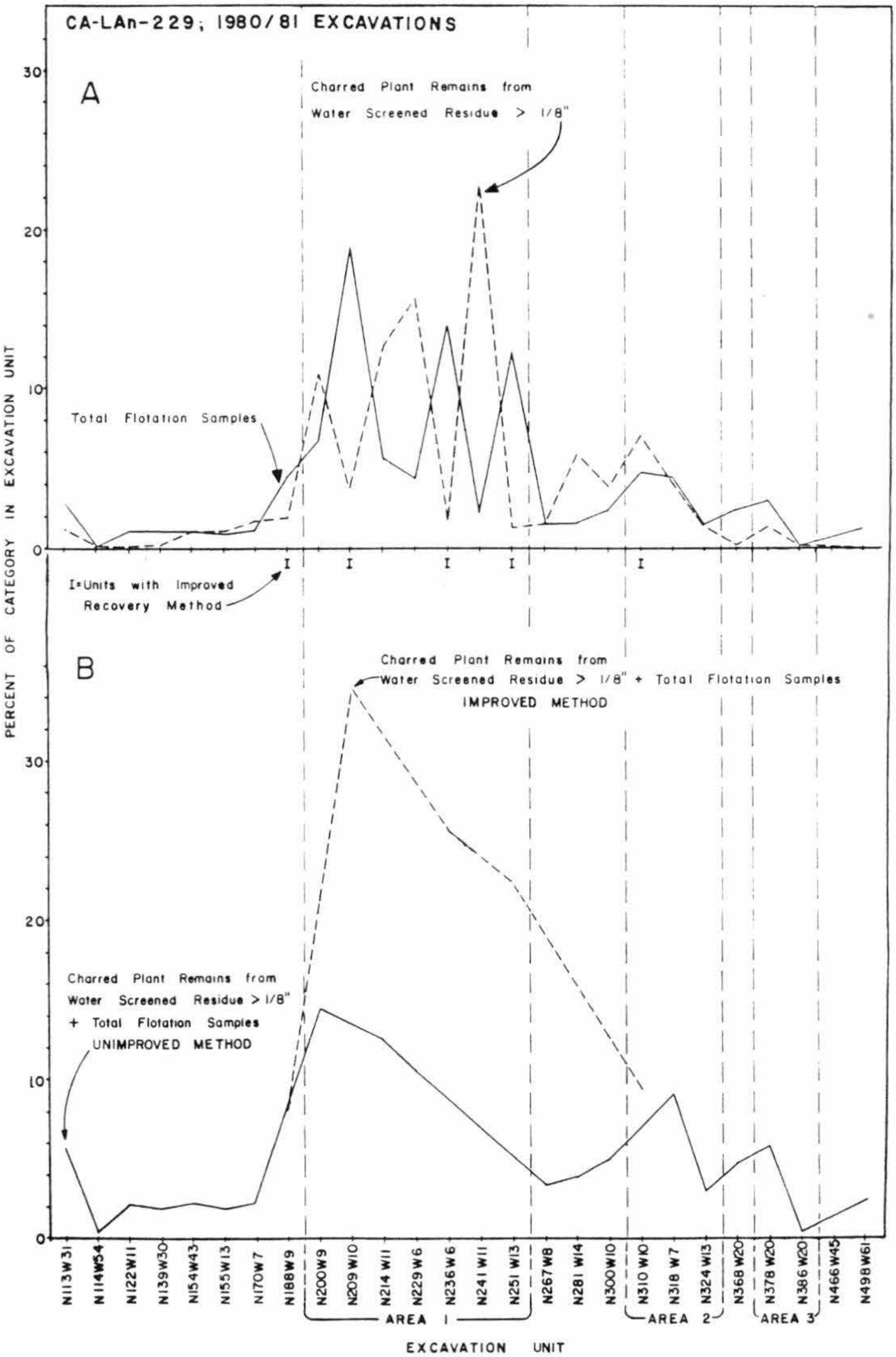


FIGURE 5.4 Comparison of Improved and Unimproved Flotation Techniques.

detect anomalies in recovery effectiveness. This standard comparative technique should be useful in evaluating virtually any recovery method.

In the laboratory, feature designations dictated archaeobotanical sampling. The two areas of the site with the most intact features, Areas 1 and 2, were sampled most intensively. Within those areas, the remains from specific feature concentrations were examined. Two possible house hearths, N200W9, 30-50 cm and N209W10, 80-90 cm were studied most intensively.

Excavations conducted during 1987 by California State University, Northridge, utilized techniques developed and refined in the 1980/81 excavations (Wessell and Raab 1987). Unfortunately there was little overlap in crews to provide standardization of techniques. Also evidence such as masking tape found in flotation sample bags indicates that there was less care in processing these samples that there had been during the previous work. Finally the Northridge group excavated on the edge of Las Virgenes Road and recovered a lot more contaminants from the roadbed. The project archaeologists did not distinguish features in this transect. In the lab, areas where discrete concentrations of cultural material were identified from excavators notes and computer generated distributions, were designated "feature" for purposes of archaeobotanical sampling.

ARCHAEOBOTANICAL RESULTS

During 1980/81, in conjunction with a survey of the ethnobotanical literature to identify economically important native plant species, I made a preliminary archaeobotanical assessment. The archaeological plant remains could be separated into several basic types: 1) small seeds from herbaceous plants such as grasses, composites, sage, pigweed, goosefoot; 2) nut crops from trees and larger shrubs (acorns, islay, and walnuts); 3) berries from chaparral woody shrubs including elderberry, manzanita and toyon (Figures 5.5 through 5.8); and 4) European cultivated crop plants including wheat, barley, corn and beans and crop associated weedy plants such as wild oats which are available during the mission period.

During this first phase of archaeobotanical work (1980/81), I was able to distinguish only larger fragments of wood, nutshells, and berries. The light fraction flotation samples were often quite substantial. For example the flotation samples from the N200W9 hearth (30-50 cm below datum) totalled over 200 grams of almost pure charred plant remains. With no subsampling strategy in place, and overwhelmed by the diversity of small seeds seen in the light fractions, I decided to tackle the heavy fraction remains which were larger and fewer. This decision was supported by a test of modern seed labs. The two biggest labs came up with consistently different identifications for the same specimens (Hammett and Wohlgemuth 1982). The small seed work was postponed until refinement in sampling and identification procedures could be made.

Analysis of Large Charred Plant Fragments from CA-LAn-229

During 1981, 33% of the archaeobotanical remains caught in the heavy fraction by the water separation process were analyzed. The most common large fragments were wood, acorn, walnut, and islay nutshells, manzanita berry nutlets (seeds), walnut and wood (Tables 5.2 through 5.6).

I was able to determine species differences for acorn attachment (abscission) scars. The cellular structure where the acorn attaches to its cup is a more durable part of the shell that often separated from the rest of the shell. This is especially interesting, because other archaeobotanists working in other

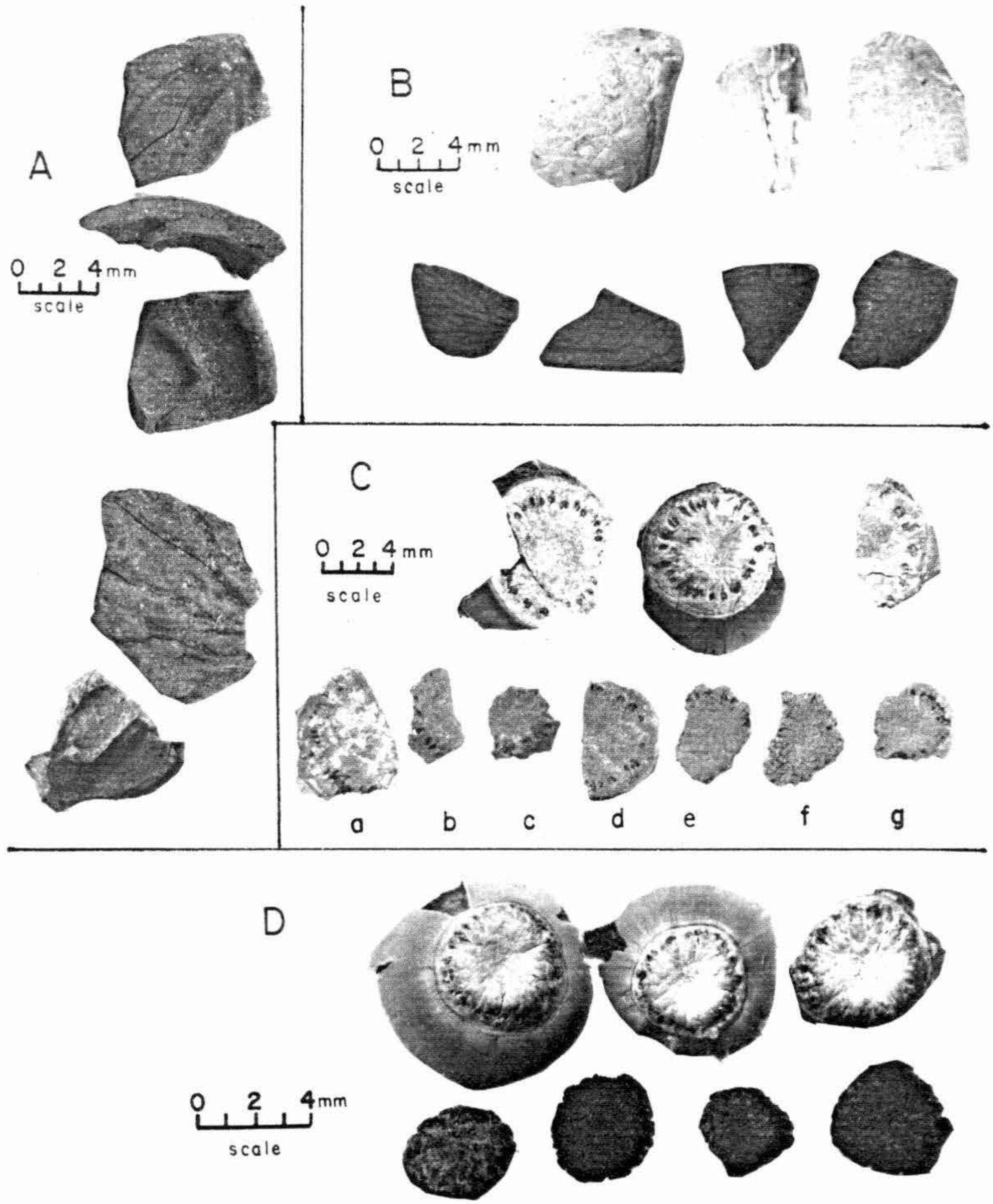


FIGURE 5.5: A-Charred *Juglans* sp. (Walnut) nutshells from N310W10; B-*Prunus ilicifolia* (Islay nutshell, top row-modern unburned reference materials, bottom two rows-charred remains from N209W10; C-Charred *Quercus lobata* (Valley Oak) acorn attachment scars, top row-modern unburned reference materials, bottom row-charred remains from N200W9 (a & d), N209W10 (b, c, e, f & g); D-*Quercus agrifolia* (Coastal Live Oak) acorn attachment scars, top row-modern unburned reference materials, bottom row-charred remains from N200W9.

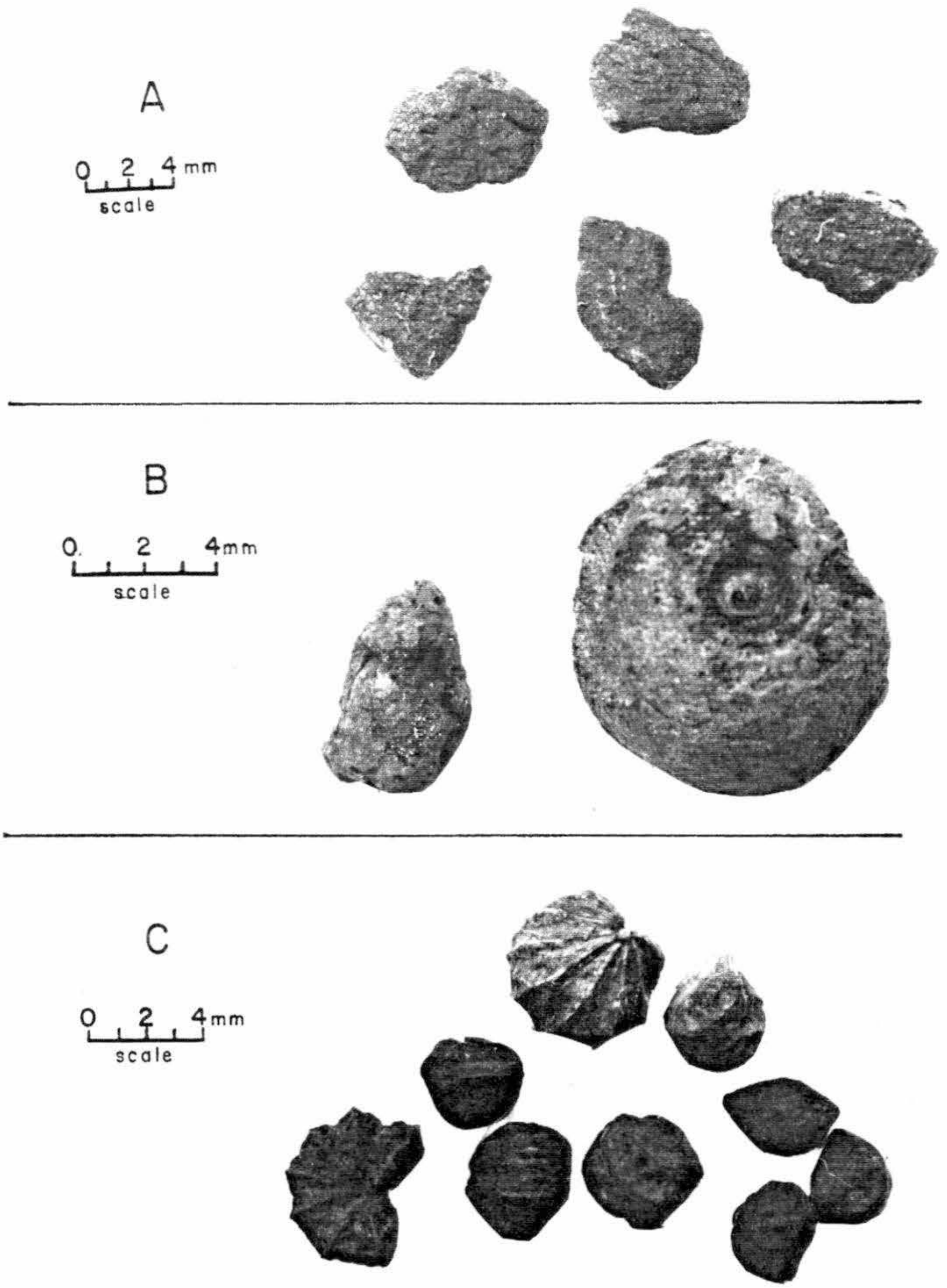


FIGURE 5.6: A-Charred amorphous plant material from N241W11; B-Charred berries, left-*Heteromeles arbutifolia* (Toyon) with seed visable from N241W11, right-*Arctostaphylos cf. glandulosa* (Eastwood Manzanita) fruit from N318W7; C-*Arctostaphylos glandulosa* seed nutlets (top two nutlets-modern unburned reference mateirals, bottom-charred nutlets from N188W9 and N209W10).

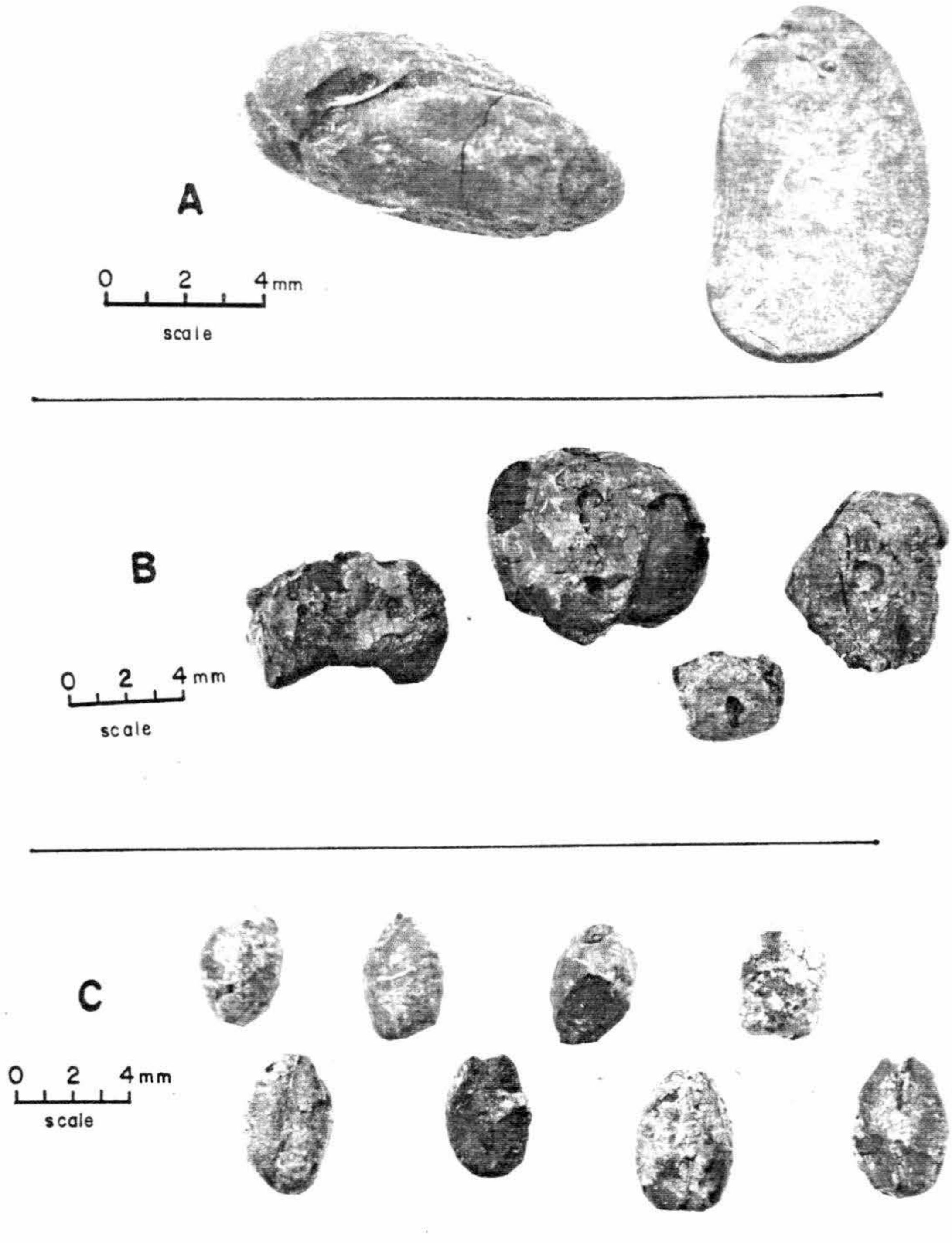


FIGURE 5.7: Charred cultigen seeds from N200W9 of CA-LAn-229. A-*Phaseolus vulgaris* (Common Bean); B-*Zea mays* (Corn); C-Gramineae (Grass Family), *Triticum* sp. (Wheat) or *Hordeum vulgare* (Common Barley).

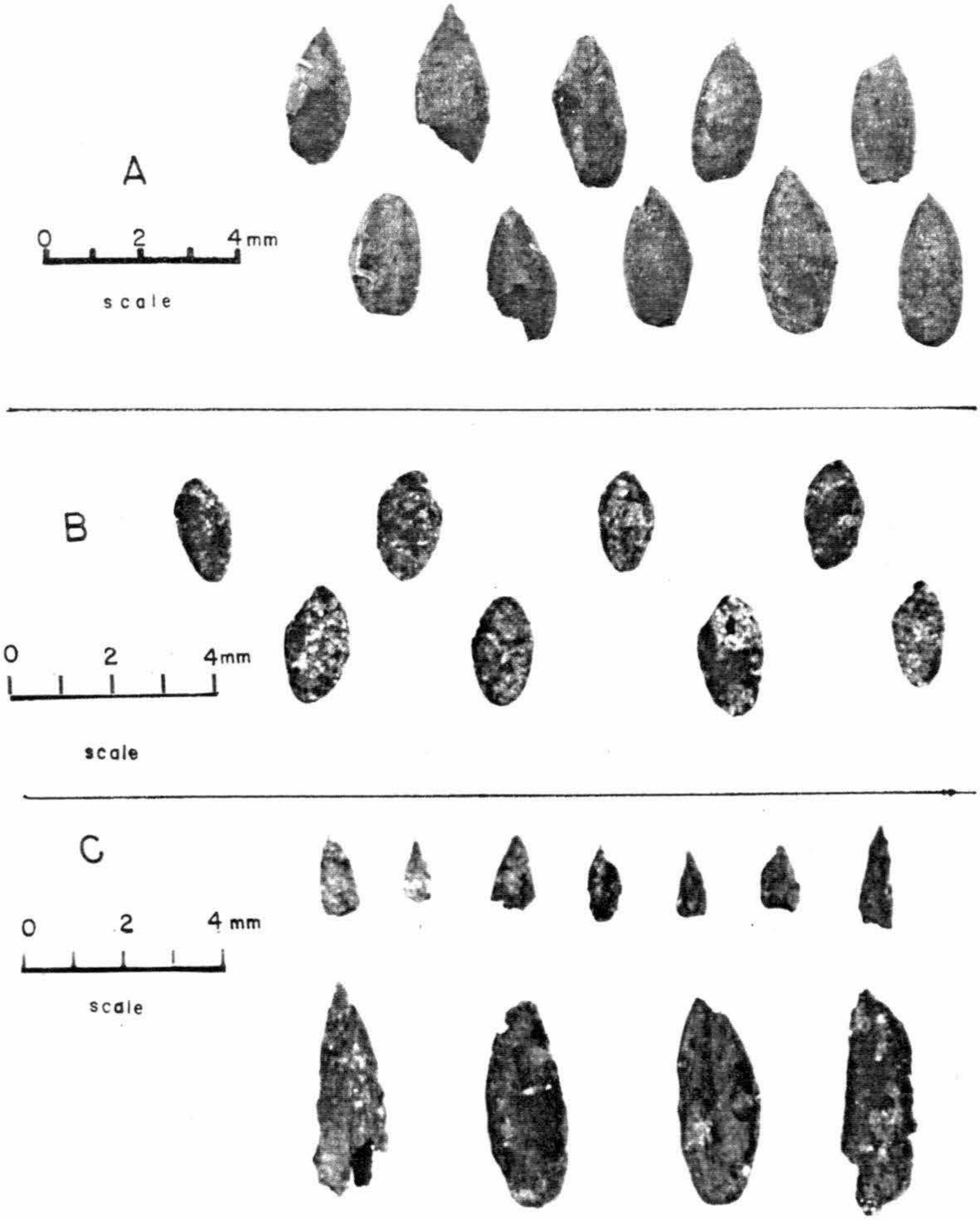


FIGURE 5.8: Charred Gramineae (Grass Family). A-*Hordeum* sp. from N200W9 of CA-LAn-229; B-*Phalaris* sp. from N200W9 of CA-LAn-229; C-Unidentified grass caryopses from CA-SLO-165 (top row: detached embroyos only).

Depth		AREA 5 N139W30 pc(M)/gm	N155W13 pc(M)/gm	N188W9 pc(M)/gm	AREA 1 N200W9 pc(M)/gm	N209W10 pc(M)/gm	N214W11 pc(M)/gm	N229W6 pc(M)/gm	N236W6 pc(M)/gm	N241W11 pc(M)/gm	N251W13 pc(M)/gm	AREA 6 N267W8 pc(M)/gm	N281W14 pc(M)/gm	AREA 2 N300W10 pc(M)/gm	N310W10 pc(M)/gm	N318W7 pc(M)/gm	N324W13 pc(M)/gm
0cm	N.											0					
	A.S.											1/.01					
	H.											0					
10cm	N.	0													0		0
	A.S.	0													0		(1)/.01
	H.	0													0		1/.01
20cm	N.														0		
	A.S.														0		
	H.														0		
30cm	N.		0	0	4/.08			0			0				0		
	A.S.		(1)/.01	0	(4)/.08			0			0				(2)/.01		
	H.		0	1/.01	775/.95			0			0				0		
40cm	N.			0	3(2)/.11	0	0	0			0			0	0	1/.02	
	A.S.			(5)/.06	(12)/.09	(2)/.03	(1)/.01	0			0			0	(2)/.02	0	
	H.			3/.02	137/.56	0	0	0			0			0	0	2/.02	
50cm	N.	0				0	0				0			0			
	A.S.	0				(2)/.02	(2)/.03				(1)/.01			0			
	H.	0				0	0				0			0			
60cm	N.								0	0	0						
	A.S.								(1)/.02	(5)/.06	(1)/.01						
	H.								0	5/.02	0						
70cm	N.				1/.01					0	0			0			
	A.S.				(5)/.06					(7)/.09	(2)/.03			(1)/.02			
	H.				45/.1					0	0			0			
80cm	N.					0	0		1/.02					0			
	A.S.					(9)/.08	(3)/.03		0					0			
	H.					23/.09	0		0					0			
90cm	N.							0	0				0				
	A.S.							(7)/.08	0				0				
	H.							0	0				0				
100cm	N.												0				
	A.S.												0				
	H.												0				
110cm	N.								0								
	A.S.								(2)/.01								
	H.								0								
120cm																	

Key: pc-pieces; M-Minimum Number of Individual acorns represented; gm-grams; N.-nutmeats A.S.-acorn attachment scars; H.-hulls (nutshells)

TABLE 5.2: HEAVY FRACTION CHARRED ACORN FRAGMENTS FROM CA-LAN-229, 1980/81 EXCAVATIONS

		Area 5			Area 1							Area 6		Area 2			
		N139W30	N155W13	N188W9	N200W9	N209W10	N214W11	N229W6	N236W6	N241W11	N261W13	N267W8	N281W14	N300W10	N310W10	N318W7	N324W13
		pc(M)/gm	pc(M)/gm	pc(M)/gm	pc(M)/gm	pc(M)/gm	pc(M)/gm	pc(M)/gm	pc(M)/gm	pc(M)/gm	pc(M)/gm	pc(M)/gm	pc(M)/gm	pc(M)/gm	pc(M)/gm	pc(M)/gm	pc(M)/gm
0cm–10cm	nutshells											4/.02					
10cm–20cm	nutshells	0													12(1)/.08		0
20cm–30cm	nutshells														5/.10		
30cm–40cm	nutshells		1(1)/.01	14/.88	0			0			0				8/.05		
40cm–50cm	nutshells			0	3(1)/.03	0	2/.01	0			1/.02			0	11(1)/.11	5/.06	
50cm–60cm	nutshells	0				6/.05	8(1)/.07				1/.03			3(2)/.02			
60cm–70cm	nutshells								0	20(1)/.13	5/.03						
70cm–80cm	nutshells				20(2)/.14					9(1)/.09	1/.02			12(3)/.12			
	nutmeats									1/.06							
80cm–90cm	nutshells					52(3)/.38	37(8)/.21		2/.02					9(2)/.12			
90cm–100cm	nutshells							7(2)/.09	4/.01				0				
100cm–110cm	nutshells												0				
110cm–120cm	nutshells								11(1)/.08								

Key: pc-pieces; M-Minimum Number of Individual fruits represented; gm-grams

TABLE 5.3: HEAVY FRACTION CHARRED ISLAY FRAGMENTS FROM CA-LAN-229, 1980/81 EXCAVATIONS

Depth	Area 5 N139W30 pc(M)/gm	N155W13 pc(M)/gm	N188W9 pc(M)/gm	Area 1 N200W9 pc(M)/gm	N209W10 pc(M)/gm	N214W11 pc(M)/gm	N229W6 pc(M)/gm	N236W6 pc(M)/gm	N241W11 pc(M)/gm	N251W13 pc(M)/gm	Area 6 N267W8 pc(M)/gm	N281W14 pc(M)/gm	Area 2 N300W10 pc(M)/gm	N310W10 pc(M)/gm	N318W7 pc(M)/gm	N324W13 pc(M)/gm
0cm–10cm											2(1)/.02					
10cm–20cm	0													1/.01		0
20cm–30cm														0		
30cm–40cm		0	0	0			0			0				0		
40cm–50cm			4(1)/.07	0	2(1)/.02	0	0			0			0	0	5(2)/.09	
50cm–60cm	0				1/.03	0				0			0			
60cm–70cm								0	1/.01	0						
70cm–80cm				4(1)/.10					0	0			3(1)/.04			
80cm–90cm					7(3).10	6(2)/.14		1(1)/.03					2/.04			
90cm–100cm							3(1)/.06	1/.01				8/.01				
100cm–110cm												0				
110cm–120cm								0								

Key: pc-pieces; M-Minimum Number of Individual fruits represented; gm-grams

TABLE 5.4: HEAVY FRACTION CHARRED MANZANITA FRAGMENTS FROM CA-LAN-229, 1980/81 EXCAVATIONS

	Area 5			Area 1							Area 6		Area 2			
	N139W30	N155W13	N188W9	N200W9	N209W10	N214W11	N229W6	N236W6	N241W11	N251W13	N267W8	N281W14	N300W10	N310W10	N318W7	N324W13
	gm	gm	gm	gm	gm	gm	gm	gm	gm	gm	gm	gm	gm	gm	gm	gm
0cm–10cm											.10					
10cm–20cm	.06													1.65		.23
20cm–30cm														7.14		
30cm–40cm		.11	.22	.25			.07			.04				6.54		
40cm–50cm			1.35	.40	.29	.07	.08			.05			.37	3.3	.64	
50cm–60cm	.02				.14	.16				.08			.03			
60cm–70cm								.12	.57	.25						
70cm–80cm				1.6					1.79	.36			.77			
80cm–90cm					1.70	1.56		.44					.55			
90cm–100cm							.41	.23				.01				
100cm–110cm												.22				
110cm–120cm								1.00								

TABLER 5.5: HEAVY FRACTION CHARRED WALNUT FRAGMENTS FROM CA-LAN-229, 1980/81 EXCAVATIONS

Depth	Area 5 N139W30 pc/gm	N155W13 pc/gm	N188W9 pc/gm	Area 1 N200W9 pc/gm	N209W10 pc/gm	N214W11 pc/gm	N229W6 pc/gm	N236W6 pc/gm	N241W11 pc/gm	N251W13 pc/gm	Area 6 N267W8 pc/gm	N281W14 pc/gm	Area 2 N300W10 pc/gm	N310W10 pc/gm	N318W7 pc/gm	N324W13 pc/gm
0cm–10cm											53/.68					
10cm–20cm	20/.30													13/.10		77/.94
20cm–30cm														101/1.52		
30cm–40cm		42/.53	40/.79	35/.50			32/.40			6/.04				147/1.77		
40cm–50cm			46/.56	173/2.20	66/.59	108/.95	79/1.08			0			27/.37	104/1.42	59/.95	
50cm–60cm	2/.01				46/.49	402/3.23				2/.01			20/.16			
60cm–70cm								31/.23	798/9.14	75/1.05						
70cm–80cm				73/.88					/16.69	44/.58			7/.16			
80cm–90cm					106/1.42	305/3.48		9/.11					8/.08			
90cm–100cm							/6.63	12/.12				33/.34				
100cm–110cm												22/.15				
110cm–120cm								/.68								

Key: pc-pieces; gm-grams

TABLE 5.6: HEAVY FRACTION CHARRED WOOD FROM CA-LAN-229, 1980/81 EXCAVATIONS

regions have not observed such high recovery of the attachment scars. It is possible that some unique aspect of California Indian processing of acorns accounts for this occurrence. In any case, California oaks appear to have a unique quality that increases their likelihood of preserving archaeologically. Three oaks occur in the study region. At the *Talepop* site, the high amount of preservation of scars, combined with a limited number of species each with rather discreet morphological attributes allowed some qualitative assessment of the acorns remains (Hammett 1984).

Quercus lobata, the valley oak has very distinctive acorns and attachment scars from *Q. agrifolia*, the coastal live oak (Figure 5.5). *Quercus dumosa* (scrub oak) is known to hybridize with either of these tree oaks and its acorn scars reflect this morphological variability, although they are typically smaller than the acorns of the two tree oaks. The local scrub oak most frequently overlaps in size with the smaller end of the size range for *Q. agrifolia* (Hammett 1984).

Even with some of the sample undifferentiated, over half of the completed scars examined from the archaeological deposits at *Talepop* were distinguishable to species (Table 5.7). Overall the bulk of the acorn remains occurred in Area 1, and *Quercus agrifolia* occurred a great deal more frequently than *Q. lobata*. By far the majority of the *Q. agrifolia* was recovered from two hearths in Area 1: N200W9, 30-50 cm, and N209W10, 80-90 cm. Biases in subsampling for analysis should be noted (Table 5.6), nevertheless, the general observations regarding acorn distributions are valid. It is interesting to note that a single acorn scar was recovered from the 1/4" screen used at CA-LAn-227, and two more were recovered from the Medea Creek Cemetery (CA-LAn-243), a Late Period Chumash site located several miles northwest of *Talepop*. All three are *Q. lobata*. Medea Creek site is located in the valley floor and thus *Q. lobata* acorns would have been more readily available for these people than

TABLE 5.7: ACORN ATTACHMENT SCARS (MNI) FROM CA-LAN-229, 1980/81 SEASON

	AREA 1	AREA 2	AREA 5	AREA 6	TOTAL
Quercus agrifolia	36	4	0	0	40
Quercus lobata	17	1	1	0	19
Quercus dumosa	10	0	0	0	10
Undifferentiated	19	3	5	1	28
TOTALS	82	8	6	1	97

SAMPLING INFORMATION:

No. Unit/Level Samples by Site Area	AREA 1	AREA 2	AREA 5	AREA 6	TOTAL
LIGHT FRACTION	4	0	0	0	4
HEAVY FRACTION	23	10	5	3	41

NOTE: Table includes attachment scars from all screen sizes

Q. agrifolia. But this argument cannot be used to explain its presence at CA-LAn-227. It is suspected that the larger size of the *Q. lobata* acorn scar is the primary reason for their recovery in the 1/4" screen used in 1960s excavations of these two sites with the concomitant absence of the other species with smaller scars.

Prunus ilicifolia (**islay; holly leaved cherry**) was another highly valued food commodity to the Chumash. The seed (nutmeat) was leached and then ground into meal like acorns. According to Harrington, one basketry hatful of islay was worth two of acorns. Note that a basketry hatful, like a specific length of beads, was apparently a standard measure for the Chumash. One of his Barbareno Chumash informants noted that when islay was gathered far from home, it was processed in the field. When nearer home, it was processed at home (Timbrook *et al.* 1981). An abundance of islay nutshells at *Talepop* might indicate that they were harvested nearby, although Harrington's notes specify no scale for distance.

The frequency of islay nut hulls appear to increase with depth of deposits at CA-LAn-229 (Table 5.3). Although the sample is quite small, this trend may indicate that islay was used more commonly in the earlier periods of occupation than later. This general trend also seems to be the case for manzanita (*Arctostaphylos* sp.) and walnut (*Juglans californica*) refuse (Tables 5.4 and 5.5). The manzanita berries were crushed and drunk as a cider throughout California. There are many jars of crushed and uncrushed berries curated in the Lowie Museum (Appendix 1). The notes with a jar collected from the Yokut of the Central Valley indicates that the "cider is made by soaking in water for a short time."

The berries contain a small spheroid nut that breaks into sections or nutlets. It is these nutlets that are most frequently covered archaeologically although occasionally a complete berry is preserved. Both *A. glandulosa* and *A. glauca* are present in the remains, although *A. glandulosa* is a great deal more common. Based on the 1980/81 work the distribution of nutlets appears to be concentrated in the lower deposits in contexts dated to the earlier period of occupation at *Talepop*, with the exception of one noticeable increase in the 40-50 cm level of unit N318W7 on the knoll of Area 2.

Area 2 is rather intriguing because it fails to have the earlier or higher status beads associated with it (King 1982a). On the other hand there is refuse from shell bead manufacture on this knoll, a fairly rare occurrence for mainland Chumash sites. The bead making detritus in Area 1 is from the manufacture of protohistoric "money" beads, the common beads used in exchange throughout the region. Based on bead chronology, the occupants of this knoll area appear to have moved to the community after other, higher status people had already settled in Area 1. It is possible that these people moved from Santa Cruz Island where bead making was the principle industry (King *et al.* 1982).

Another intriguing aspect of plant distribution is related to walnut (*Juglans californica*). Due to their high density and thickness relative to acorn and islay shell, walnut shells tend to preserve at a higher frequency than other nutshells found in the catchment area. The California walnut is much like the black walnut of the Eastern U.S. in terms of flavor, food properties, and processing requirements. Harrington's informants told him that the nuts were hard to get out of the shell but they were good to eat. I told two separate Chumash visiting our project in 1980/81 about the recovery of walnut shell. Independently (and not surprisingly) they informed me that the walnuts were hard to get out of the shells, that there was not much food in them, but that they tasted good and that children eat them.

Walnut shells, like islay hulls and manzanita nutlets, occurred in high frequency near the bottom of the site deposits. Unlike the latter plant categories, however, their highest frequency occurred in the upper levels of N310W10 of Area 2. This unit had improved recovery, which indicates that a large part of the walnut shell was recovered through flotation. And indeed the unexamined light fraction samples are full of walnut shell and some whole walnuts; the Table 5.5 counts of walnut recovered from heavy fractions are deflations of the actual amount present in N310W10, which is presumably at the edge of a house (King *et al.* 1982). Site wide, walnut is not a dominant taxa, particularly in light of the durability of walnut relative to other nutshells. It is also possible that the walnuts were not actually consumed as food, but were only used as a fuel source in a fire for some other purpose. However, it seems unlikely someone would select for walnut shells as a fuel source if there were other woods available. Aside from the two oak species growing at the same distance away from the houses as the walnut, there are also more immediate willows, over thirty feet high growing in a small draw that separated Areas 1 and 2 at their western boundaries.

It is possible that the "newcomers" that lived in Area 2 lacked good access to important resources such as the acorn groves and stands of <u>islay</u> and manzanita. They collected lesser quality foods that were not so closely monitored such as the abundant, but somewhat less preferred walnuts. Walnuts are nutritious food (see Chapter 4), but their energy return rate is lower, relative to the time invested during processing when compared to acorns and islay. Another possibility is that they were processing walnuts for trade. A few fragments of *Juniperus* sp. and *Pinus* sp. indicate that pine nuts and juniper berries were both traded, or at least transported, into the Santa Monica Mountains from outside the catchment area. Walnut was not known to have been an important food trade item, however, walnut shell halves were filled with asphaltum and pieces of shell and then traded and used as gaming pieces (Kroeber 1925, Figure 54). Ethnographic specimens of these "dice" have been collected and curated at the Lowie Museum. The reason for this walnut shell concentration remains unknown.

Remains from foods introduced by Europeans such as cattle, wheat and barley from the Old World, and corn and beans from the American Southwest occurred in very limited areas of the site. Remains from a historic hearth from *Talepop* included whole acorns, and islay kernels as well as whole beans, corn and wheat or barley kernels (Hammett 1984). These foods would all have been rather highly ranked food items. The reason for "repositing" a mix of whole edible food items in a house hearth remains uncertain. The possibility exists that this was a food offering. This is consistent with ethnographic documentation for the Chumash (i.e. Beeler 1967; Blackburn 1975), as for many other Native American groups.

The mission records attest to the baptism of a baby from *Talepop* in 1823, at a time apparently when a family had been sent back to the catchment area (presumably after the community of *Talepop* had been abandoned) to a rancheria associated with Rancho De Ortega in order to herd cattle for the mission, and attempt to raise some grain (Edberg 1982). Documentation regarding this misguided attempt to introduce domesticated plants and animals into a foreign setting were discussed above (see Chapter 2).

Small Seeds from CA-LAn-229

More recent archaeobotanical analysis (Hammett 1989) has centered on identification of small seeds and increasing the general data base of all archaeological plant remains and their spatial distributions. The 1987 excavations, although less controlled in recovery due in part to road contamination, did nevertheless, provide a valuable and diverse sample of small seeds for analysis. The basic data from these two excavations are summarized in Tables 5.8 and 5.9.

It is important to note the method of subsampling light fraction remains smaller that 2.0 mm. For N236W2 all materials were scanned and all seeds were extracted. For N197W2 two 10% subsamples were drawn for comparisons of the smaller particles. The results from this comparison indicated that 10% was a representative subsample, and for all other units only a 10% subsample of remains smaller than 2.0 mm was drawn and scanned. This procedure has made comparisons between feature samples more difficult, although frequencies between genera and families of plants are still quite reliable.

Many of the genera identified, such as *Oxalis*, *Calandrinia*, *Rumex*, and *Galium*, were present in very low numbers, nevertheless their presence is noteworthy. *Galium* sp. (bedstraw), *Rumex* sp. (dock), and *Oxalis* sp. all produce edible greens, and many of the *Oxalis* species also produce an edible corm. Any of these could have been collected for greens etc. when seeds were already ripening on the plant. All three genera are weed-like species sometimes represented by small numbers of seeds in archaeological sites throughout much of the grasslands and woodlands of North America. Their presence at *Talepop* follows this general pattern. All three genera contain species that are native to Southern California; therefore, at the genus level it is difficult to speculate as to whether their origin is that of a native or an introduced species.

Calandrinia sp. (red maids) is a small herbaceous plant of the Portulacaceae family. The seeds of red maids were reported by J. P. Harrington's informants to have been important to the Chumash (J. Timbrook,

TABLE 5.8: CA-LAN-229 TALEPOP
SMALL SEEDS AND BULBS (N<2MM)
1980/81 EXCAVATIONS

KEY TO TABLE: PCS (MNI % GRAMS	N2OOW9 30-40CM	N2OOW9 40-50CM	N236W6 110-120CM	TOTALS
RANUCULACEAE				
Ranunculus sp.	3 (3) <.01	- - -	- - -	3 (3) <.01
MALVACEAE				
cf. Malvus/ Malvastrum	3 (3) <.01	- - -	- - -	3 (3) <.01
GERANIACEAE				
Erodium sp.	9 (9) <.01	10 (10) <.01	- - -	19 (19) <.01
CRUCIFERAE				
Lepidium sp.	1 (1) <.01	- - -	- - -	1 (1) <.01
Other Cruciferae	- - -	- - -	5 (5) <.01	5 (5) <.01
PORTULACAEAE				
Calandrinia sp.	3 (3) <.01	- - -	1 (1) <.01	4 (4) <.01
Montia sp.	5 (5) <.01	7 (7) <.01	2 (2) <.01	14 (14) <.01
POLYGONACEAE				
Eriogonum sp.	3 (2) <.01	1 (1) <.01	- - -	4 (3) <.01
Polygonum sp.	- - -	- - -	4 (4) <.01	4 (4) <.01
CHENOPODIACEAE				
Atriplex sp.	- - -	- - -	1 (1) <.01	1 (1) <.01
Chenopodium sp.	1 (1) <.01	- - -	5 (4) <.01	6 (5) <.01
AMARANTHACEAE				
Amaranthus sp.	- - -	1 (1) <.01	- - -	1 (1) <.01
CARYOPHYLADAE (PORTU-CHENO-AMS)	- - -	8 (8) <.01	8 (4) <.01	16 (12) <.01
BORAGINACEAE				
Amsinckia sp.	- - -	1 (1) <.01	1 (1) <.01	2 (2) <.01
Plagiobothrys sp.	- - -	1 (1) <.01	- - -	1 (1) <.01

TABLE 5.8, CONTINUED

KEY TO TABLE: PCS (MNI %) GRAMS	N200W9 30-40CM	N200W9 40-50CM	N236W6 110-120CM	TOTALS
LABIATEAE				
Salvia sp.	12 (10) <.01	26 (17) 0.02	8 (8) <.01	46 (35) 0.02
SOLANACEAE				
Solanum sp.	- - -	- - -	1 (1) <.01	1 (1) .<01
LEGUMINOSAE				
cf. Lotus sp.	- - -	1 (1) <.01	- - -	1 (1) <.01
Other sp.	29 (29) 0.02	19 (19) 0.01	24 (24) 0.02	72 (72) 0.05
RUBIACEAE				
Galium sp.	1 (1) <.01	1 (1) <.01	- - -	2 (2) <.01
ASTERACEAE				
Hemizonia sp.	6 (5) <.01	12 (12) 0.01	9 (9) <.01	27 (26) 0.01
Other	33 (29) 0.01	33 (15) 0.01	8 (8) <.01	74 (52) 0.02
TYPHACEAE				
Typha sp.	- - -	1 (1) <.01	- - -	1 (1) <.01
CYPERACEAE				
Scirpus sp.	- - -	1 (1) <.01	1 (1) <.01	2 (2) <.01
POACEAE				
Phalaris sp.	21 (21) 0.01	14 (14) 0.01	22 (20) 0.03	57 (55) 0.05
Hordeum sp.	29 (26)	31 (31) 0.03	2 (2) <.01	62 (59) 0.06
Elymus sp.	- - -	1 (1) <.01	- - -	1 (1) <.01
Other Grasses	107 (59) 0.03	64 (51) 0.02	126 (21) 0.09	297 (131) 0.14
UNIDENTIFIED SEEDS	43 (43) 0.01	75 (75) 0.07	19 (19) <.01	137 (137) 0.08
UNIDENTIFIED SEED FRAGMENTS	277 (8) 0.31	201 (6) 0.56	152 (12) 0.03	630 (26) 0.9
TOTALS: SEEDS (MNI) GRAMS	586 (258) 0.42	509 (274) 0.74	399 147) 0.17	1494 (679) 1.33

TABLE 5.9: SMALL SEEDS FROM CA-LAN-229, 1987 EXCAVATIONS

KEY TO CHART: # FRAGMENTS (# MNI) GRAMS	N197W2 70-80cm	N218W2 120-130cm	N227W2 100-110cm	N230W2 130-140cm	N236W2 30-40cm	N236W2 100-110cm	N236W2 150-160cm	N248W2 100-110cm	TOTAL
Cupressaceae *Juniperus* sp.		3 (1) .03					2 (2) .04	1 (1) .02	6 (4) .09gm
Geraniaceae *Erodium* sp.	23 (22) .01		2 (2) <.01		1 (1) <.01				26 (25) .01
Oxalidaceae *Oxalis* sp.							1 (1) <.01		1 (1) <.01
Cruciferae cf. *Lepidium* sp.	6 (6) <.01	2 (2) <.01		1 (1) <.01			8 (8) <.01	12 (12) .01	29 (29) .01
Portulacaeae *Calandrinia* sp.	1 (1) <.01	1 (1) <.01	4 (3) <.01			1 (1) <.01			7 (6) <.01
Polygonaceae *Polygonum* sp.	11 (11) <.01	1 (1) <.01	1 (1) <.01			1 (1) <.01	4 (4) <.01		18 (18) <.01
Rumex sp.	1 (1) <.01		1 (1) <.01	1 (1) <.01		1 (0) <.01	1 (1) <.01		5 (4) <.01
Chenopodiaceae *Atriplex* sp.	1 (1) <.01						2 (2) .01	1 (1) <.01	4 (4) .01
Chenopodium sp.	38 (38) .01	13 (12) <.01	7 (7) <.01	5 (5) <.01	3 (3) <.01	45 (45) .01	3 (3) <.01	5 (5) <.01	119 (118) .02
Amaranthaceae *Amaranthus* sp.	14 (14) <.01	5 (5) <.01	1 (1) <.01	12 (12) <.01		7 (7) <.01	15 (15) <.01	6 (6) <.01	60 (60) <.01
"Cheno-Am" seed fragments	159 (159) .04	15 (15) <.01	12 (12) <.01	9 (9) <.01	4 (3) <.01	85 (85) .02	51 (51) <.01	10 (9) <.01	345 (343) .06
Boraginaceae *Amsinckia* sp.	19 (19) .02	1 (1) <.01	1 (1) <.01			14 (14) .01			35 (35) .03
Lamiaceae *Salvia* sp.	27 (27) .01	3 (3) <.01	9 (8) .01			27 (27) .01	13 (13) .01		79 (78) .04

TABLE 5.9. CONTINUED

KEY TO CHART: # FRAGMENTS (# MNI) GRAMS	N197W2 70-80cm	N218W2 120-130cm	N227W2 100-110cm	N230W2 130-140cm	N236W2 30-40cm	N236W2 100-110cm	N236W2 150-160cm	N248W2 100-110cm	TOTAL
Rosaceae									
<u>Heteromeles arbutifolia</u>		1 (1) .03		1 (1) <.01				1 (1) .03	3 (3) .06
Other Genera							2 (2) .01		2 (2) .01
Rubiaceae									
<u>Galium</u> sp.	1 (1) <.01			1 (1) <.01	1 (1) <.01	2 (2) <.01	2 (2) <.01	1 (1) <.01	8 (8) <.01
Caprifoliaceae									
<u>Sambucus mexicana</u>	11 (11) <.01	1 (1) <.01				5 (5) <.01	2 (2) <.01	5 (5) <.01	24 (24) <.01
Asteraceae									
<u>Helianthus</u> sp.	2 (2) <.01								2 (2) <.01
<u>Hemizonia</u> sp.	14 (14) .01	5 (5) <.01	4 (4) <.01			32 (32) .01	14 (14) .01	3 (3) <.01	72 (72) .03
Unknown #A	6 (3) <.01	4 (4) <.01	2 (2) <.01					6 (6) <.01	18 (15) <.01
Unknown #B	4 (4) <.01		1 (1) <.01				2 (2) <.01		7 (7) <.01
Other Composites	37 (35) .01	9 (9) <.01	10 (8) <.01	18 (18) <.01		83 (68) .02	10 (7) <.01	18 (14) <.01	185 (159) .03
Cyperaceae									
<u>Scirpus</u> sp.	5 (5) <.01	1 (1) <.01		1 (1) <.01	1 (1) <.01	13 (13) .01	3 (3) <.01	6 (6) <.01	30 (30) .01
Poaceae									
<u>Phalaris</u> sp.	63 (63) .04	10 (10) .01	4 (4) .01	2 (2) .01	1 (1) <.01	35 (34) .03	17 (17) .02	10 (10) .01	142 (141) .13
<u>Hordeum</u> sp.	6 (4) <.01		3 (2) .01			5 (5) <.01	1 (1) <.01		15 (12) .01
Cereal Grain					1 (1) .01				1 (1) .01
Other Grasses	415 (149) .15	54 (22) .03	28 (28) .02	29 (13) .04	30 (13) .03	331 (124) .09	98 (39) .05	104 (91) .03	1089 (479) .44
Unknown Seed #1	57 (54) .03	9 (9) <.01	4 (4) <.01		6 (6) .01	35 (35) .02	32 (32) .01		143 (140) .07
Unknown Seed #2	159 (159) .04	15 (15) <.01	12 (12) <.01	9 (9) <.01	4 (3) <.01	85 (85) .02	51 (51) <.01	10 (9) <.01	345 (343) .06
Other Unidentifiable Whole Seeds	255 (255) .09	84 (84) .03	69 (69) .03	38 (38) .01	11 (11) .01	281 (218) .09	81 (81) .02	72 (72) .05	891 (828) .33
Other Unident. Seed Fragments	1336 (238) .40	351 (8) .08	293 (18) .09	208 (4) .06	37 (3) .02	1902 (151) .41	268 (41) .07	347 (20) .10	4742 (483) 1.23
TOTAL	2671 (1296) .86	588 (210) .21	468 (188) .17	335 (115) .12	100 (47) .08	2990 (952) .75	683 (394) .25	618 (272) .25	8457 (3474) 2.69

personal communication). Large quantities of the seeds were cached with a burial across Stokes Creek due south of *Talepop* at site CA-LAn-840 (T. Wheeler *et al.* 1989) and with a burial at Medea Creek Cemetery, site CA-LAn-243 (L. King 1969). More recently they have been found cached in small abalone shells, sometimes in associated with a deciduous (subadult) human tooth. As noted in Chapter 4, red maids in the Malibu Creek State Park today occur in low frequencies. The low frequencies of red maid seeds archaeologically from the *Talepop* domestic deposits suggests that red maids were not a common food item for the people who inhabited *Talepop* but apparently they also had a special spiritual value. This possibility merits further investigation.

The seeds of all the genera identified during analysis, except for *Erodium* sp. (filaree), *Oxalis* sp., *Galium* sp. and the grass species, have been documented as having been used by the Chumash or their immediate neighbors (C. King, personal communication). The grasses are particularly noteworthy because of their overall high frequency from site deposits, especially *Phalaris* sp. and *Hordeum* sp. (Tables 5.8 and 5.9). Recent work at the herbaria of UNC-Chapel Hill and UC-Berkeley has indicated that there is a great deal of difficulty distinguishing caryopses of these two grass genera to the species level. There are at least six species of *Hordeum* and three of *Phalaris* that occur in California (Munz and Keck 1968). The origin of these genera, whether introduced or indigenous to the area, is somewhat controversial among botanists, however both genera have been found in prehistoric sites from both central and Southern Coastal California. Their presence in such high frequency from throughout the domestic deposits at *Talepop* is significant.

One species of the *Phalaris*, *P. caroliniana*, has been recognized as an important seed crop throughout much of the Eastern United States (Cowan

1978; Asch and Asch 1985). Similarly the presences of *Hordeum* sp. is noteworthy given the recognized importance of one species, *H. pusillum*, as a crop in the Eastern United States and perhaps also the Southwestern United States (Asch and Asch 1985; Cowan 1985). Both of these crop species occur in California, although *P. caroliniana* is considered to be introduced to California from the Eastern United States (Munz and Keck 1963), however, archaeobotanical data to support or rebut these claims are still lacking. Both species are the subject of considerable paleoethnobotanical study in the other regions regarding their domesticatory status.

The composite family (Asteraceae) was another category of seed plants that occurred in high frequency. "Tarweeds" such as *Madia* sp. and *Hemizonia* sp. are known to have been important throughout Native California, however, their prehistoric importance and distributions are poorly known. *Madia* sp. has not yet been identified from the deposits as *Talepop*. However, *Hemizonia* sp. was recovered in all of the feature samples except N230W2 Feature B and the top of N236W2. The absence of *Madia* sp. from site deposits does not reflect its absence from the modern landscape, as three native species of this genus grow in the Santa Monica Mountains (Raven *et al.* 1986). This suggests that other composites such as *Hemizonia* sp. may have been preferred over *Madia* sp. by the inhabitants of *Talepop*.

Two other unidentifiable, yet distinctive composites were isolated in the 1987 samples:

Unknown composite #A is approximately 2 mm long and 1 mm wide with a distinct attachment "knob" on the base of the proximal surface and parallel striations leading away from the central vein on both surfaces. The somewhat bumpy texture of this achene is similar to species of *Hemizonia* and this may be another distinct species of that genus.

Unknown composite #B is 3mm long and 1 mm wide with parallel striations running the length of the achene. The attachment scar of this achene is at the center of the base of the achene. Its overall morphology, symmetry, and size are very similar to *Helianthus* sp. and this is the most likely candidate, although it is slightly smaller and narrower than the modern reference samples collected from Malibu Creek State Park.

Two other unknown seeds occurred in such high frequencies that they were tallied, despite their lack of taxonomic identification:

Unknown Seed #1 is leguminous in general morphology although it may be a Cruciferae, such as *Sisymbrium* sp. The general appearance (size and morphology) are most similar to three members of Leguminosae, *Trifolium* sp., *Melilotus* sp. and *Astragalus* sp., but most of the seeds are too misshapen from charring to be positively identified.

Unknown Seed #2 is morphologically most similar to the compressed reniform seeds of the genus *Malva* of the Mallow (Malvaceae) family. The *Malva* species that have thus far been examined are not exactly identical, yet strikingly similar.

If these seeds do prove to be a species of *Malva*, their ubiquity and absolute numbers are a testimonial to the degree to which this site was impacted during the period of European contact. Of *Malva* sp., Jose Longinos Martinez noted in 1792 (Simpson 1938:35) that:

"The common apothecary's mallow which was not known in those countries (Southern and Baja California) has been propagated from some seeds which were mixed with other--so much that it is difficult each year to clear it out. It grows with such vigor that because of it one cannot walk in the immediate vicinity of the missions or through certain grain fields. Each plant looks like a small tree."

One other genus of plants deserves a special note. The seeds of *Salvia* sp., like those of Unknown Seed #1 were especially misshapen and distorted due to the carbonization process. In the case of the *Salvia* seeds this is probably due to the high oil content and gelatinous property of seeds of this genera. Therefore, it is quite likely that the *Salvia* seeds are substantially under-represented relative to other seeds in terms of the seeds originally present.

By far the majority of the unidentifiable seeds and fragments are badly misshapen and their identification is very unlikely in the future. On the other hand there are a number of well-preserved whole seeds that occurred in very low numbers that were not identified due to time constraints and they merit further attention in the future.

Comparisons Between 1980/81 and 1987 Excavations

In the report on plant remains from the 1980/81 excavations (Hammett and Wohlgemuth 1982), analysis focused on forty-one (33%) of the heavy fractions (Table 5.1 to 5.5). Several trends were identified regarding these samples. Over 50% of the walnut recovered from those excavations came from one unit, N310W2 (Table 5.4). In general, islay and manzanita remains (Tables 5.2 and 5.3) were concentrated vertically between 50 cm and 100 cm below datum, and horizontally between N200 and N240 meters from site datum. Overall, walnut and *Prunus* tended to increase with vertical depth (Tables 5.2 and 5.4). The main concentration of acorn remains (Table 5.1) was recovered at the southern end of Area 1 between 30 cm and 50 cm in units N188W9 and N200W9, and between 70 cm and 100 cm in units from N200W9 to N229W6. The greatest concentration of acorn was recovered between 30 cm and 50 cm in N200W9.

The work with the 1987 field sample has served to refine some of the observations and trends previously reported. Ninety-seven (100%) of the heavy fraction samples and eight light fraction samples were analyzed. Basic data for 1987 used in the comparisons discussed in this section are presented in Tables 5.10 and 5.11. Although the frequency of walnut did tend to increase with depth in some units such as N173W2, N197W2, and N221W2, the pattern was less clear in other units. The light fractions (Table 5.11) lent support to this previously observed trend of an increase with depth. This pattern may be partly a result of the density of this material. Overall, the high ubiquity of walnut (97%) in heavy fraction samples from the 1987 excavations with only a trace of

TABLE 5.10: CA-LAN-229 TALEPOP 1987 EXCAVATIONS
LARGE PLANT FRAGMENTS (N > 3.175 MM) FROM HEAVY FRACTIONS

TOTAL PLANTS

DEPTH (cm)	N14OW2 gm	N149W2 gm	N162W2 gm	N173W2 gm	N18OW2 gm	N197W2 gm	N218W2 gm	N221W2 gm	N224W2 gm	N227W2 gm	N230W2 gm	N236W2 gm	N248W2 gm	N249W2 gm
0-10	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10-20	-	-	-	<.01	-	-	-	-	-	-	-	-	-	-
20-30	-	-	-	0.07	0.05	0.01	-	-	-	-	-	-	-	-
30-40	-	0.01	0.15	0.2	0.01	-	-	-	-	-	-	-	-	-
40-50	-	0.13	1.57	0.04	0.29	0.22	-	-	-	-	-	-	-	-
50-60	0.08	0.37	0.46	2.02	1.54	0.05	-	-	-	-	-	-	-	-
60-70	0.26	0.27	0.14	0.14	2.08	0.05	-	0.11	-	0.02	0.12	0.03	-	-
70-80	-	0.16	-	1.85	0.68	0.22	-	0.04	-	-	-	0.02	-	0.02
80-90	0.05	0.02	-	3.14	0.74	14.17	0.07	0.01	0.04	0.01	-	-	0.01	-
90-100	-	-	-	0.69	-	0.91	-	0.21	-	0.21	0.04	0.02	0.12	0.28
100-110	-	-	-	-	-	0.57	0.02	0.09	0.05	0.12	0.37	0.05	0.14	0.34
110-120	-	-	-	-	-	0.54	-	0.16	0.11	-	0.06	0.09	0.28	0.42
120-130	-	-	-	-	-	0.91	0.08	0.55	0.18	0.09	0.01	-	0.09	0.34
130-140	-	-	-	-	-	-	0.06	0.14	-	-	0.11	0.08	0.06	0.31
140-150	-	-	-	-	-	-	-	-	0.01	0.04	0.06	1.27	0.18	0.19
150-160	-	-	-	-	-	-	-	-	-	-	<.01	-	0.04	0.01

UNIT LEVELS WITH NO HEAVY FRACTION SAMPLE (-)

DEPTH (cm)	N14OW2	N149W2	N162W2	N173W2	N18OW2	N197W2	N218W2	N221W2	N224W2	N227W2	N23OW2	N236W2	N248W2	N249W2
0-10	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10-20	-	-	-		-	-	-	-	-	-	-	-	-	-
20-30	-	-	-				-	-	-	-	-	-	-	-
30-40	-					-	-	-	-	-	-	-	-	-
40-50	-						-	-	-	-	-	-	-	-
50-60							-	-	-	-	-	-	-	-
60-70							-		-				-	-
70-80	-		-				-		-	-	-		-	
80-90			-								-	-		-
90-100	-	-	-		-		-		-					
100-110	-	-	-	-	-									
110-120	-	-	-	-	-		-			-				
120-130	-	-	-	-	-							-		
130-140	-	-	-	-	-	-			-	-				
140-150	-	-	-	-	-	-	-	-						
150-160	-	-	-	-	-	-	-	-	-	-		-		

WOOD

DEPTH (cm)	N14OW2 gm	N149W2 gm	N162W2 gm	N173W2 gm	N18OW2 gm	N197W2 gm	N218W2 gm	N221W2 gm	N224W2 gm	N227W2 gm	N23OW2 gm	N236W2 gm	N248W2 gm	N249W2 gm
0-10	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10-20	-	-	-	0	-	-	-	-	-	-	-	-	-	-
20-30	-	-	-	0.02	0.01	0.01	-	-	-	-	-	-	-	-
30-40	-	0	0.01	0.03	0.01	-	-	-	-	-	-	-	-	-
40-50	-	0.03	0.34	0.04	0.02	0.05	-	-	-	-	-	-	-	-
50-60	0.01	0.32	0.05	0.41	0.08	0	-	-	-	-	-	-	-	-
60-70	0.14	0	0	0	0.19	0	-	0	-	0.02	0	<.01	-	-
70-80	-	0.16	-	0.27	0.04	0.15	-	0	-	-	-	0.01	-	0.02
80-90	0	0	-	0.41	0	<.01	0	0.09	0.03	0.01	-	-	0	0
90-100	-	-	-	0.24	-	0.08	-	0	-	0.15	0	<.01	0	0.21
100-110	-	-	-	-	-	0.01	0	0	0	0.03	0.16	0.05	0.02	0.07
110-120	-	-	-	-	-	0.02	-	0	0	-	0.01	0.01	0.01	0.19
120-130	-	-	-	-	-	<.01	0	0.05	0.16	0	0	-	<.01	0.02
130-140	-	-	-	-	-	-	0	0.02	-	-	0	0	0	0.1
140-150	-	-	-	-	-	-	-	-	0	0	0	1.27	0	0.16
150-160	-	-	-	-	-	-	-	-	-	-	0	-	0	0

AMORPHOUS PLANT MATERIALS

DEPTH (cm)	N14OW2 gm	N149W2 gm	N162W2 gm	N173W2 gm	N18OW2 gm	N197W2 gm	N218W2 gm	N221W2 gm	N224W2 gm	N227W2 gm	N23OW2 gm	N236W2 gm	N248W2 gm	N249W2 gm
0-10	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10-20	-	-	-	0	-	-	-	-	-	-	-	-	-	-
20-30	-	-	-	0.02	0	0	-	-	-	-	-	-	-	-
30-40	-	0	0	0	0	-	-	-	-	-	-	-	-	-
40-50	-	0	0.09	0	0	0	-	-	-	-	-	-	-	-
50-60	0	0	0.01	0.06	0	0	-	-	-	-	-	-	-	-
60-70	0.02	0	0	0	0	0	-	0	-	0	0	0	-	-
70-80	-	0	-	0	0	0	-	0	-	-	-	0	-	0
80-90	0	0	-	0.23	0	0	0	0	0	0	-	-	0	0
90-100	-	-	-	0.05	-	0	-	0	-	0.04	0	0	0	0
100-110	-	-	-	-	-	0	0	0	0	0	0.09	0	0	0
110-120	-	-	-	-	-	0	-	0	0	-	0	<.01	0	0
120-130	-	-	-	-	-	0	0	0.05	0	0	0	-	0	0
130-140	-	-	-	-	-	-	0	0	-	-	0	0	0	0
140-150	-	-	-	-	-	-	-	-	0	0	0	0	0	0
150-160	-	-	-	-	-	-		-	-	-	0	-	0.04	0.01

TABLE 5.10, CONTINUED

WALNUT (JUGLANS SP.)

DEPTH (cm)	N14OW2 gm	N149W2 gm	N162W2 gm	N173W2 gm	N18OW2 gm	N197W2 gm	N218W2 gm	N221W2 gm	N224W2 gm	N227W2 gm	N23OW2 gm	N236W2 gm	N23OW2 gm	N236W2 gm	N248W2 gm	N249W2 gm
0-10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10-20	-	-	-	<.01	-	-	-	-	-	-	-	-	-	-	-	-
20-30	-	-	-	0.03	0.04	<.01	-	-	-	-	-	-	-	-	-	-
30-40	-	-	0.14	0.17	<.01	-	-	-	-	-	-	-	-	-	-	-
40-50	0.04	0.09	1	<.01	0.24	0.16	-	-	-	-	-	-	-	-	-	-
50-60	0.04	0.05	0.37	1.22	1.33	0.05	-	-	-	-	-	-	-	-	-	-
60-70	0.1	0.26	0.1	0.11	1.62	0.05	-	0.11	-	<.01	0.11	<.01	0.11	<.01	-	-
70-80	-	-	-	1.46	0.56	0.07	-	0.04	-	-	-	<.01	-	<.01	-	<.01
80-90	<.01	-	-	2.13	0.72	14.15	0.06	<.01	<.01	<.01	-	-	-	-	0.01	-
90-100	-	-	-	0.39	-	0.71	-	0.05	-	0.02	0.03	0.02	0.03	0.02	0.12	0.05
100-110	-	-	-	-	-	0.53	0.02	0.07	0.05	0.09	0.07	<.01	0.07	<.01	0.06	0.22
110-120	-	-	-	-	-	0.48	-	0.14	0.11	-	0.05	0.05	0.05	0.05	0.23	0.21
120-130	-	-	-	-	-	0.86	0.08	0.45	<.01	0.09	0.01	-	0.01	-	0.08	0.19
130-140	-	-	-	-	-	-	0.06	0.09	-	-	0.1	0.04	0.1	0.04	0.06	0.12
140-150	-	-	-	-	-	-	-	-	<.01	0.03	0.06	<.01	0.06	<.01	0.17	0.9
150-160	-	-	-	-	-	-	-	-	-	-	<.01	-	<.01	-	<.01	0.03

ISLAY (PRUNUS SP.)

DEPTH (cm)	N14OW2 gm/(MNI)	N149W2 gm/(MNI)	N162W2 gm/(MNI)	N173W2 gm/(MNI)	N18OW2 gm/(MNI)	N197W2 gm/(MNI)	N218W2 gm/(MNI)	N221W2 gm/(MNI)	N224W2 gm/(MNI)	N227W2 gm/(MNI)	N23OW2 gm/(MNI)	N236W2 gm/(MNI)	N23OW2 gm/(MNI)	N236W2 gm/(MNI)	N248W2 gm/(MNI)	N249W2 gm/(MNI)
0-10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10-20	-	-	-	<.01/(0)	-	-	-	-	-	-	-	-	-	-	-	-
20-30	-	-	-	<.01/(1)	0	0	-	-	-	-	-	-	-	-	-	-
30-40	-	0	0	0	0	-	-	-	-	-	-	-	-	-	-	-
40-50	0	0	.01/(2)	0	.01/(0)	0	-	-	-	-	-	-	-	-	-	-
50-60	0	0	.02/(0)	0.09/(1)	09/(2)	0	-	-	-	-	-	-	-	-	-	-
60-70	0	0	04/(1)	0	0.2/(2)	0	-	0	-	0	.01/(0)	0	.01/(0)	0	-	-
70-80	-	0	-	.05/(0)	.08/(0)	0	-	0	-	-	-	0	-	0	-	0
80-90	0	0.02/(0)	-	.13/(1)	.01/(0)	0	.01/(0)	.01/(0)	.01/(0)	0	-	-	-	-	0	0
90-100	-	-	-	.01/(0)	-	.07/(0)	-	.01/(0)	-	0	.01/(0)	0	.01/(0)	0	0	02/(1)
100-110	-	-	-	-	-	.02/(0)	<.01/(0)	.02/(0)	0	0	.05/(1)	0	.05/(1)	0	.01/(0)	0
110-120	-	-	-	-	-	0	-	0	0	-	0	.01/(0)	0	.01/(0)	.04/(0)	02/(1)
120-130	-	-	-	-	-	.05/(0)	0	0	.02/(0)	0	0	-	0	-	.01/(0)	13/(2)
130-140	-	-	-	-	-	-	0	.01/(0)	-	-	.01/(0)	0	.01/(0)	0	0	01/(0)
140-150	-	-	-	-	-	-	-	-	.01/(0)	.01/(0)	0	0	0	0	01/(0)	-
150-160	-	-	-	-	-	-	-	-	-	-	<.01/(0)	-	<.01/(0)	-	0	0

ACORN (QUERCUS SP.)

DEPTH (cm)	N14OW2 gm/(MNI)	N149W2 gm/(MNI)	N162W2 gm/(MNI)	N173W2 gm/(MNI)	N18OW2 gm/(MNI)	N197W2 gm/(MNI)	N218W2 gm/(MNI)	N221W2 gm/(MNI)	N224W2 gm/(MNI)	N227W2 gm/(MNI)	N23OW2 gm/(MNI)	N236W2 gm/(MNI)	N23OW2 gm/(MNI)	N236W2 gm/(MNI)	N248W2 gm/(MNI)	N249W2 gm/(MNI)
0-10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10-20	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
20-30	-	-	-	0	0	0	-	-	-	-	-	-	-	-	-	-
30-40	-	.01/(0)	0	0	0	-	-	-	-	-	-	-	-	-	-	-
40-50	0	0	.01/(1)	0	0	0	-	-	-	-	-	-	-	-	-	-
50-60	0	0	.01/(1)	.11/(4)	0	<.01/(1)	-	-	-	-	-	-	-	-	-	-
60-70	0	.01/(1)	0	.03/(2)	<.01/(1)	0	-	0	-	0	0	0	0	0	-	-
70-80	-	0	-	0	0	0	-	0	-	-	-	0	-	0	-	0
80-90	0	0	-	.11/(6)	0	.02/(1)	0	0	0	.01/(1)	-	-	-	-	0	0
90-100	-	-	-	0	-	.03/(3)	-	06/(1)	-	0	0	0	0	0	0	0
100-110	-	-	-	-	-	.01/(1)	0	0	0	0	0	0	0	0	0	.01/(0)
110-120	-	-	-	-	-	.03/(1)	-	0	0	-	0	0	0	0	0	0
120-130	-	-	-	-	-	0	0	0	0	0	0	-	0	-	0	0
130-140	-	-	-	-	-	-	0	.02/(1)	-	-	0	0	0	0	0	0
140-150	-	-	-	-	-	-	-	-	0	0	0	0	0	0	0	0
150-160	-	-	-	-	-	-	-	-	-	-	0	-	0	-	0	0

MANZANITA (ARCTOSTAPHYLOS SP.)

DEPTH (cm)	N14OW2 gm/(MNI)	N149W2 gm/(MNI)	N162W2 gm/(MNI)	N173W2 gm/(MNI)	N18OW2 gm/(MNI)	N197W2 gm/(MNI)	N218W2 gm/(MNI)	N221W2 gm/(MNI)	N224W2 gm/(MNI)	N227W2 gm/(MNI)	N23OW2 gm/(MNI)	N236W2 gm/(MNI)	N23OW2 gm/(MNI)	N236W2 gm/(MNI)	N248W2 gm/(MNI)	N249W2 gm/(MNI)
0-10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10-20	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-
20-30	-	-	-	0	0	0	-	-	-	-	-	-	-	-	-	-
30-40	-	0	0	0	0	-	-	-	-	-	-	-	-	-	-	-
40-50	0	0	0	0	0	0	-	-	-	-	-	-	-	-	-	-
50-60	.03/(3)	0	0	.04/(1)	.01/(0)	0	-	-	-	-	-	-	-	-	-	-
60-70	0	0	0	0	<.01/(0)	0	-	0	-	0	0	0	0	0	-	-
70-80	-	0	-	.04/(1)	0	0	-	0	-	-	-	0	-	0	-	0
80-90	0	0	-	<.01(0)	<.01/(0)	0	0	0	0	0	-	-	-	-	0	0
90-100	-	-	-	0	-	0	-	0	-	0	0	0	0	0	0	0
100-110	-	-	-	-	-	0	0	0	0	0	0	0	0	0	0	0.04/(1)
110-120	-	-	-	-	-	0	-	0	0	-	0	0	0	0	0	0
120-130	-	-	-	-	-	0	0	0	0	0	0	-	0	-	0	0
130-140	-	-	-	-	-	-	0	0	-	-	0	0	0	0	0	0.03/(0)
140-150	-	-	-	-	-	-	-	-	0	0	0	0	0	0	0	0
150-160	-	-	-	-	-	-	-	-	-	-	0	-	0	-	0	0

PROVENIENCE	CHARRED WOOD gm	CHARRED AMORPHOUS gm	YUCCA gm	BULB gm MNI	WALNUT SHELL gm	WALNUT MEAT gm	ACORN SHELL gm	ACORN SCARS gm MNI	ACORN MEAT gm MNI	PRUNUS SHELL gm MNI	PRUNUS MEAT gm MNI	UNIDENT. SHELL gm	NUT MEAT gm	MANZANITA gm MNI	TOYON gm MNI	JUNIPER gm MNI	FRUIT ATTACH. gm MNI	SMALL SEEDS gm MNI	OTHER	CHARRED TOTAL
N197W2 70-80 CM																				
N>2.00 MM	22.01	6.08	0	0.02 (0)	0.56	0	0.41	0.26 (30)	0.04 (0)	0.09 (3)	0	0	0.01	0.15 (1)	0	0	0	0	0.23	29.86
N<2.00 MM	-	-	-	-	-	-	-	0	-	-	-	-	-	0.01 (0)	0	0	0.01 (32)	0	-	0.02
TOTAL	22.01	6.08	0	0.02 (0)	0.56	0	0.41	0.26 (30)	0.04 (0)	0.09 (3)	0	0	0.01	0.16 (1)	0	0	0.01 (32)	0	0.23	29.88
N218W2 120-130 CM																				
N>2.00 MM	34.68	8.43	0.43	0.01 (1)	3.68	0.02	0.33	0.39 (23)	0.17 (0)	0.49 (5)	0.05 (1)	0.04	0	0.14 (4)	0.03 (1)	0.03 (1)	0.02 (1)	0	0	48.94
N<2.00 MM	-	-	-	0.01 (0)	-	-	-	0	-	-	-	-	-	0.03 (1)	0	0	0	0	-	0.04
TOTAL	34.68	8.43	0.43	0.02 (1)	3.68	0.02	0.33	0.39 (23)	0.17 (0)	0.49 (5)	0.05 (1)	0.04	0	0.17 (5)	0.03 (1)	0.03 (1)	0.02 (2)	0	0	48.98
N227W2 100-110 CM																				
N>2.00 MM	33.29	5.11	0.27	0.15 (0)	0.76	0	0.49	0.2 (29)	0.22 (0)	0.2 (3)	0	0.06	0.29	0.07 (1)	0	0	0	0.05 (3)	0.31	41.47
N<2.00 MM	-	-	-	-	-	-	-	0.01 (4)	-	-	-	-	-	0	0	0	0	0	-	0.01
TOTAL	33.29	5.11	0.27	0.15 (0)	0.76	0	0.49	0.21 (33)	0.22 (0)	0.2 (3)	0	0.06	0.29	0.07 (1)	0	0	0	0.05 (3)	0.31	41.48
N230W2 FEATURE B 130-140 CM																				
N>2.00 MM	11.91	5.07	0.06	0	2.19	0	0.24	0.1 (5)	0 0	0.78 (11)	0	<.01	0.04	0.1 (3)	<.01 (2)	0	0	0	0.06	20.55
N<2.00 MM	-	-	-	-	-	-	-	0.01 (1)	-	-	-	-	-	0	0	0	0	0	-	0.01
TOTAL	11.91	5.07	0.06	0	2.19	0	0.24	0.11 (6)	0	0.78 (11)	0	<.01	0.04	0.1 (3)	<.01 (2)	0	0	0	0.06	20.56
N236W2 30-40 CM																				
N>2.00 MM	0.93	0.13	0	0.03 (0)	0.03	0	0.01	0	0	<.01 (0)	0	0	0	0	0	0	0 0	0.01 (1)	0.03	1.17
N<2.00 MM	-	-	-	-	-	-	-	0	-	-	-	-	-	<.01 (0)	0	0	<.01 (1)	0	-	<.01
TOTAL	0.93	0.13	0	0.03 (0)	0.03	0	0.01	0	0	<.01 (0)	0	0	0	<.01 (0)	0	0	<.01 (1)	0.01 (1)	0.03	1.17
N236W2 100-110 CM																				
N>2.00 MM	32.46	7.56	0	0.01 (0)	0.63	0	0.07	0.05 (8)	0	0.16 (7)	0	0	0.17	0.01 (0)	0	0	0	0	0.05	41.17
N<2.00 MM	-	-	-	-	-	-	-	0	-	-	-	-	-	<.01 (0)	0	0	0.03 (34)	0	-	0.03
TOTAL	32.46	7.56	0	0.01 (0)	0.63	0	0.07	0.05 (8)	0	0.16 (7)	0	0	0.17	0.01 (0)	0	0	0.03 (34)	0	0.05	41.2
N236W2 150-160 CM																				
N>2.00 MM	10.1	3.32	0	0.09 (0)	1.55	0	0.11	0.06 (6)	0	0.47 (5)	0.09 (1)	0.37	0.05	0.14 (3)	0	0.04 (2)	0 0	0.01 (1)	0.09	16.49
N<2.00 MM	-	-	-	-	-	-	-	0.01 (2)	-	-	-	-	-	0	0	0	<.01 (14)	0.05 (0)	-	0.06
TOTAL	10.1	3.32	0	0.09 (0)	1.55	0	0.18	0.07 (8)	0	0.64 (5)	0.09 (1)	0.46	0.05	0.14 (3)	0	0.04 (2)	<.01 (14)	0.06 (1)	0.09	16.88
N248W2 100-110 CM																				
N>2.00 MM	30.03	8.02	0	<.01 (1)	0.99	0	0.28	0.07 (13)	0	0.29 (5)	0	0.13	0	0.02 (0)	0.06 (1)	0	0 0	0.03 (5)	0.26	40.18
N<2.00 MM	-	-	-	-	-	-	-	0	-	-	-	-	-	0	0	0	<.01 (2)	0	-	0
TOTAL	30.03	8.02	0	0 (1)	0.99	0	0.28	0.07 (13)	0	0.29 (5)	0	0.13	0	0.02 (0)	0.06 (1)	0	<.01 (2)	0.03 (5)	0.26	40.18
GRAND TOTAL	175.41	43.72	0.76	0.32 (2)	10.39	0.02	1.94	1.16 (121)	0.43 (0)	2.48 (39)	0.14 (2)	0.6	0.56	0.67 (13)	0.09 (3)	0.07 (3)	0.06 (85)	0.15 (10)	1.03	240

TABLE 5.11: LARGE LIGHT FRACTION PLANT REMAINS, FROM CA-LAN-229, 1987 EXCAVATIONS

identified nutmeat fragments suggests that walnut was a more substantial part of the diet throughout the occupation of *Talepop* than previously suspected. On the other hand, as the most durable plant food remain present at the site, a bias due to differential preservation should not be ignored.

Regarding other plant remains, analysis of the heavy fraction samples failed to substantiate the trend of an increase with vertical depth for islay, although the light fractions do appear to reflect this trend. Further analysis may clarify this problem. Manzanita and islay concentrations were more broadly distributed throughout site deposits than previously observed, although a general pattern of higher frequencies in the upper levels to the south of N200 and in the lower levels north of N200 still prevailed. Acorn concentrations were also more widely distributed although the general vicinity of N200 remained the center of these concentrations.

In 1980/81, a historic house hearth was identified in the unit N200W9. It contained beads dating to the historic period. The greatest frequencies of corn, beans and a cereal grain (either wheat or barley) found anywhere on the site were recovered from this unit (Table 5.12). Because of this, a light fraction sample from the nearest 1987 unit, N197W2 was examined. No evidence of European cultigens was seen in the sample from N197W2. Only one fragment of a cereal grain (wheat or barley) has been recovered from the 30-40 cm light fraction sample of N236W2. During the 1980/81 work most of the European cultigen evidence was recovered from light fractions, although small fragments of cereal grains were also recovered from N214W11 and N188W9. This would suggest that the historic occupation of *Talepop* was concentrated in areas away from the area of the site excavated in 1987.

		30 - 40 cm level *				40 - 50 cm level				70 - 80 cm level			
		Water screened residue	Flotation materials			Water screened residue	Flotation materials			Water screened residue	Flotation materials		
		1/8"	1/4"	1/4" 1/8"	1/8" 1/10"	1/8"	1/4"	1/4" 1/8"	1/8" 1/10"	1/8"	1/4"	1/4" 1/8"	1/8" 1/10"
Juglans sp.	nutshells	10 pcs .25 gm	0	not examined	not examined	MNI-1 22 pcs .4 gm	0	0	0	81 pcs 1.6 gm	2 pcs .13 gm	not examined	not examined
Prunus illicifolia (or *lyonii*)	nutshells (endocarp)	0	0	"	"	MNI-1 3 pcs .03 gm	0	0	0	MNI-2 20 pcs .14 gm	0	"	"
Arctostaphylos glandulosa	stones	0	0	"	"	0	0	0	1 nutlet (1/10 stone) .01 gm	MNI-1 4 pcs .1 gm	0	"	"
Quercus sp.	attachment scars	MNI-4 4 pcs .08 gm	0	"	"	MNI-12 13 pcs .09 gm	0	MNI-2 2 pcs .1 gm	MNI-1 1 pc .01 gm	MNI-5 8 pcs .06 gm	0	"	"
	shells w/o attachment scars	775 pcs .95 gm	3 pcs .04 gm	"	"	137 pcs .56 gm	0	103 pcs .62 gm	94 pcs .29 gm	45 pcs .14 gm	7 pcs .05 gm	"	"
	nutmeats (cotyledons)	4 pcs .08 gm	MNI-3 10 pcs .92 gm	"	"	MNI-2 3 pcs .11 gm	MNI-2 4 pcs .57 gm	MNI-3 27 pcs .49 gm	0	1 pc .01 gm	2 pcs .1 gm	"	"
Zea mays	kernels (seeds)	0	MNI-1 1 pc .06 gm	"	"	MNI-1 1 pc .04 gm	MNI-1 1 pc .1 gm	MNI-2 7 pcs .14 gm	0	0	0	"	"
Phaseolus vulgaris	beans (seeds)	0	0	MNI-2 3 pcs .23 gm	"	0	MNI-1 1 pc	MNI-2 2 pcs	0	0	0	"	"
Poaceae (Grass Family) *Triticum* sp. or *Hordeum vulgare*	seeds	0	0	not examined	"	MNI-2 3 pcs .01 gm	0	MNI-10 10 pcs .09 gm	MNI-2 2 pcs .02 gm	0	0	"	"
Unknown	wood fragments	35 pcs .5 gm	44 pcs 3.16 gm	"	"	170 pcs 2.2 gm	24 pcs 2.06 gm	508 pcs 8.55 gm	234 pcs 1.21 gm	73 pcs .88 gm	27 pcs 1.94 gm	"	"
Unknown	amorphous plant material	31 pcs .6 gm	24 pcs 2.57 gm	"	"	51 pcs .94 gm	14 pcs 1.85 gm	132 pcs 3.15 gm	not examined	12 pcs .18 gm	8 pcs 1.21 gm	"	"
Unknown other and or unsorted	plant material	.64 gm	2.75 gm	15.6 gm	16.10 gm	.92 gm	.45 gm	1.13 gm	9.17 gm	.71 gm	.37 gm	13.46 gm	11.3 gm

*-One whole acorn was recovered during excavation from the 30-40 cm level in the hearth feature which is not quantified above (.32 gm)

TABLE 5.12: QUANTIFIED LARGE PLANT REMAINS FROM N200W9, CA-LAN-229

Plant Food Consumption at Talepop

In sum, analysis of larger plant fragments indicates that oak acorns, manzanita berries, islay and walnut were important foods utilized by households at *Talepop*. Comparison between the spatial patterning of plant remains and social status indicators (shell beads and ornament and Santa Catalina steatite) suggests that the most prestigious people living at *Talepop* in Area 1 (King 1982) preferred acorns and islay over walnuts (Tables 5.1. 5.2 and 5.4). The berries of *Arctostaphylos glandulosa* ("common" or "eastwood" manzanita) occurred in much higher frequency than "big berry" manzanita (*A. glauca*). The latter was extremely rare at *Talepop* (Hammett 1990). Range management and plant ecological data on manzanitas predict a greater number of the smaller *A. glandulosa* would occur in a typical population of the two coexisting species (see Chapter 4), however, the extremely rare occurrence of *A glauca* is rather striking.

Quercus agrifolia (coastal live oak) acorns were more common than the *Q. lobata* (valley oak). This observation is based on both MNI (minimum number of individuals) and number of fragments (Table 5.6). The higher frequency of *Q. agrifolia* in concert with ethnographic evidence and range management studies (see Chapter 4) indicates that the *Talepop* community probably did have acorn preferences. Both types of tree oaks probably occurred in substantial numbers in the immediate vicinity. Both are a stone's throw away from *Talepop* today. It is possible that *Q. agrifolia* are, over time, substantially more productive than *Q. lobata*, but range management studies have failed to demonstrate this point. It would appear more conservative to conclude that they simply preferred the *Q. agrifolia*, which grow in groves along creek banks and north-facing hill slopes throughout the catchment or that cost-effectiveness was greater. A preference for *Q. agrifolia* over *Q. lobata* is consistent with the information of acorn species selection discussed previously in Chapter 4.

Two other important crops, islay and manzanita berries, reflect more intensive exploitation during the earlier periods of occupation. Of course there is the distinct possibility of bioturbation (ground squirrel activity) causing denser materials to sink to lower depths (Pierce 1988) but deposits of dense cultigens near the top of N200W9 and the walnut shell concentration near the top of N310W10 appear to reduce the importance of these processes with respect to charred plant remains.

Thus it is possible (and hardly surprising) that the more intensive exploitation of traditional crops was more important during the late prehistoric period than during early historic times. This may indicate that the management of traditional crops decreased after historic contact with Spaniards. Walnuts, apparently a lower ranked food item, became more important as traditional crops that involved group harvests and resource management strategies declined in use. At the same time there is evidence that historic cultigens (corn, beans, wheat and barley) were incorporated into the diet during the final occupation of this site area.

Small seed consumption was dominated by grasses, in particular native species of *Hordeum* sp. and *Phalaris* sp., and composites, in particular the tarweed *Hemizonia* sp., and to a lesser extent, at least one species of sage (*Salvia* sp.) and an unknown leguminous seed (Unknown Seed #1, discussed above). All but the latter seed have been recognized as important food. Native legumes are particularly significant indicators of disturbance regimes.

The Question of Management

Archaeobotanical evidence from *Talepop* reflects a catchment area of grasslands, marshland, and chaparral woodlands, with utilization of plants available in the immediate vicinity of the village. Only the acorns, *islay*, and perhaps manzanita berries would have required organized collecting ventures off site. Junipers and pine nuts were so rare that they were never a staple. Thus harvesting of islay and manzanita, and probably acorns, indicated substantial energy input. The grasses and composites were presumably collected on the low grassland slopes immediately north of the village, and may have been collected by groups or by individuals.

This site area of CA-LAn-229 (*Talepop*) contains refuse from a wide variety of activities and related vegetational replacements and modifications from the period of village, to open field, to more recently a roadside. This archaeobotanical work has provided a crucial baseline for plant taxa deposited in archaeological sites in the region. Alone, these data (or data from any single site) provide little direct evidence related to prescribed burning or any other single resource management practice; rather the evidence from this long term settlement suggests a wide range of exploitation strategies. As a reference point, the *Talepop* data are invaluable. By comparison with this "comprehensive" picture of interior woodland Chumash archaeobotanical remains, is as possible to assess data from other sites, some of them special use camp sites, and some from other subregions. A comparative assessment providing direct information of specific exploitation and resource management schemes is presented in Chapter 6.

CHAPTER 6

ARCHAEOBOTANY OF THE CHUMASH REGION

Several sites in the Chumash region have produced archaeobotanical information during the last few years. They include (Figure 6.1; Table 6.1) the historic village site of *Helo'* on Mescalitan Island (CA-SBa-46) in Goleta Slough, several small prehistoric special use sites in the dune area north of Santa Barbara on the Vandenberg Air Force Base, a prehistoric special use site (CA-Ven-1020) located a few miles northwest of *Talepop*, and finally, a site in the northern end of the Chumash region on Morro Creek (CA-SLO-165). Together these data provide a more substantial understanding of subsistence and plant management strategies for the region.

GOLETA SLOUGH

On August 20, 1769, in the general vicinity of Santa Barbara/Goleta Father Crespi noted:

> "We went over land that was all of it level, dark and friable, will covered with fine grasses, and very large clumps of very tall, broad grass, burnt in some spots and not in other; the unburned grass was so tall that it topped us on horseback by a yard. All about are large tablelands with big tall live-oaks (I have never see larger), and many sycamores as well. We have come across rose-patches in such great amounts that the plains here were full of them in many spots" (Brown n.d.; Timbrook *et al.* 1982).

Leaving the heavily populated Goleta area two mornings later and heading toward Point Conception, Fr. Crespi reported:

> "...in sight of the shore, over some low rolling tablelands with very good dark friable soil and fine dry grasses; in many places it had been burnt off. It was all flat land, excepting only some short descents into a few dry creeks. If it can be dry-farmed, all the soil could be cultivated. Shortly after we left this point, the great live-oaks at this spot dropped behind us." (Brown n.d.; Timbrook *et al.* 1982).

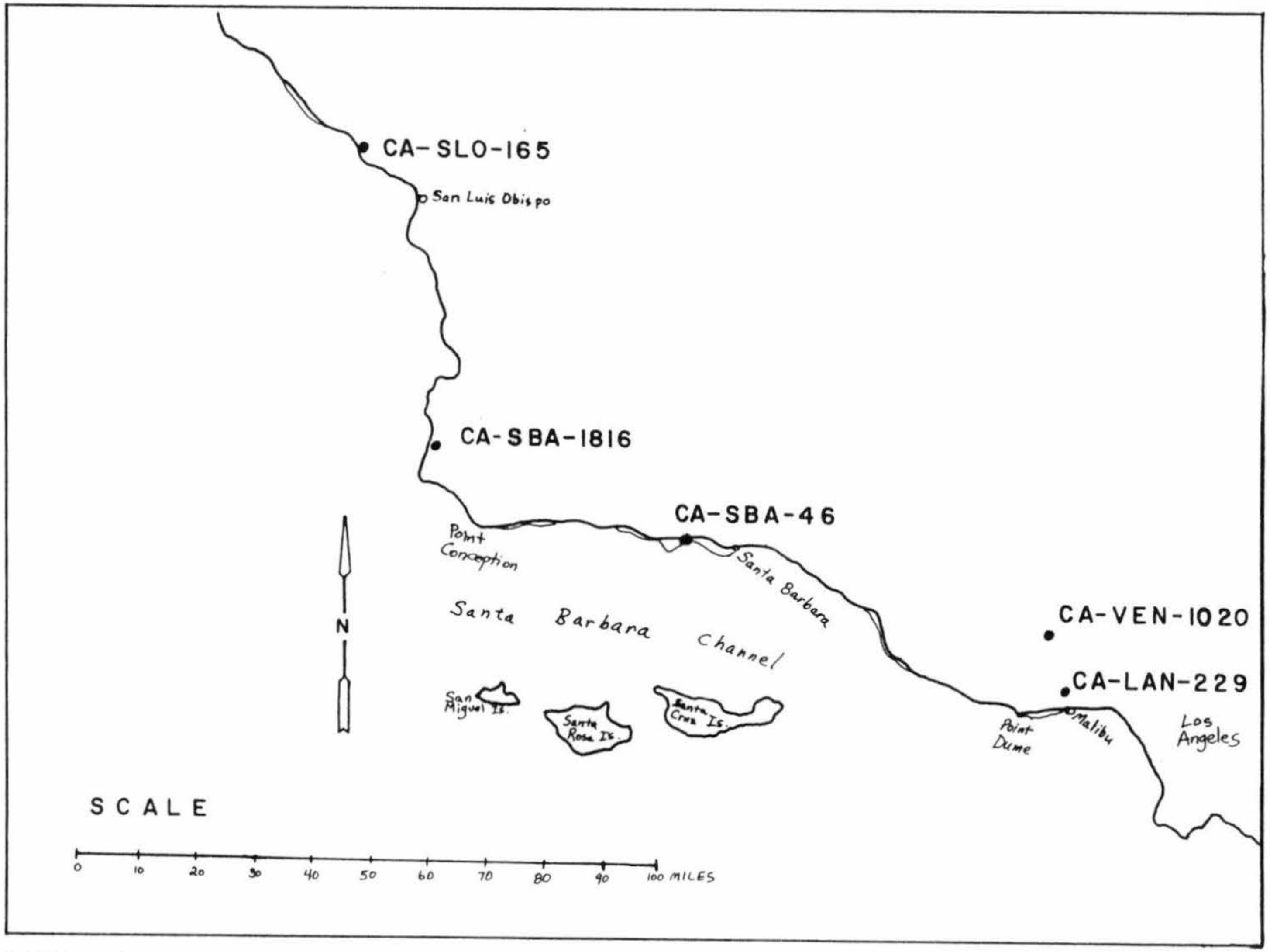


FIGURE 6.1 Map of Study Sites.

TABLE 6.1: CHUMASH SITES IN STUDY

SITE NAME	MICROENVIRONMENT	SITE TYPE	DATES OF OCCUPATION
CA-LAN-229 TALEPOP	OAK WOODLAND, GRASSLAND, CHAPARRAL, AQUATIC	PREHISTORIC AND HISTORIC VILLAGE; HISTORIC CATTLE STATION	A.D. 1000 UNTIL A.D. 1805 ALSO POSSIBLE UNTIL A.D. 1824
CA-SBA-46 HELO' MESCALITAN ISLAND	COASTAL SLOUGH	PREHISTORIC AND PROTOHISTORIC VILLAGE	1000 B.C. UNTIL A. D. 1100; A.D.1700'S-1803
CA-SBA-1816	STABILIZED AND UNSTABILIZED SAND DUNES EPHEMERAL DRAINAGE	SEASONAL RESIDENTIAL BASE CAMP	SEASONALLY FROM A.D. 1000 UNTIL CONTACT
CA-VEN-1020	SEMI-ARID CHAPARRAL SCRUB; STABILIZED DUNES	PREHISTORIC YUCCA HARVESTING BASE CAMP	SEASONALLY FROM A.D. 750 UNTIL A.D. 1700
CA-SLO-165	FRESH WATER MARSH RIVERINE	PREHISTORIC VILLAGE	3500-4500 B.C.

Two days later, near a large village at or close to Tajiguas Canyon, Crespi again comments that the tablelands were "well covered with very fine grasses that nearly everywhere had been burnt off by the heathens" (Brown n.d.; Timbrook *et al.* 1982).

Helo' (CA-SBa-46), a historic Chumash village was located on the small island of Mescalitan in Goleta Slough adjacent to Santa Barbara. This site was apparently first occupied during the Middle Period (1000 B.C. TO A.D.1100) (Gamble, personal communication, 1987). It was later reoccupied, probably by the early 1700s. By 1769 when the Spaniards arrived, it was the thriving community of *Helo'*. At that time Crespi estimated there were 100 houses and 16 plank boats on the island and put the population at between 600 and 800. By 1796, due to disease and forced immigration to the mission, *Helo'* had declined in population to 101 (Johnson 1990). In 1804 the final inhabitants were taken into the Mission Santa Barbara to be baptized (Gamble, *et al.* 1990).

Recent excavations by U.C.-Santa Barbara (Gamble *et al.* 1990) identified discrete floors from the historic occupation and possibly the prehistoric deposits as well. All feature and floor materials were put through the improved flotation process developed during the excavations at *Talepop*. Archaeobotanical remains recovered from in and around the floors, and several features that went through floors were analyzed. The results are tabulated in Tables 6.2 through 6.4).

In general, when compared to data from *Talepop* (Table 6.5), these *Helo'* data indicate a drop off in utilization of acorns, or at least a decrease of acorn processing refuse relative to other large plant fragments. Perhaps the energy necessary for acorn harvests was directed to harvesting fish and other marine resources which were more readily accessible to this coastal community.

TABLE 6.2: CA-SBA-46 HELO'

LARGE PLANT REMAINS (N > 2 MM) FROM NON-HOUSE FLOOR FEATURES

KEY TO TABLE: PCS (MNI) GRAMS	U83 120-140 cm	U83 (FL 2) 41-46 CM	U68 FEA.54 20-40 CM	U73 FEA.59 SQUARE 1	TR12N FEA.59 SQUARE 5 80-99 CM	TR12N FEA.59 SQUARE 5 80-120 CM	TR12 FEA.59 SQUARE 7 100-120 CM	TR12 FEA.59/62 SQUARE 7	TR12N FEA.62 SQUARE 7 100-120 CM
ERICACEAE									
Arctostaphylos	11 (0)	119 (8)	- -	5 (0)	- -	4 (0)	- -	1 (0)	2 (0)
glandulosa	0.04	0.71	-	0.03	-	0.01	-	0.01	0.02
A. glauca	- -	- -	2 (0)	- -	- -	- -	- -	- -	- -
	-	-	0.01	-	-	-	-	-	-
FAGACEAE									
Quercus sp.	1 (0)	5 (0)	- -	3 (0)	- -	2 (0)	- -	- -	- -
	<.01	0.01	-	0.01	-	0.01	-	-	
ROSACEAE									
Prunus sp.	17 (0)	92 (4)	- -	8 (0)	- -	2 (0)	- -	- -	- -
	0.03	0.17	-	0.01	-	0.04	-	-	-
JUGLANDACEAE									
Juglans sp.	- -	- -	- -	- -	- -	- -	- -	- -	- -
	-	-	-	-	-	-	-	-	-
UNIDENTIFIED	- -	62 (0)	- -	8 (0)	- -	- -	- -	- -	- -
NUTSHELL	-	0.06	-	<.01	-	-	-	-	-
AMORPHOUS	- -	- -	- -	- -	- -	- -	13 (0)	-	- -
	-	1	0.19	0.25	0.01	0.63	0.11	0.04	0.19
WOOD	- -	- -	- -	- -	- -	- -	- -	-	- -
	-	4.54	0.46	3.52	0.09	2.29	1.02	1.03	0.84
AGAVACEAE									
Yucca sp.	- -	4 (0)	2 (0)	- -	- -	- -	- -	- -	- -
	-	0.02	0.01	-	-	-	-	-	-
BULB/CORM	- -	- -	- -	- -	- -	- -	- -	- -	- -
FRAGMENTS	-	-	-	-	-	-	-	-	-
ANACARDIACEAE									
Rhus sp.	- -	1 (0	- -	- -	- -	- -	- -	- -	- -
	-	0.02	-	-	-	-	-	-	-
CAPRIFOLIACEAE									
Sambucus mexicana	- -	10 (7)	- -	- -	- -	- -	- -	- -	- -
	-	0.01	-	-	-	-	-	-	-
CUCURBITACEAE									
cf. Marah sp.	12 (0)	36 (0)	- -	1 (0)	1 (0)	- -	- -	- -	- -
	0.01	0.1	-	<.01	0.01	-	-	-	-
UNID. CHARRED	- -	2 (0)	5 (0)	4 (2)	- -	- -	- -	- -	- -
PLANTS	-	<.01	0.01	0.01	-	-	-	-	-
TOTAL	0.08	6.64	0.68	3.83	0.11	2.98	1.13	1.08	1.05

TABLE 6.2: CONTINUED

KEY TO TABLE: PCS (MNI) GRAMS	U73 FEA.62 SQUARE 1	U75 FEA.60 SQUARE 1	EAST U82 FEA.64 SQUARE 1	U81 FEA.65 STRATUM 13 LOWER WALL	U75 FEATURE 6 E. WALL; ASH ABOVE ASPHALT	U75 FEA.66 E. WALL; MIDDEN ASPHALTUM	U75 FEA. 68 SHELL LAYER ASH LENS	TOTAL COUNTS/MNI WEIGHTS
ERICACEAE								
Arctostaphylos glandulosa	6 (0) 0.04	- - -	1 (1) <.01	- - -	- - -	1 (0) 0.01	- - -	150 (1) 0.87
A. glauca	- - -	- - -	- - -	- - -	- - -	- - -	- - -	2 (0) 0.01
FAGACEAE								
Quercus sp.	25 (0) 0.04	- - -	1 (0) <.01	- - -	- - -	1 (0) <.01	1 (0) <.01	39 (0) 0.07
ROSACEAE								
Prunus sp.	21 (0) 0.03	- - -	- - -	- - -	- - -	- - -	- - -	140 (0) 0.28
JUGLANDACEAE								
Juglans sp.	- - -	- - -	- - -	- - -	- - -	- - -	- - -	0 0
UNIDENTIFIED NUTSHELL	7 (0) 0.01	- - -	- - -	- - -	- - -	- - -	- - -	77 (0) 0.07
AMORPHOUS	- - 0.7	- - -	- - 0.09	- - 0.26	- - 0.21	- - 0.27	- - 0.24	13 4.19
WOOD	- - 3.14	- - <.01	- - 1.79	- - 0.13	- - 1	- - 0.95	- - 1.1	0 21.9
AGAVACEAE								
Yucca sp.	2 (0) 0.01	- - -	- - -	- - -	- - -	- - -	- - -	8 (0) 0.04
BULB/CORM FRAGMENTS	- - -	- - -	- - -	- - -	- - -	- - -	- - -	0 0
ANACARDIACEAE Rhus sp.	- - -	- - -	- - -	- - -	- - -	- - -	- - -	1 0.02
CAPRIFOLIACEAE Sambucus mexicana	- - -	- - -	- - -	- - -	- - -	- - -	- - -	10 0.01
CUCURBITACEAE cf. Marah sp.	4 (0) <.01	- - -	- - -	- - -	- - -	- - -	2 (0) <.01	56 (0) 0.12
UNID. CHARRED PLANTS	12 (1) <0.01	- - -	- - -	- - -	- - -	- - -	- - -	23 (0) 0.02
TOTAL	3.97	0	1.88	0.39	1.21	1.23	1.34	27.6 GRAM

TABLE 6.3: CA-SBA-46 HELO'

LARGE PLANT REMAINS (N > 2MM) FROM HOUSE FLOORS

KEY TO TABLE: PCS (MNI) GRAMS	U76 FLOOR 1 A/B FILL SQUARE 1	U74 FLOOR 2 SQUARE 1	U74 FLOOR 2A SQUARE 1	U74 FLOOR SQUARE 1	U74 FLOOR 2A SQUARE 2 60-74 CM	U74 BETWEEN FLOOR 2B+C SQUARE 2
ERICACEAE Arctostaphylos glandulosa	1 (0) <.01	- - -	- - -	- - -	1 (0) <.01	2 (0) <.01
FAGACEAE Quercus sp.	1 (0) 0.01	3 (0) <.01	- - -	- - -	- - -	1 (0) <.01
ROSACEAE Prunus sp.	- - -	- - -	- - -	1 (0) <.01	3 (0) <.01	- - -
JUGLANDACEAE Juglans sp.	- - -	- - -	- - -	- - -	- - -	- - -
UNIDENTIFIED NUTSHELL	1 (0) <.01	- - -	- - -	- - -	- - -	- - -
AMORPHOUS	- - 0.39	- - 0.01	- - -	- - -	- - <.01	- - -
WOOD	- - 0.28	- - 0.01	- - <.01	- - 0.02	- - 0.03	- - 0.01
AGAVACEAE Yucca sp.	4 (0) 0.03	- - -	- - -	- - -	- - -	- - -
BULB/CORM FRAGMEN	- - -	- - -	- - -	- - -	- - -	- - -
ANACARDIACEAE Rhus sp.	- - -	- - -	- - -	- - -	- - -	- - -
CAPRIFOLIACEAE Sambucus mexicana	- - -	- - -	- - -	- - -	- - -	- - -
CUCURBITACEAE cf. Cucurbita sp.	- - -	- - -	- - -	- - -	- - -	- - -
Marah sp.	- - -	- - -	- - -	- - -	- - -	- - -
UNID. CHARRED PLANTS	- - -	- - -	- - -	- - -	- - -	- - -
TOTALS	0.71	0.02	0	0.02	0.03	0.01

TABLE 6.3. CONTINUED

KEY TO TABLE: PCS (MNI) GRAMS	U74 FLOOR 2C SQUARE 2	U74 BETWEEN FLOOR 2C+D SQUARE 2	U74 FLOOR 2D SQUARE 2	U74 BETWEEN FLOOR 2D+E	U74 FLOOR 2E SQUARE 2	TOTALS
ERICACEAE Arctostaphylos glandulosa	5 (0) <.01	1 (0) 0.01	3 (0) 0.01	1 (0) <.01	- - -	14 (0) 0.02
FAGACEAE Quercus sp.	2 (0) <.01	1 (0) <.01	2 (0) <.01	1 (0) <.01	- - -	11 (0) 0.01
ROSACEAE Prunus sp.	2 (0) <.01	2 (0) <.01	2 (0) <.01	3 (0) <.01	1 (0) <.01	14 (0) 0
JUGLANDACEAE Juglans sp.	- - -	- - -	- - -	- - -	- - -	0 0
UNIDENTIFIED NUTSHELL	1 (0) <.01	- - -	5 (0) <.01	3 (0) <.01	- - -	10 (0) 0
AMORPHOUS	- - 0.04	- - -	- - 0.04	- - 0.46	- - 0.01	0 0.95
WOOD	- - 0.34	- - 0.05	- - 0.41	- - 0.21	- - 0.09	0 1.45
AGAVACEAE Yucca sp.	4 (0) 0.04	- - -	- - -	- - -	- - -	8 (0) 0.07
BULB/CORM FRAGMEN	- - -	- - -	- - -	- - -	- - -	0 0
ANACARDIACEAE Rhus sp.	- - -	- - -	- - -	- - -	- - -	0 0
CAPRIFOLIACEAE Sambucus mexicana	- - -	- - -	- - -	- - -	- - -	0 0
CUCURBITACEAE cf. Cucurbita sp.	- - -	- - -	- - -	- - -	- - -	0 0
Marah sp.	4 (0) <.01	- - -	2 (0) <.01	- - -	- - -	6 (0) 0
UNID. CHARRED PLANTS	- - -	- - -	- - -	- - -	- - -	0 (0) 0
TOTALS	0.42	0.06	0.46	0.67	0.1	2.5 GRAMS

TABLE 6.4 CA-SBA-46 HELO'

SMALL SEEDS (N<2MM)

KEY TO TABLE PCS (MNI) GRAMS	U73 FEA.62 SQUARE 1	U73 FEA.59 SQUARE 1	U76 FLOOR 1 A/B FILL SQUARE 1	U74 FLOOR 2 SQUARE 1	U74 FLOOR 2A SQUARE 1	U74 FLOOR 2 SQUARE 1	U74 FLOOR 2A+B SQUARE 2 60-74 CM
CRUCIFERAE							
Lepidium sp.	1 (1) <.01	1 (1) <.01	- - -	- - -	- - -	- - -	- - -
Other Cruciferae	- - -	1 (1) <.01	- - -	- - -	- - -	- - -	- - -
PORTULACAEAE							
Calandrinia sp.	1 (1) <.01	2 (2) <.01	- - -	- - -	- - -	- - -	- - -
Montia sp.	2 (2) <.01	1 (1) <.01	- - -	- - -	- - -	- - -	- - -
POLYGONACEAE							
Rumex sp.	- - -	- - -	- - -	- - -	- - -	- - -	- - -
CHENOPODIACEAE							
Atriplex sp.	9 (9) <.01	1 (1) <.01	- - -	- - -	1 (0) <.01	- - -	- - -
Chenopodium sp.	4 (4) <.01	9 (9) <.01	- - -	- - -	- - -	- - -	1 (1) <.01
AMARANTHACEAE							
Amaranthus sp.	7 (7) <.01	5 (5) <.01	- - -	- - -	2 (1) <.01	- - -	1 (1) <.01
PLANTAGINACEAE							
Plantago sp.	1 (1) <.01	- - -	- - -	- - -	- - -	- - -	- - -
BORAGINACEAE							
Amsinckia sp.	- - -	1 (1) <.01	- - -	- - -	- - -	- - -	- - -
LABIATEAE							
Salvia sp.	- - -	- - -	- - -	- - -	- - -	- - -	- - -
SOLANACEAE							
Solanum sp.	- - -	6 (6) <.01	- - -	- - -	- - -	- - -	- - -
LEGUMINOSAE							
Unident. sp.	4 (4) <.01	- - -	- - -	- - -	- - -	- - -	- - -
ANACARDIACEAE							
Rhus sp.	- - -	- - -	- - -	- - -	- - -	- - -	- - -
CAPRIFOLIACEAE							
Sambucus mexicana	- - -	- - -	- - -	- - -	- - -	- - -	- - -
ASTERACEAE							
Hemizonia sp.	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Other	7 (3) <.01	1 (1) <.01	- - -	- - -	- - -	- - -	- - -
CYPERACEAE							
Scirpus sp.	- - -	- - -	- - -	- - -	- - -	- - -	- - -
POACEAE							
Phalaris sp.	1 (1) <.01	- - -	- - -	- - -	- - -	- - -	- - -
Hordeum sp.	- - -	1 (1) <.01	- - -	- - -	- - -	- - -	- - -
Other Grasses	52 (18) 0.02	16 (5) 0.01	- - -	- - -	- - -	- - -	- - -
UNIDENTIFIED SEEDS	43 (43) 0.01	27 (27) <.01	3 (3) <.01	1 (1) <.01	- - -	- - -	9 (9) 0.01
UNIDENTIFIED SEED FRAGMENTS	102 (15) 0.04	70 (11) <.01	- - -	- - -	- - -	- - -	18 (3) <.01
TOTALS: SEEDS (MNI) GRAMS	234 (109) 0.07	142 (72) 0.01	3 (3) <.01	1 (1) 0	3 (1) 0	0 0	29 (14) 0.01

TABLE 6.4. CONTINUED

U74 BETWEEN FLOOR 2B+C SQUARE 2	U74 FLOOR 2C SQUARE 2	U74 BETWEEN FLOOR 2C+D SQUARE 2	U74 FLOOR 2D SQUARE 2	U74 BETWEEN FLOOR 2D+E	U74 FLOOR 2E SQUARE 2	U83 FL.2 41-46 cm	U83 120-140 cm	TOTALS
- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	2 (2) <.01
- - -	- - -	- - -	- - -	- - -	- - -	2 (2) <.01	- - -	3 (3) <.01
- - -	2 (1) <.01	- - -	- - -	- - -	- - -	3 (1) <.01	- - -	8 (5) <.01
- - -	2 (2) <.01	- - -	- - -	1 (1) <.01	- - -	- - -	- - -	6 (6) <.01
- - -	1 (1) -	- - -	- - -	- - -	- - -	- - -	- - -	1 (1) <.01
- - -	4 (4) <.01	- - -	1 (1) <.01	1 (1) <.01	- - -	2 (2) <.01	- - -	19 (18) <.01
- - -	11 (11) <.01	- - -	17 (17) <.01	9 (9) <.01	- - -	52 (31) 0.01	- - -	103 (82) 0.01
- - -	- - -	- - -	- - -	- - -	- - -	17 (16) <.01	2 (1) <.01	34 (31) <.01
- - -	- - -	- - -	- - -	- - -	- - -	8 (8) <.01	1 (1) <.01	10 (10) <.01
- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	1 (1) <.01
- - -	- - -	- - -	- - -	- - -	- - -	- - -	1 (1) <.01	1 (1) <.01
- - -	- - -	- - -	1 (1) <.01	1 (1) <.01	- - -	- - -	- - -	8 (8) <.01
- - -	1 (1) <.01	- - -	- - -	- - -	- - -	53 (53) 0.03	4 (3) <.01	62 (61) 0.03
- - -	- - -	- - -	- - -	- - -	- - -	1 (1) 0.02	- - -	1 (1) 0.02
- - -	- - -	- - -	- - -	- - -	- - -	11 (8) 0.02	3 (3) <.01	14 (11) 0.02
- - -	- - -	- - -	- - -	- - -	- - -	1 (1) <.01	- - -	1 (1) <.01
- - -	2 (2) <.01	- - -	2 (1) <.01	- - -	- - -	20 (18) 0.01	2 (1) <.01	34 (26) 0.01
- - -	- - -	- - -	- - -	- - -	- - -	27 (10) 0.02	3 (0) <.01	30 (10) 0.02
- - -	- - -	- - -	- - -	- - -	- - -	1 (1) <.01	2 (2) <.01	4 (4) <.01
- - -	- - -	- - -	- - -	- - -	- - -	7 (7) 0.01	- - -	8 (8) 0.01
- - -	11 (3) <.01	1 (0) <.01	4 (2) <.01	3 (2) <.01	3 (2) <.01	335 (79) 0.16	47 (10) 0.01	471 (121) 0.2
1 (1) <.01	13 (13) <.01	- - -	5 (5) <.01	3 (3) <.01	2 (2) <.01	53 (53) 0.03	1 (1) <.01	161 (158) 0.05
7 (0) <.01	10 (2) 0.01	- - -	18 (0) <.01	4 (0) <.01	6 (1) <.01	270 (29) 0.09	19 (5) 0.01	524 (69) 0.15
8 (1) 0	57 (40) 0.01	1 (0) 0	48 (27) 0	22 (17) 0	11 (5) 0	863 (320) 0.4	85 (28) 0.02	1506 (637) 0.52

FIGURE 6.5: ARCHAEOLOGICAL PLANT REMAINS FROM THE CHUMASH REGION

LARGE FRAGMENTS (N>2MM) FROM FLOTATION SAMPLES

KEY TO TABLE: PCS (MNI) GRAMS +-sum not tabulated	CA-LAN-229 TALEPOP WOODLAND VILLAGE 1980/81 SAMPLE	 1987 SAMPLE	CA-VEN-1020 ARID SCRUB YUCCA HARVESTING	CA-SBA-46 MESCALITAN ISLAND GOLETA SLOUGH	CA-SBA-1816 VANDENBERG STABILIZED SAND DUNE	CA-SLO-165 MORRO CREEK FRESH WATER CREEK/SLOUGH	TOTALS
PINACEAE							
Pinus sp.	+ (1)	- -	- -	- -	- -	- -	+ (1)
		-	-	-	-	-	
FAGACEAE							
Quercus sp.	529 (30)	+ (147)	- -	50 (1)	5 (1)	2 (0) -	586 (179)
	8.86	3.99	-	0.08	0.01	<.01	12.9
ROSACEAE							
Prunus sp.	189 (5)	+ (54)	- -	154 (0)	- -	10 (2)	353 (57)
	0.39	4.05	-	0.28	-	0.03	4.75
JUGLANDACEAE							
Juglans sp.	1.43	29.28	-	-	-	-	30.7
CUCURBITACEAE							
cf. Marah sp.	44 (1)	- -	- -	62 (0)	119 (4)	- -	225 (5)
	0.06	-	-	0.12	0.16	-	0.34
UNIDENTIFIED	77 (0)	+	- -	87 (0)	- -	- -	164 (0)
NUTSHELL	0.15	0.4	-	0.07	-	0.03	0.65
UNIDENTIFIED	7 (0)	+	- -	- -	- -	- -	7 (0)
NUTMEAT	0.27	0.56	-	-	-	-	0.83
AMORPHOUS PLANT MATERIAL	18.1	44.47	+	5.09	-	1.37	69
WOOD	59.6	182.5	+	29.35	133.61	1.85	407
LILIACEAE							
Chlorogalum sp.	8 (1)	- -	- -	- -	- -	- -	8 (1)
	1.67	-	-	-	-	-	1.67
AGAVACEAE							
Yucca sp.	0.08	0.76	+	-	- -	0.02	0.86
CORM/BULB	9 (0)	+ (2)	+	- -	253 (30)	- -	262 (32)
FRAGMENTS	0.13	0.38		-	0.88	-	1.39
BULBLET	- -	- -	+	- -	80 (30)	- -	80 (30)
FRAGMENTS	-	-		-	0.23	-	0.23
TOTALS: BULBOUS	17 (1)	+ (2)	+	- -	333 (60)	- -	350 (63)
	1.88	1.14		-	1.11	0.02	4.15

FIGURE 6.5 , CONTINUED

BERRY/FLESHY FRUITS							
CUPRESSACEAE *Juniperus* sp.	1 (1) •	6 (5) 0.13	- -	- -	- -	- -	7 (6) 0.13
CACTACEAE *Opuntia* sp.	2 (2) <.01	- -	- -	- -	- -		2 (2) 0
ERICACEAE *Arctostaphylos* sp.	16 (4) 0.14	+ (13) 0.86	+	156 (1) 0.89	3 (0) 0.01	- -	175 (18) 1.9
ROSACEAE *Heteromeles arbutifolia*	1 (1) +	4 (3) 0.11	- -	- -	- -	- -	5 (4) 0.11
ANACARDIACEAE *Rhus* sp.	1 (1) <.01	- -	- -	1 (1) 0.02	42 (0) 0.02	- -	44 (2) 0.04
CAPRIFOLIACEAE *Sambucus mexicana*	9 (7) 0.02	24 (24) 0.01	- -	11 (8) 0.01	85 (67) 0.02	- -	129 (106) 0.06
NATIVE CALIFORNIAN CHARRED PLANTS TOTALS	893 (54) 90.9	34 (248) 267.5	+	521 (11) 35.91	587 (132) 134.94	12 (2) 3.3	2047 (447) 533
FABACEAE *Phaseolus vulgaris*	7 (5) 0.51	- -	- -	- -	- -	- -	7 (5) 0.51
POACEAE *Hordeum/Triticum*	41 (33) 0.38	- -	- -	- -	- -	- -	41 (33) 0.38
Zea mays	18 (11) 0.49	- -	- -	- -	- -	- -	18 (11) 0.49
TOTAL INTRODUCED CULTIGENS	66 (49) 1.38	- -	- -	- -	- -	- -	66 (49) 1.38
UNIDENTIFIED CHARRED PLANTS	0.73	0.14	-	0.02	1.75	0.07	2.71
TOTAL PLANT REMAINS	959 (113) 93.01	34 (248) 267.6	+	521 (11) 35.93	587 (132) 136.69	12 (2) 3.37	2113 (496) 537

Oak trees were definitely further away from *Helo'* than at *Talepop*. Oaks do grow along the Santa Barbara coastline as well as the interior, but their numbers are fewer than in the interior and the marine resources were abundant to these coastal residents.

Another factor that might account for the low numbers of acorn remains recovered from *Helo'* is the possibility that acorns were field hulled due to the distance back to the village, or that hulled acorns were obtained through trade from interior villages such as *Talepop*. This processing/depositional problem noted, it is possible to infer from these data that the inhabitants at *Helo'* did utilize acorns, but probably not as much as their southern interior cousins.

The relative frequencies of islay (*Prunus* sp.) at *Helo'* are similar to those noted for acorns, as processing needs and geographic distance from the respective communities were similar. By weight and counts there was less frequency of *islay* relative to other remains at *Helo'*, when compared to its frequency at the village of *Talepop*. On the other hand, unlike *Talepop*, islay appears to have been a more important resource than acorns at *Helo'*. Recall that Harrington's informants indicated that a basketry hatfull of islay was worth two of acorns. It is possible that inland villagers such as the Chumash at *Talepop* harvested more acorns and *islay* than they needed in order to trade them to the larger coastal communities.

Manzanita berries were utilized to a greater extent at *Helo'* than at *Talepop*. Although presumably berries from these shrubs would also have been at some distance from the community of *Helo'*, they were perhaps lighter or easier to harvest than nut crops, making their transport easier. The manzanita berries, which were mixed with water to make a cider, probably were not cleaned prior to the transport to the village. Thus, the presence of the small interior nutlets of the manzanita berries is probably a better reflection of actual utilization than the exterior shell refuse from the nuts.

In terms of small seed utilization (Table 6.6), there were fewer total genera present at *Helo'* than at *Talepop*, and those present indicate rather common herbaceous weedy plants that would have been readily available in this slough area. A marked decrease in the economic grasses *Phalaris* sp. and *Hordeum* sp., in the tarweeds, and in sage seeds suggests that these people were less involved in harvesting the grassland "field" crops identified at *Talepop*. Their apparent lack of (or minimal) utilization of grassland and woodland food plants is not surprising considering their proximity to important coastal resources including fish, shellfish, and sea mammals.

Overall all it appears that the inhabitants of *Helo'* did not venture as far from their settlement to harvest plant resources. Two explanations come to mind. For the historic phase, their access to traditional plant resources may have been restricted due to the presence of the Spaniard oppressors. Another possibility, valid for both time periods of occupations is that inhabitants emphasized marine rather than terrestrial resources. The presence of acorns and other woodland resources at *Helo'*, like the presence of pine nut and juniper at *Talepop*, indicates longer distance travel or trade, but in both cases, there is no evidence for dependence upon plant resources obtained at a long distance. The plant constituents at *Talepop* provide evidence for a reliance upon nut and berry crops that definitely would have required offsite collection, probably with community cooperation, as well as small seed resources; several resource zones were exploited, various slopes and elevations of the chaparral, as well as the grasslands and drainage/slough areas. A comparison between the data from *Helo'* and *Talepop* reflects basic environmental differences between a late period interior woodland village and

TABLE 6.6: ARCHAEOBOTANY OF THE CHUMASH REGION

SMALL SEEDS (N<2MM) FROM LIGHT FRACTION FLOTATIONS

KEY TO TABLE: PCS (MNI GRAMS	CA-LAN-229 TALEPOP INTERIOR WOODLAND VILLAGE 1980/81 SAMPLE	1987 SAMPLE	CA-VEN-1020 ARID WOODLAND YUCCA HARVESTING	CA-SBA-46 MESCALITAN ISLAND GOLETA SLOUGH	SBA-1816 VANDENBERG STABILIZED DUNES	CA-SLO-165 MORRO CREEK FRESH WATER CREEK/SLOUGH	TOTALS
RANUNCULACEAE Ranunculus sp.	3 (3) <.01	- - -	- - -	- - -	- - -	- -	3 (3) 0
MALVACEAE cf. Malva/ Malvastrum	3 (3) <.01	- - -	- - -	- - -	- - -	- - -	3 (3) 0
GERANIACEAE Erodium sp.	19 (19) <.01	26 (25) 0.01	- - -	- - -	3 (2) <.01	- - - -	48 (46) 0.01
OXALIDACEAE Oxalis sp.	- - -	1 (1) <.01	- - -	- - -	- - -	- -	1 (1) 0
CRUCIFERAE Lepidium sp.	1 (1) <.01	29 (29) 0.01	- - -	2 (2) <.01	31 (31) 0.01	2 (2) <.01	65 (65) 0.02
Other Cruciferae	5 (5) <.01	- - -	- - -	3 (3) <.01	- - -		8 (8) 0
PORTULACAEAE Calandrinia sp.	4 (4) <.01	7 (6) <.01	- - -	8 (5) <.01	13 (13) <.01	- - -	32 (28) 0
Montia sp.	14 (14) <.01	- - -	•	6 (6) <.01	12 (12) <.01	- - -	32 (32) 0
POLYGONACEAE Eriogonum sp.	4 (3) <.01	- - -	- - -	- - -	24 (20) <.01	- - - -	28 (23) 0
Polygonum sp.	4 (4) <.01	18 (18) <.01	- - -	- - -	6 (6) <.01	- - -	28 (28) 0
Rumex sp.	- - -	5 (4) <.01	- - -	1 (1) <.01	3 (3) <.01	1 (1) <.01	10 (9) 0
CHENOPODIACEAE Atriplex sp.	1 (1) <.01	4 (4) 0.01	- - -	19 (18) <.01	6 (2) <.01	- - -	30 (25) 0.01
Chenopodium sp.	6 (5) <.01	119 (118) 0.02	- - -	103 (82) 0.01	12 (11) <.01	3 (3) <.01	243 (219) 0.03
AMARANTHACEAE Amaranthus sp.	1 (1) <.01	60 (60) <.01	•	34 (31) <.01	- - -	- - -	95 (92) 0
CARYOPHYLLADAE (PORTU-CHENO-AMS)	16 (12) <.01	345 (343) 0.06	- - -	- - -	- - -	- - -	361 (355) 0.06
PLANTAGINACEAE Plantago sp.	- - -	- - -	- - -	10 (10) <.01	5 (5) <.01	- - -	15 (15) 0
BORAGINACEAE Amsinckia sp.	2 (2) <.01	35 (35) 0.03	- - -	1 (1) <.01	4 (4) <.01	- - -	42 (42) 0.03
Plagiobothrys sp.	1 (1) <.01	- - -	- - -	- - -	- - -	- - -	1 (1) 0
LABIATEAE Salvia sp.	46 (35) 0.02	79 (78) 0.04	•	1 (1) <.01	37 (34) <.01	40 (28) <.01	203 (176) 0.06

TABLE 6.6. CONTINUED

SMALL SEEDS (N<2MM) FROM LIGHT FRACTION FLOTATIONS

KEY TO TABLE: PCS (MNI) GRAMS	CA-LAN-229 TALEPOP INTERIOR WOODLAND VILLAGE 1980/81 SAMPLE	CA-LAN-229 TALEPOP INTERIOR WOODLAND VILLAGE 1987 SAMPLE	CA-VEN-1020 ARID WOODLAND YUCCA HARVESTING	CA-SBA-46 MESCALITAN ISLAND GOLETA SLOUGH	SBA-1816 VANDENBERG STABILIZED DUNES	CA-SLO-165 MORRO CREEK FRESH WATER CREEK/SLOUGH	TOTALS
SOLANACEAE							
Nicotiana sp.	- - -	10 (10) <.01	- - -	- - -	1 (1) <.01	- - -	11 (11) 0
Solanum sp.	1 (1) <.01	- - -	- - -	8 (8) <.01	- - -	- - -	9 (9) 0
ROSACEAE							
Adenostoma sp.	- - -	- - -	•	- - -	69 (63) 0.01	- - -	69 (3) 0.01
LEGUMINOSAE							
cf. Lotus sp.	1 (1) <.01	- - -	- - -	- - -	219 (191) 0.1	- - -	220 (200) 0.1
Other	72 (72) 0.05	- - -	- - -	62 (61) 0.03	37 (33) 0.01	- - -	171 (165) 0.09
RUBIACEAE							
Galium sp.	2 (2) <.01	8 (8) <.01	- - -	- - -	35 (35) <.01	- - -	45 (45) 0
ASTERACEAE							
Hemizonia sp.	27 (26) 0.01	72 (72) 0.23	- - -	1 (1) <.01	8 (8) <.01	9 (9) <.01	117 (116) 0.24
Madia sp.	- - -	- - -	- - -	- - -	1 (1) <.01	1 (1) <.01	2 (2) 0
Helianthus sp.	- - -	2 (2) <.01	- - -	- - -	- - -	- - -	2 (2) 0
Other	74 (52) 0.02	210 (181) 0.03	- - -	34 (26) 0.01	29 (29) <.01	10 (9) 0.01	357 (297) 0.07
TYPHACEAE							
Typha sp.	1 (1) <.01	- - -	- - -	- - -	- - -	- - -	1 (1) 0
CYPERACEAE							
Scirpus sp.	2 (2) <.01	30 (30) 0.01	- - -	30 (10) 0.02	1 (0) <.01	- - -	63 (42) 0.03
POACEAE							
Phalaris sp.	57 (55) 0.05	142 (141) 0.13	- - -	4 (4) <.01	- - -	2 (2) <.01	205 (202) 0.18
Hordeum sp.	62 (59) 0.06	15 (12) 0.01	- - -	8 (8) 0.01	- - -	25 (25) 0.02	110 (104) 0.1
Elymus sp.	1 (1) <.01	- - -	- - -	- - -	- - -	3 (3) <.01	4 (4) 0
Other Grasses	297 (131) 0.14	1090 (480) 0.45	- - -	471 (121) 0.2	116 (67) 0.04	571 (87) 0.38	2545 (886) 1.21
UNIDENTIFIED SEEDS	137 (137) 0.08	1379 (1311) 0.46	- - -	161 (158) 0.05	365 (365) 0.08	50 (50) 0.03	2092 (2021) 0.7
UNIDENTIFIED SEED FRAGMENTS	630 (26) 0.9	4742 (483) 1.23	- - -	524 (69) 0.15	2188 (285) 0.7	855 (32) 0.19	8939 (895) 3.17
TOTALS: SEEDS (MNI) GRAMS	1494 (679) 1.33	8428 (3451) 2.73	•	1491 (637) 0.48	3225 (1353) 0.95	1572 (253) 0.63	16210 (6373) 6.12

TABLE 6 7: ARCHAEOBOTANY OF THE CHUMASH REGION
LIGHT FRACTION
SMALL SEEDS (N<2MM) PER WOOD (N>2MM)

KEY	CA LAN 229 TALEPOP INTERIOR WOODLAND VILLAGE 1980/81 SAMPLE		1987 SAMPLE		CA VEN 1020 ARID SCRUBLAND YUCCA ROASTING	CA SBA 46 HELO COASTAL VILLAGE MESCALITAN ISLAND GOLETA SLOUGH		CA SBA 1816 CAMPSITE STABILIZED SAND DUNE VANDENBURG AIR BASE		CA SLO 165 MORRO CREEK FRESH WATER SLOUGH CREEKSIDE		TOTALS	
PCS PIECES MNI MININUM NUMBER OF INDIVIDUALS GM GRAMS	SEEDS/WOOD		SEEDS / WOOD			SEEDS / WOOD		SEEDS / WOOD		SEEDS / WOOD		SEEDS / WOOD	
	PCS/GM	(MNI/GM)	PCS/G	(MNI/GM)		PCS/GM	(MNI/GM)	PCS/GM	(MNI/GM)	PCS/GM	(MNI/GM)	PCS/GM	(MNI/GM)
RANUNCULACEAE													
Ranunculus sp	0.05	(0.05)	0.00			0		0.00		0.00		0.01	(0.01)
MALVACEAE													
cf Malva/ Malvastrum	0.05	(0.05)	0.00			0		0.00		0.00		0.01	(0.01)
GERANIACEAE													
Erodium sp	0.32	(0.32)	0.14	(0.14)		0		0.02	(0.01)	0.00		0.12	(0.11)
OXALIDACEAE													
Oxalis sp	0.00		0.01	(0.01)		0		0.00		0.00		0.00	
CRUCIFERAE													
Lepidium sp	0.02	(0.02)	0.16	(0.16)		0.07	(0.07)	0.23	(0.23)	1.08	(1.08)	0.16	(0.16)
Other Cruciferae	0.08	(0.08)	0.00			0.10	(0.10)	0.00				0.02	(0.02)
PORTULACAEAE													
Calandrinia sp	0.07	(0.07)	0.04	(0.03)		0.27	(0.17)	0.10	(0.10)	0.00		0.08	(0.07)
Montia sp	0.23	(0.23)	0.00		•	0.20	(0.20)	0.09	(0.09)	0.00		0.08	(0.08)
POLYGONACEAE													
Eriogonum sp	0.07	(0.05)	0.00			0.00		0.18	(0.15)	0.00		0.07	(0.06)
Polygonum sp	0.07	(0.07)	0.10	(0.10)		0.00		0.04	(0.04)	0.00		0.07	(0.07)
Rumex sp	0.00		0.03	(0.02)		0.03	(0.03)	0.02	(0.02)	0.54	(0.54)	0.02	(0.02)
CHENOPODIACEAE													
Atriplex sp	0.02	(0.02)	0.02	(0.02)		0.65	(0.61)	0.04	(0.01)	0.00		0.07	(0.06)
Chenopodium sp	0.10	(0.08)	0.65	(0.65)		3.51	(2.79)	0.09	(0.08)	1.62	(1.62)	0.60	(0.54)
AMARANTHACEAE													
Amaranthus sp	0.02	(0.02)	0.33	(0.33)	•	1.16	(1.06)	0.00		0.00		0.23	(0.23)
CARYOPHYLLADAE (PORTU CHENO AMS)	0.27	(0.20)	1.89	(1.89)		0.00		0.00		0.00		0.89	(0.87)
PLANTAGINACEAE													
Plantago sp	0.00		0.00			0.34	(0.34)	0.04	(0.04)	0.00		0.04	(0.04)
BORAGINACEAE													
Amsinckia sp	0.03	(0.03)	0.19	(0.19)		0.03	(0.03)	0.03	(0.03)	0.00		0.10	(0.10)
Plagiobothrys sp	0.02	(0.02)	0.00			0.00		0.00		0.00		< 01	(0.00)
LABIATEAE													
Salvia sp	0.77	(0.59)	0.43	(0.43)	•	0.03	(0.03)	0.28	(0.25)	21.62	(15.14)	0.50	(0.43)

TABLE 6.7: CONTINUED

KEY	CA-LAN-229 TALEPOP INTERIOR WOODLAND VILLAGE 1980/81 SAMPLE		CA-LAN-229 1987 SAMPLE		CA-VEN-1020 ARID SCRUBLAND YUCCA ROASTING	CA-SBA-46 HELO COASTAL VILLAGE MESCALITAN ISLAND GOLETA SLOUGH		CA-SBA-1816 CAMPSITE STABILIZED SAND DUNE VANDENBURG AIR BASE		CA-SLO-165 MORRO CREEK FRESH WATER SLOUGH CREEKSIDE		TOTALS	
PCS PIECES MNI MININUM NUMBER OF INDIVIDUALS GM GRAMS	SEEDS/WOOD PCS/GM	(MNI/GM)	SEEDS / WOOD PCS/G	(MNI/GM)		SEEDS / WOOD PCS/GM	(MNI/GM)	SEEDS / WOOD PCS/GM	(MNI/GM)	SEEDS / WOOD PCS/GM	(MNI/GM)	SEEDS / WOOD PCS/GM	(MNI/GM)
SOLANACEAE Nicotiana sp.	0.00		0.05	(0.05)		0.00		0.01	(0.01)	0.00		0.03	(0.03)
Solanum sp.	0.02	(0.02)	0.00			0.27	(0.27)	0.00		0.00		0.02	(0.02)
ROSACEAE Adenostoma sp.	0.00		0.00		•	0.00		0.52	(0.47)	0.00		0.17	(0.01)
LEGUMINOSAE cf. Lotus sp.	0.02	(0.02)	0.00			0.00		1.64	(1.43)	0.00		0.54	(0.49)
Other	1.21	(1.21)	0.00			2.11	(2.08)	0.28	(0.25)	0.00		0.42	(0.41)
RUBIACEAE Galium sp.	0.03	(0.03)	0.04	(0.04)		0.00		0.26	(0.26)	0.00		0.11	(0.11)
ASTERACEAE Hemizonia sp.	0.45	(0.44)	0.39	(0.39)		0.03	(0.03)	0.06	(0.06)	4.86	(4.86)	0.29	(0.29)
Madia sp.	0.00		0.00			0.00		0.01	(0.01)	0.54	(0.54)	<.01	(0.00)
Helianthus sp.	0.00		0.01	(0.01)		0.00		0.00		0.00		<.01	(0.00)
Other	1.24	(0.87)	1.15	(0.99)		1.16	(0.89)	0.22	(0.22)	5.41	(4.86)	0.88	(0.73)
TYPHACEAE Typha sp.	0.02	(0.02)	0.00			0.00		0.00		0.00		<.01	(0.00)
CYPERACEAE Scirpus sp.	0.03	(0.03)	0.16	(0.16)		1.02	(0.34)	0.01	0.00	0.00		0.15	(0.10)
POACEAE Phalaris sp.	0.96	(0.92)	0.78	(0.77)		0.14	(0.14)	0.00		1.08	(1.08)	0.50	(0.50)
Hordeum sp.	1.04	(0.99)	0.08	(0.07)		0.27	(0.27)	0.00		13.51	(13.51)	0.27	(0.26)
Elymus sp.	0.02	(0.02)	0.00			0.00		0.00		1.62	(1.62)	0.01	(0.01)
Other Grasses	4.98	(2.20)	5.97	(2.63)		16.05	(4.12)	0.87	(0.50)	308.65	(47.03)	6.25	(2.18)
UNIDENTIFIED SEEDS	2.30	(2.30)	7.56	(7.18)		5.49	(5.38)	2.73	(2.73)	27.03	(27.03)	5.14	(4.97)
UNIDENTIFIED SEED FRAGMENTS	10.57	(0.44)	25.98	(2.65)		17.85	(2.35)	16.38	(2.13)	462.16	(17.30)	21.96	(2.20)
TOTAL SEEDS/WOOD	25.07	(11.39)	46.18	(18.91)	•	50.80	(21.70)	24.14	(2.13)	849.73	136.76	39.83	(2.20)

TABLE 6.8: ARCHAEOBOTANY OF THE CHUMASH REGION
LIGHT FRACTION FLOTATIONS
SMALL SEEDS (N<2MM) PER CHARCOAL (N>2MM)

KEY	CA-LAN-229 TALEPOP WOODLAND INTERIOR VILLAGE 1980/81 SAMPLE		CA-LAN-229 TALEPOP WOODLAND INTERIOR VILLAGE 1987 SAMPLE		CA-VEN-1020 ARID SCRUBLAND YUCCA ROASTING	CA-SBA-46 HELO COASTAL VILLAGE MESCALITAN ISLAND GOLETA SLOUGH		CA-SBA-1816 CAMPSITE STABILIZED SAND DUNE VANDENBURG AIR BASE		CA-SLO-165 MORRO CREEK FRESH WATER SLOUGH/ CREEKSIDE		TOTALS	
PCS-PIECES MNI-MININUM # INDIVIDUALS GM-GRAMS	SEEDS/CHARCOAL PCS/GM	(MNI/GM)	SEEDS/CHARCOAL PCS/GM	(MNI/GM)	- ABSENT * PRESENT	SEEDS/CHARCOAL PCS/GM	(MNI/GM)	SEEDS/CHARCOAL PCS/GM	(MNI/GM)	SEEDS/CHARCOAL PCS/GM	(MNI/GM)	SEEDS/CHARCOAL PCS/GM	(MNI/GM)
RANUNCULACEAE Ranunculus sp	0.03	(0.03)	0.00		-	0.00		0.00		0.00		0.01	(0.01)
MALVACEAE cf. Malva/ Malvastrum	0.03	(0.03)	0.00		-	0.00		0.00		0.00		0.01	(0.01)
GERANIACEAE Erodium sp	0.20	(0.20)	0.10	(0.09)	-	0.00		0.02	(0.01)	0.00		0.09	(0.09)
OXALIDACEAE Oxalis sp	0.00		0.00		-	0.00		0.00		0.00		0.00	(0.00)
CRUCIFERAE Lepidium sp	0.01	(0.01)	0.11	(0.11)		0.06	(0.06)	0.23	(0.23)	0.59	(0.59)	0.12	(0.12)
Other Cruciferae	0.05	(0.05)	0.00		-	0.08	(0.08)	0.00				0.01	(0.01)
PORTULACAEAE Calandrinia sp	0.04	(0.04)	0.03	(0.02)	-	0.22	(0.14)	0.10	(0.10)	0.00		0.06	(0.05)
Montia sp	0.15	(0.15)	0.00		*	0.17	(0.17)	0.09	(0.09)	0.00		0.06	(0.06)
POLYGONACEAE Eriogonum sp	0.04	(0.03)	0.00		-	0.00		0.18	(0.15)	0.00		0.05	(0.04)
Polygonum sp	0.04	(0.04)	0.07	(0.07)	-	0.00		0.04	(0.04)	0.00		0.05	(0.05)
Rumex sp	0.00		0.02	(0.01)	-	0.03	(0.03)	0.02	(0.02)	0.30	(0.30)	0.02	(0.02)
CHENOPODIACEAE Atriplex sp	0.01	(0.01)	0.01	(0.01)	-	0.53	(0.50)	0.04	(0.01)	0.00		0.06	(0.05)
Chenopodium sp	0.06	(0.05)	0.44	(0.70)	-	2.87	(2.28)	0.09	(0.08)	0.89	(0.89)	0.45	(0.41)
AMARANTHACEAE Amaranthus sp	0.01	(0.01)	0.22	(0.22)	*	0.95	(0.86)	0.00		0.00		0.18	(0.17)
CARYOPHYLLADAE (PORTU-CHENO-AMS)	0.17	(0.13)	1.29	(1.28)	-	0.00		0.00		0.00		0.67	(0.66)
PLANTAGINACEAE Plantago sp	0.00		0.00		-	0.28	(0.28)	0.04	(0.04)	0.00		0.03	(0.03)
BORAGINACEAE Amsinckia sp	0.02	(0.02)	0.13	(0.13)	-	0.03	(0.03)	0.03	(0.03)	0.00		0.08	(0.08)
Plagiobothrys sp	0.01	(0.01)	0.00		-	0.00		0.00		0.00		0.00	(0.00)
LABIATEAE Salvia sp	0.49	(0.38)	0.30	(0.29)	*	0.03	(0.03)	0.27	(0.25)	11.87	(8.31)	0.38	(0.33)

TABLE 6.8 ARCHAEOBOTANY OF THE CHUMASH REGION CONTINUED

KEY	CA-LAN-229 TALEPOP WOODLAND INTERIOR VILLAGE 1980/81 SAMPLE		1987 SAMPLE		CA-VEN-1020 ARID SCRUBLAND YUCCA ROASTING	CA-SBA-46 HELO COASTAL VILLAGE MESCALITAN ISLAND GOLETA SLOUGH		CA-SBA-1816 CAMPSITE STABILIZED SAND DUNE VANDENBURG AIR BASE		CA-SLO-165 MORRO CREEK FRESH WATER SLOUGH/ CREEKSIDE		TOTALS	
PCS PIECES	SEEDS/CHARCOAL		SEEDS/CHARCOAL		- ABSENT	SEEDS/CHARCOAL		SEEDS/CHARCOAL		SEEDS/CHARCOAL		SEEDS/CHARCOAL	
MNI MININUM # INDIVIDUALS GM GRAMS	PCS/GM	(MNI/GM)	PCS/GM	(MNI/GM)	* PRESENT	PCS/GM	(MNI/GM)	PCS/GM	(MNI/GM)	PCS/GM	(MNI/GM)	PCS/GM	(MNI/GM)
SOLANACEAE													
Nicotiana sp.	0.00		0.04	(0.04)	-	0.00		0.01	(0.01)	0.00		0.02	(0.02)
Solanum sp	0.01	0.01	0.00			0.22	(0.22)	0.00		0.00		0.02	(0.02)
ROSACEAE													
Adenostoma sp	0.00		0.00		*	0.00		0.50	(0.46)	0.00		0.13	(0.01)
LEGUMINOSAE													
cf. Lotus sp	0.01	(0.01)	0.00		-	0.00		1.60	(1.40)	0.00		0.41	(0.37)
Other	0.77	(0.77)	0.00		-	1.73	(1.70)	0.27	(0.24)	0.00		0.32	(0.31)
RUBIACEAE													
Galium sp	0.02	(0.02)	0.03	(0.03)	-	0.00		0.26	(0.26)	0.00		0.08	(0.08)
ASTERACEAE													
Hemizonia sp	0.29	(0.28)	0.27	(0.27)	-	0.03	(0.03)	0.06	(0.06)	2.67	(2.67)	0.22	(0.22)
Madia sp	0.00		0.00		-	0.00		0.01	(0.01)	0.30	(0.30)	0.00	(0.00)
Helianthus sp	0.00		0.01	(0.01)	-	0.00		0.00		0.00		0.00	(0.00)
Other	0.80	(0.56)	0.78	(0.68)	-	0.95	(0.72)	0.21	(0.21)	2.97	(2.67)	0.66	(0.55)
TYPHACEAE													
Typha sp	0.01	(0.01)	0.00		-	0.00		0.00		0.00		0.00	(0.00)
CYPERACEAE													
Scirpus sp.	0.02	(0.02)	0.11	(0.11)	-	0.83	(0.28)	0.01	(0.00)	0.00		0.12	(0.55)
POACEAE													
Phalaris sp	0.61	(0.59)	0.53	(0.53)	-	0.11	(0.11)	0.00		0.59	(0.59)	0.38	(0.38)
Hordeum sp.	0.67	(0.63)	0.06	(0.04)	-	0.22	(0.22)	0.00		7.42	(7.42)	0.20	(0.19)
Elymus sp.	0.01	(0.01)	0.00		-	0.00		0.00		0.89	(0.89)	0.01	(0.01)
Other Grasses	3.19	(1.41)	4.07	(1.79)	-	13.11	(3.37)	0.85	(0.49)	169.44	(25.82)	4.74	(1.65)
UNIDENTIFIED SEEDS	1.47	(1.47)	5.15	(4.90)	-	4.48	(4.40)	2.67	(2.67)	14.84	(14.84)	3.90	(3.76)
UNIDENTIFIED SEED FRAGMENTS	6.77	(0.28)	17.72	(1.80)	-	14.58	(1.92)	16.01	(2.09)	253.71	(9.50)	16.65	(1.67)
TOTALS: SEEDS/CHARCOAL GRAMS	16.06	(7.30)	31.49	(12.90)	*	41.50	(17.73)	23.59	(9.90)	466.47	(75.07)	30.19	(11.87)

a protohistoric coastal slough village. Together they provide a portrait of distinct adaptations, perhaps almost at environmental extremes, within the Chumash region. Yet the specific resource management strategies applied to obtain these varied resources are still poorly understood. For this information I turn my attention to more limited use sites.

NORTHERN SANTA BARBARA REGION

Archaeological work in the sand dune area north of Santa Barbara has produced a series of sites of low density. Glassow (1985) has hypothesized that these sites were seasonal residential bases, overnight hunting camps and day-use hunting locations. The latter two contained evidence of hunting and butchering animals. The "overnight camps" also contained remains of marine food resource and fire-altered rock, all imported from the coast. He observed that the "seasonal residential bases" were located in the southern part of the dune area, overlooking bottom lands which presently support a variety of plant resources and deer. "Day-use hunting camps" tended to be located in southern and intermediate zones, again overlooking bottom lands, whereas "overnight hunting camps" were located in the northern central dunefields. Glassow (1985:63-64) adds that they found one "rather unique site" in the northern zone which contained hearths and an "unusual number of plant-processing tools" where he suggests there was "an overnight camp devoted to collection and procession of plants".

Two sites in the sand dune areas of Vandenberg Air Force Base were recently tested by Chester King (1990). They are CA-SBa-1816 and CA-SBa-537. The charred plant remains from the first ten columns of CA-SBa-1816 have been analyzed. CA-SBa-1816 is located in the small drainage of Spring Canyon; CA-SBa-537, located in the dune area near this small drainage has not yet been analyzed archaeobotanically. Located about 1000 meters from the coast CA-SBa-1816 produced a diversity of stone artifacts, fire altered rock, bone, and shell, indicating this site was a seasonal residential base camp. The primary cultural deposits of this site have been dated to late prehistoric times, although the site is periodically contaminated in its upper stratum by flood runoff from the Spring Canyon drainage.

Plant remains from CA-SBa-1816 (Table 6.6) included a plethora of seeds or small herbaceous plants (wildflowers) and many small bulbs of at least two genera. Evidence of the seeds, nuts, berries or fruits of woody shrubs, more characteristic of the woody chaparral zones and oak woodlands of the coastal zone were rare. The most common genera present are those indicative of recent burning. Recall that ecologists (i.e. Sweeney 1956; Westman 1981) have observed that legumes, in particular *Lupinus* sp. and *Lotus* sp. have their highest foliar cover (and hence seed productivity) in the seven years immediately following a fire. After this time, legume dominance in terms of ground cover is reduced from 11 to 1.5% (Westman 1981:178). *Marah macrocarpus* and *Eriogonum cinerum*, also exhibit this type trend.

These data suggest a pattern of frequent burning, which has already been documented for this locale through the ethnohistoric record (Timbrook *et al.* 1982). The general vicinity was traversed and described in 1769-1770 by Father Juan Crespi of the Portola expedition; these texts were translated by Alan K. Brown (Brown n.d.; Timbrook *et al.* 1982). On August 29, 1769, travelling northwestward past Chumash villages at Jalama Beach and Canada Agua Viva, the expedition rounded Point Arguello."

> "...On going about a league and a half (4.5 miles), we reached a stream [Honda Canyon] with a good amount of fresh water emptying into the seas. but no village nor soil of any worth upon it. The soldiers had scouted up to this point, and it was not a full day's march, nor was there grass for the animals, as it had all been burned

off ... On going about three hours, in which we must have made about two leagues and a half, we came to a hollow where the heathens had said there were some pools of water, and although it had been burned off, there were spots that had not been where there was good grass for the animals; a halt was ordered here..." (Brown n.d.; Timbrook *et al.* 1982).

In May 7, 1770, on a return trip to the area, again travelling northwestward along the same piece of "coastal tablelands" Crespi noted:

"At once after setting out, we commenced to find the field all abloom with different kinds of wildflowers of all colors, so that as many as were the flowers we had been meeting all along the way and on the Channel, it was not in such plenty as here, for it is all one mass of blossom, great quantities of white, yellow, red, purple, and blue ones; many yellow violets or gillyflowers of the sort that are planted in gardens, a great deal of larkspur, poppy and sage in bloom, and what graced the fields most of all was the sight of all the different sorts of colors together. On going about a league and a half, we came down to a deep of grass and a good-sized stream of running water...On this whole march, three leagues (9 miles) from the point of San Juan Bautista de los Perdernales, we have seen not a bush not a single heathen" (Brown n.d.; Timbrook *et al.* 1982).

The natural richness for this area for growing herbaceous plants was appreciated until at least 1954 when a National Geographic Society map of California noted that just two miles north of CA-SBa-1816 in an area near of the mouth of the Santa Inez River then called the Lompoc Valley was a "flower seed-growing center (with) acre after acre of blazing color". Sometime after that date Vandenberg Air Force Base and a Naval Missile Facility took over this coastal territory. Our knowledge of the area since that time remains clouded due to restricted access.

Overall, there is good evidence that the dune area north of Santa Barbara produces a natural richness of diversity, including many taxa that intensify their food production in response to frequent fires. There is also good evidence that the Chumash understood the disturbance phenomena that exist there and acted upon them by intensifying the vegetational response to fire.

A SPECIAL USE SITE IN THE SIMI HILLS

Upon discovery of such obvious fire disturbance evidence, it is tempting to predict that many seasonal harvesting camps away from main settlements were subjected to prescribed burning. With this idea in mind a small encampment with evidence of roasting ovens (CA-Ven-1020) was tested in 1990 by Chester King. This site is located in a dry chaparral scrub area about a mile north of Medea Creek site (CA-LAn-243). A series of C14 dates taken from the wood associated with the ovens indicates that various ovens were constructed and utilized from about A.D. 750 to about 1700. Apparently this site was always used as a temporary encampment--never a permanent village. The only structural features that were constructed were the ovens.

Cultural fill from in and around the ovens and from a small dark stained midden area were put through the water separation process developed at *Talepop*. The charred plant fragments greater that 1/4" from within one of the ovens were about half *Yucca* and about half wood. The wood fragments were dominated by *Adenostoma fasciculatum* (chamise), Rhamnaceae (*Rhamnus* sp. or *Ceanothus* sp.), *Arctostaphylos* sp. (manzanita) and *Prunus* sp.

Remarkably few seeds were recovered from this site; the few that did occur were quite possibly burned in association with cooking *Yucca* in the ovens. Small seeds identified from this site include a few *Salvia* sp. (sage), and several seeds from woody chaparral found in the immediate vicinity including *Ceanothus* sp. and quite a few *Adenostoma* sp. (Chamise) seeds, both burned and unburned. A few manzanita nutlets were also identified.

There were also a few bulbs recovered. They were quite similar to those produced by several plants including *Dichelostemma pulchellum* (blue dicks), *Brodiaea* sp. and *Calochortus* sp. (mariposa lilies). The frequency of all of these bulbs increase with burning or several other types of disturbance, but their low numbers provide insubstantial evidence to indicate frequent burning prehistorically in this vicinity.

For this site are it is possible to assess little evidence of management through the use of fire. The main crop exploited at this site, yucca, has a natural advantage over other food plants due to the rocky and arid terrain. There were obviously other and better zones to exploit for fire follower crops, for the inhabitants of nearby Medea Creek. Site CA-Ven-1020 apparently was used as a temporary harvesting and roasting site over a long period of time. Thus, there is no evidence of extensive manipulation of the site, aside from disturbances related to yucca extraction and roasting pits.

FAR NORTHERN CHUMASH

A final source of evidence for the application of selective pressures is seed morphology. Any fire-dependent species managed by humans may have undergone extinction with the cessation of such intervention. Ethnohistoric researchers have pointed to early accounts that describe grass caryopses similar to "European wild oats but more prolific and nutritive to cattle" (Shipek 1989:162) or "much like rye" or that near the sea there was wheat which they harvested without planting it" (Bolton 1930:346; Bean and Lawton 1972:41). The only possible archaeobotanical evidence of such a grass come from a site at the extreme northern end of the Chumash area.

Morro Creek Site (CA-SL0-165) is located a mile from the coast at the foot of a fresh water lagoon/estuary on the west bank of Morro Creek, adjacent to Estero Bay which empties into the Pacific Ocean one mile north of Morro Bay (Figure 6.1). It was tested by Singer and Associates in February of 1988, under contract to the City of Morro Bay, during installation of a water pipeline along Highway 41. A series of Carbon 14 dates taken from shell associated with the deposits of this site range in date from 4385 $\pm$ 75 to 5530 $\pm$ 80 B.P. (corrected ages). One shell sample taken from the 150-160 cm level of Unit 10 West produced a date of 5115 $\pm$ 75 B.P. A small control column of samples was recovered for flotation from the test unit excavated in the site.

Of all the plant remains recovered from the site, the grasses produced the most interesting new information. In general, the category of grasses tended to be larger in morphological size than other small seeds. A minimum of four genera of grasses were present. The three genera recognized (*Hordeum*, *Phalaris*, and *Elymus*) all contain more than one species that is native to the local region. Given the damaged and fragmented conditions of these remains, distinction to species is problematic.

Hordeum-like embryos detached from their caryopses occurred rather frequently. More *Hordeum* sp. embryos without caryopses than caryopses without embryos were recovered. Detached embryos and attached embryos were both measured, and each was given a count of one MNI. One unidentified grass species (Unidentified Grass #1) possessed distinctive morphological attributes, that could be isolated and measured. The embryo morphology of this grass most resembles several native species of *Hordeum*, yet its size is more like that of a larger grass, such as *Avena*. It is smaller than the Old World cultigens wheat (*Triticum aestivum*) and barley (*Hordeum vulgare*), and it lacks specific morphological attributes of these species. Yet, the size of the fragments of Unidentified Grass #1 are more similar to Old World cultigens than native specimens. All six caryopses of this grass were fragmented, yet the length of all near complete specimens exceeded 4.7 mm and the width of each ranged from 1.1 to 2.2 mm (Table 6.7). There exists the remote possibility that these are the remains of an extinct species of grass,

TABLE 6.9: CA-SLO-165, EXCAVATION UNIT 10 WEST
MEASUREMENTS OF DIAGNOSTIC GRASSES

UNIT LEVEL (CM)		CARYOPSIS LENGTH (MM)	CARYOPSIS WIDTH (MM)	POSITION OF GROOVE	EMBROYO LENGTH (MM)	EMBROYO WIDTH (MM)	COMMENTS
120-130		NONE INTACT ENOUGH TO MEASURE					
130-140	1)	4.2+	1.9	VENTRAL	ABSENT		Cf. HORDEUM
	2)	4.2	1.8	VENTRAL	DAMAGED		Cf. HORDEUM
	3)	4.8+	1.8	INDETERMINATE	ABSENT		Cf. HORDEUM
	4)	4.5+	1.8	VENTRAL	0.8	0.5	Cf. HORDEUM
	5)	3.0+	2.0	VENTRAL	0.8	0.6	Cf. HORDEUM
	6)	ABSENT		-	1.2	0.5	Cf. HORDEUM; DETACHED EMBROYO ONLY
	7)	ABSENT		-	1.0	0.5	Cf. HORDEUM; DETACHED EMBROYO ONLY
	8)	ABSENT		-	1.7	0.5	Cf. HORDEUM; DETACHED EMBROYO ONLY
	9)	ABSENT		-	0.9	0.4	Cf. HORDEUM; DETACHED EMBROYO ONLY
	10)	ABSENT		-	1.7	0.6	Cf. HORDEUM; DETACHED EMBROYO ONLY
	11)	ABSENT		-	1.4	0.6	Cf. HORDEUM; DETACHED EMBROYO ONLY
	12)	ABSENT		-	0.9	0.5	Cf. HORDEUM; DETACHED EMBROYO ONLY
	13)	ABSENT		-	1.0	0.5	Cf. HORDEUM; DETACHED EMBROYO ONLY
	14)	ABSENT		-	1.5	0.5	Cf. HORDEUM; DETACHED EMBROYO ONLY
	15)	ABSENT		-	1.3	0.4	Cf. HORDEUM; DETACHED EMBROYO ONLY
	16)	ABSENT		-	1.7	0.7	Cf. HORDEUM; DETACHED EMBROYO ONLY
	17)	ABSENT		-	1.5	0.5	Cf. HORDEUM; DETACHED EMBROYO ONLY
	18)	ABSENT		-	1.5	0.5	Cf. HORDEUM; DETACHED EMBROYO ONLY
	19)	ABSENT		-	1.1	0.6	Cf. HORDEUM; DETACHED EMBROYO ONLY
	20)	ABSENT		-	1.4	0.7	Cf. HORDEUM; DETACHED EMBROYO ONLY
	21)	ABSENT		-	1.3	0.7	Cf. HORDEUM; DETACHED EMBROYO ONLY
	22)	ABSENT		-	FRAGMENTED		Cf. HORDEUM; DETACHED EMBROYO ONLY
	23)	ABSENT		-	FRAGMENTED		Cf. HORDEUM; DETACHED EMBROYO ONLY
	24)	ABSENT		-	FRAGMENTED		Cf. HORDEUM; DETACHED EMBROYO ONLY
	25)	FRAGMENTED		-	0.5	0.4	Cf. ELYMUS
	26)	5.O+	2.2	VENTRAL	1.5	1.0	UNIDENTIFIED GRASS #1
	27)	4.7+	2.0	VENTRAL	ABSENT		UNIDENTIFIED GRASS
	28)	2.4	1.3	-	1.2	0.8	Cf. PHALARIS
	29)	1.8	1.0	-	0.6	0.3	Cf. PHALARIS
140-150		NONE INTACT ENOUGH TO MEASURE					
150-160	1)	5.0	1.5	DORSAL	0.9	0.5	Cf. HORDEUM
	2)	ABSENT		-	2.0	0.5	UNIDENTIFIED GRASS #1; DETACHED EMBROYO ONLY
	3)	4.2	1.2	INDETERMINATE	ABSENT		UNIDENTIFIED GRASS
	4)	ABSENT		-	0.5	0.3	UNIDENTIFIED GRASS
	5)	2.3	0.1	VENTRAL	ABSENT		Cf. ELYMUS
	6)	3.0	1.0	VENTRAL	0.5	0.3	Cf. ELYMUS
	7)	6.2+	1.0	DORSAL	ABSENT		UNIDENTIFIED GRASS; (POSS.ZIZANIA OR STIPA)
	8)	7.8	1.5	PRESENT	ABSENT		UNIDENTIFIED GRASS; (POSS.ZIZANIA OR STIPA)
160-170		NONE INTACT ENOUGH TO MEASURE					
170-180	1)	5.5	2.2	VENTRAL	ABSENT		UNIDENTIFIED GRASS
	2)	4.8+	1.5	PRESENT	ABSENT		UNIDENTIFIED GRASS
	3)	5.4+	1.4	INDETERMINATE	ABSENT		UNIDENTIFIED GRASS
	4)	ABSENT		-	0.6	0.6	UNIDENTIFIED GRASS; DETACHED EMBROYO ONLY
180-190	1)	4.7+	1.9	VENTRAL	DAMAGED		UNIDENTIFIED GRASS #1
	2)	5.0+	1.1	-	ABSENT		UNIDENTIFIED GRASS #1
	3)	2.3+	1.7	-	ABSENT		UNIDENTIFIED GRASS #1
	4)	5.0+	1.4	VENTRAL	ABSENT		UNIDENTIFIED GRASS
	5)	4.5	1.8	VENTRAL	0.5	0.8	UNIDENTIFIED GRASS
	6)	4.5+	1.5	VENTRAL	ABSENT		UNIDENTIFIED GRASS
	7)	4.0+	1.2	VENTRAL	ABSENT		UNIDENTIFIED GRASS
	8)	4.0+	1.5	VENTRAL	0.6+	0.5	UNIDENTIFIED GRASS
	9)	4.5	2.0	VENTRAL	DAMAGED		UNIDENTIFIED GRASS
	10)	ABSENT		-	1.5	0.8	UNIDENTIFIED GRASS; DETACHED EMBROYO ONLY
	11)	3.0+	1.5	VENTRAL	ABSENT		UNIDENTIFIED GRASS
	12)	4.3+	1.6	INDETERMINATE	ABSENT		UNIDENTIFIED GRASS
	13)	4.2+	1.5	INDETERMINATE	ABSENT		UNIDENTIFIED GRASS

perhaps *Hordeum* sp., that was exploited, and perhaps even manipulated 5000 years ago, but it is impossible to verify this at the present time.

Another grass morphologically resembles *Zizania* sp. (Table 6.7), although California is far out of the modern geographic range for this genus (Subarctic, down eastern seaboard to east Texas). Of the local genera, it most resembles *Stipa* sp., but the two fragments recovered are both from caryopses that are much too long to be any native stipa (shortest segment is over 6 mm long). Five thousand years ago, there may have been a larger *Stipa* grass growing in Coastal California, or the range of Indian rice grass (*Zizania* sp.) might have stretched across the Subarctic and down the Pacific seaboard into California.

These are extremely early dates for information regarding plant remains, especially related to grasses, although grinding stones are not uncommon in California deposits of this age. An informant who currently lives on the site recalled finding a small metate when he excavated a hole for a fruit tree (Singer and Atwood 1987:21). While one may consider the implications, it is extremely important to be cautionary in any interpretation of this recent find.

Large seeded grasses of the size observed from this site, if native, would be the largest such grasses found so early in all of Native North America. It is quite possible, given the proximity of a modern road, that these grasses could represent contamination from modern seed rain, but it is important to note that **all** of these large grass grains are at least partially charred, they were recovered deeply below the surface, and **no** unburned grass grains were present in the residues recovered from this site. Also, the limited sample from this site (less than 5 grams of floated charred material total) precludes making broad sweeping interpretations, but the grass caryopses are certainly worth of further work. For now this new information must remain tantalizing evidence to be substantiated or negated by further work.

ARCHAEOBOTANY AND RESOURCE MANAGEMENT

In general, these data reflect the utilization of locally available resources at both village loci. At the same time both data sets also provide evidence for the utilization of resources found at some distance as well. For *Helo'* the woody chapparal nut crops were a dietary source, but manzanita berries and slough plant resources such as *Chenopodium*, *Scirpus*, grasses were apparently much more common. As for nutrition, it is safe too assume that the major nutrient source for *Helo'* residents was the sea and its coast.

For *Talepop*, woody chaparral nut and berry crops were a significant part of the economy; acorns, islay, walnut, and manzanita were all significant contributions to their diet. Other very important plant resources at *Talepop* included grasses, in particular *Hordeum* sp. and *Phalaris* sp., the tarweed *Hemizonia* sp. and other composites, and a whole suite of small seeded plants including *Salvia* sp., *Chenopodium* sp., *Amaranthus* sp. and *Amsinckia* sp.

At the Morro Creek site, *Salvia* sp. and grasses were recovered in noteworthy numbers. The grasses are especially intriguing because of the unexpected morphological traits (discussed above), which appear to indicate the presence of species and perhaps genera that do not occur presently in the contemporary flora of the region.

Overall, plant remains indicate a wide breadth of resources exploited from several microhabitats. At *Talepop*, inhabitants utilized grasslands, oak woodlands, and chaparral areas for extraction of plant resources. In all of these areas fire may have been utilized to enhance productivity of plant crops, although the evidence is still rather thin. At Mescalitan Island, inhabitants

TABLE 6.10: PLANT GENERA DOMESTICATED IN EASTERN NORTH AMERICA

PLANT TAXA	# SPECIES NATIVE TO EASTERN U.S.	# SPECIES NATIVE TO CALIFORNIA	# SPECIES NATIVE TO CHUMASH REGION
Graminieae			
Hordeum	3	8	4
H. pusillum (little barley)	*	*	*
Phalaris	3	4	3
P. caroliniana (maygrass)	*	*	*
Polygonaceae			
Polygonum	5	26	3
P. erectum	*	-	-
Chenopodiaceae			
Chenopodium	5	14	7
C. berlandieri	*	*	*
Amaranthaceae			
Amaranthus	11	7	1
A. hypochondriacus	-	-	-
Cucurbitaceae			
Cucurbita	1	3	2
C. pepo (pepo squash)	*	-	-
Lagenaria	1	0	0
L. siceraria	-	-	-
Solanaceae			
Nicotiana sp.	0	4	3
Compositae			
Helianthus	20	10	3
H. annuus (sunflower)	-	*	*
Iva	4	3	1
I. annua (sumpweed)	*	-	-

KEY: * species altered by humans in Eastern U. S. is native to this zone;
- species that has been altered by humans is not native to this zone

Archaeobotanical info. after Yarnell (1986) B. Smith (1989);
California species based on Munz and Keck (1968); C.Smith (1976)

TABLE 6.11: COMMON PLANT SPECIES PRESENT IN STUDY SITES

	CA-LAN-229	CA-SBA-46	CA-SBA-1816	CA-SLO-165
NUT CROPS				
Fagaceae Quercus sp. (OAK)	X	X	*	*
Juglandaceae Juglans sp. (WALNUT)	X	-	-	-
Rosaceae Prunus sp. (ISLAY)	X	X	-	X
Pinaceae Pinus sp. (PINE)	X	-	-	-
BERRY CROPS				
Rosaceae Heteromeles sp. (TOYON)	X	-	-	-
Ericaceae Arctostaphylos (MANZANITA)				
A. glandulosa	X	X	*	-
A. glauca	X	X	-	-
Anacardiaceae Rhus sp. (SUMAC)	-	-	X	-
Caprifoliaceae Sambucus mexicana (ELDERBERRY)	X	X	X	-
Cupressaceae Juniperus sp. (JUNIPER)	X	-	-	-
NON-FOOD PLANTS				
Solanaceae Nicotiana sp. (TOBACCO)	-	-	*	-
Cucurbitaceae cf. Cucurbita sp. (GOURD)	-	*	-	-
Marah sp.	-	X	X	-

KEY: "X" PLANT TYPE PRESENT; "-" PLANT TYPE ABSENT;
"*" ONLY A TRACE ($N \leq .01$ GM) OF THIS PLANT TYPE PRESENT

TABLE 6.11, CONTINUED

SEED CROPS	CA-LAN-229	CA-SBA-46	CA-SBA-1816	CA-SLO-165
Cruciferae				
Lepidium sp.	X	X	X	X
Portulacaceae				
Calandrinia sp.	X	X	X	-
Montia sp.	X	X	X	-
Polygonaceae				
Eriogonum sp.	*	-	X	-
Polygonum sp.	X	X	X	-
Rumex sp.	X	X	*	*
Chenopodiaceae				
Atriplex sp.	X	X	*	-
Chenopodium sp.	X	X	X	*
Amaranthaceae				
Amaranthus sp.	X	X	-	-
Plantaginaceae *Plantago* sp.	-	X	X	-
Boraginaceae				
Amsinckia sp.	X	*	X	-
Labiteae				
Salvia sp.	X	X	X	X
Leguminosae				
Cf. *Lotus* sp.	X	-	X	-
Other	X	X	X	-
Rubiaceae				
Galium sp.	X	-	X	-
Asteraceae				
Hemizonia sp.	X	X	X	X
Madia sp.	-	*	*	*
Other	X	X	X	X
Cyperaceae				
Scirpus sp.	X	X	*	-
Poaceae				
Hordeum sp.	X	X	X	X
Phalaris sp.	X	X	X	*
Elymus sp.	*	-	-	*
Others	X	X	X	X

KEY: "X" PLANT TYPE PRESENT; "-" PLANT TYPE ABSENT;
"*" ONLY A TRACE ($N \leq 3$ SEEDS) PRESENT

obtained resources both from the grassy slough area near the site, as well as woody shrub species, most notably islay and manzanita, from chaparral areas at some distance from the site. Once again direct evidence of management strategies are lacking. On the other hand, historic and archaeobotanical evidence for the dune field area north of Point Conception appear to corroborate the point that this area was seasonally occupied by people who periodically burned off patches, presumably to increase the productivity of small seeds and bulb crops.

Thus far, site CA-SLO-165 provides our only evidence in the Santa Barbara region of morphological change in seeds that can possibly be attributed to selection pressures employed by humans. Yet given the limitations of this data set, this observation awaits further research for validation.

It is perhaps noteworthy that, of six plant genera which produced small seeded species that were domesticated in Eastern North America (Table 6.8), all but one have species that are native to California; and all but three genera have now been identified in archaeological deposits in the Santa Barbara region (Table 6.9). This does not reduce Western North America to an annex of food production strategies of the East but rather indicates that California is part of a widespread subsistence pattern, the extent of which we are only just beginning to comprehend.

CHAPTER 7

ENVIRONMENTAL MANAGEMENT, SEDENTISM, AND THE HOME RANGE ADVANTAGE

ECOLOGY OF BURNED PATCHES

The **effective landscape** is that spatial area made up of functional features responding to impacts by a group of organisms and a specific regime of physical disturbance forces. When humans are involved this is also known as the anthropogenic landscape. In the Santa Monica Mountains of the Coast Range in a seemingly harsh rocky, scrubby coastal mountain environment, the Chumash employed limited management schemes that enriched and enhanced productivity of local resources. The sources of evidence--ethnohistory, archaeobotany, and the modern vegetation all indicate that Chumash management techniques modified the disturbance regimes to which these vegetation types had already adapted and evolved. The Chumash manipulated landscapes and managed resources by intensifying disturbances locally, thus defining their effective landscape.

The above sources of information allow us to characterize the effective Chumash landscape in more general terms. The interior woodland areas of the Chumash region was canopied by the same range of native species that exist today. The modern dominant chaparral species (chamise and ceanothus) do not produce fruits that were utilized as food by the Chumash. Food shrubs, such as islay, manzanita, and oaks would have dominated slopes near human communities. On the other hand, chamise and ceanothus do produce deer browse with immature and good firewood when more mature. They may well have been left growing in areas peripheral to habitations, for hunting and fuel collection, especially in microhabitats where food producing shrubs would not thrive. Like the other species discussed, moderate fire would do these species no harm. For example, a good part of the wood burned in the yucca roasting pits at CA-Ven-1020 was chamise. To date, no systematic attempt has been made to distinguish between charred wood remains from sites, although this would be a worthy avenue for future work.

Some important food-producing woody shrubs, such as walnuts and some oaks, tend to prefer areas along drainages. They often are accompanied by an understory of grasses, composites, and whole suite of other herbaceous plants, depending upon microenvironmental conditions and site history. These limited spatial suites, or anthropogenic associations could be considered MRPs (multiple resource patches) in terms of management and monitoring, although collection may have operated more as a series of overlapping SRPs. Valley oaks live as solitary individuals on hilltops and most likely would have been managed and harvested primarily as SRPs; the herb and tuber understory would have been collected differently and a great deal earlier in the season than the acorn harvest. Islay and manzanita grow on relatively steep slopes in small north-facing stands. These shrubs rarely have many understory plants beneath them, and would have most likely been managed and harvested as SRPs, perhaps checked early in the fruiting season during hunting excursions into the foothills. It is safe to assume that food producing shrubs would have been given preference over non-food plants in any management decision making, although this may be proven false with further research.

The Burning Question

None of the woody shrubs revealed a real <u>need</u> for fire to stimulate fruit production, although field observations based on a single field season must remain inconclusive regarding this point. What these data do reveal is that "intermediate levels" of fires do **not** harm these plant crops, and that apparently any kind of disturbance that opens the canopy **can** allow selected crop plants to expand at the expense of non-crop plants, especially if people help.

No important food crop of the Chumash was shown to suffer permanent damage or deprivation due to fire; rather, in the case of smaller herbaceous, grassy, and subsurface tuberous crops, fire can be shown to have improved the productivity of these crops. Thus for all terrestrial food crops, the Chumash had nothing to lose by investing in prescribed burns at a periodicity of between 5 to 10 years for grasslands, and 10 to 20 years for woody chaparral, both more frequent than the 40 to 70 year interval postulated by Minnich (1983) for non-anthropogenic regime. In the case of productivity, enhancement of game, fruit production, resource access and travel considerations, the Chumash had very much to gain by implementing prescription burns.

CHUMASH DIET AND LANDSCAPE MANAGEMENT

Looking over past archaeobiology reports, it is evident that the Chumash relied on a mixed omnivorous diet of 1) animal wildlife including shellfish, fish, sea mammals, small and large terrestrial mammals, plus (historically) European domesticated animals. There is good evidence for the Chumash exploiting several zones of sea fishing including coastal strand to deep sea fishing (Johnson 1982), and even interior occupations such as *Talepop* had substantial shell deposits from consumption of shellfish. And now there is information on the plant portion of the diet as well.

The chaparral burned naturally, and there are indications that the frequency of burning may have been increased in the area around settlements such as *Talepop*. Higher frequencies of human food producing plants probably benefited at the expense of non-food producing plants, except where fuel/foliage plants were not competing directly with food plants. Fires naturally rush down canyons every 40 or more years in the chaparral (Minnich 1983). Ecological evidence indicates that woody plants fruit production could have been enhanced by Chumash fires every 5 to 10 years to keep production stimulated.

Previous ethnohistorical research (Timbrook *et al.* 1982) has demonstrated that the Chumash living in the foothills north of Goleta Slough burned the grasslands in patches, and the botanical evidence for that area supports these observations. Archaeobotanical and ecological evidence indicates that grassland areas just north of Point Conception may have been burned at even shorter periods, perhaps 5 years or less between burns for a given patch. Prevailing wind patterns and the coastline itself would surely have helped buffer fires and reduce the risk of a runaway fire. The rewards in terms of increased productivity of seed crops would have been substantial.

It is difficult to imagine what the grasslands would have been like prior to the introduction of the annual species. Burcham has characterized the grasslands as dominated by bunch grasses, and one could presume that increased fire periodicity would intersperse grass clumps with other species enhanced by fire, such as most native Californian bulb and tuber crops (i.e. blue dicks, mariposa lilies, soap root, and yucca).

By far most plant crops utilized extensively by the Chumash appear to be more productive in open areas, typically created by disturbance. These include bulb and tuber crops, islay, manzanita, and many herbaceous plants. Islay also appears to respond with improved fruit productivity in recently burned areas. Where fires have occurred in the last ten years the plants have already resprouted new limbs that in some cases are near the height of the plant prior to the last burn. In my survey work I found that Islay plants growing in truly exposed areas, such as roadsides, were generally more accessible and were at least as productive as those specimens in more rocky and isolated locations. I see no reason to assume different for its prehistoric habit.

WEATHER, LOCAL KNOWLEDGE AND THE HOME RANGE ADVANTAGE

This work has largely ignored the means by which basic resource information was comprehended, stored, transmitted and acted upon within the traditional society. This would be a project by itself, and surely cannot be adequately covered here. However, there obviously was a mechanism for storage and transmission of this information and the responsibility was quite likely held by the specialist known in Chumash society as a weather shaman, or rainmaker.

Sometime between 1797 to 1823, Jose Senan, O.F.M., translated a Ventureno Chumash Confesionario from Spanish to Chumash (Beeler 1967). This manuscript directed priests to interrogate **neophytes** with the following set of questions and expected answers regarding medicine people, healers and doctors:

Q. Have you ever doubted what God teaches?
Q. Have you ever believed in dances, and do you scatter seeds and beads (useless practices of the heathen)?
Q. Tell (me): when you danced, did you believe it to be true (that) you wouldn't get sick?
A. I didn't believe it, (but) because I saw others dancing, that is why I danced.
Q. Tell (me): did you believe that by scattering seeds, etc. you would kill fish? That there would be plenty of seeds, and deer, and rabbits and jackrabbits?
A. I didn't believe it; [because] I saw the others doing it, th[is] is why I did it.

Q. Do you believe in those (him) you people say make(s) it rain, who make(s) acorns grow, and who (badly) heal(s) the sick?
(Alustesh, the quack healer [medicine man]
(chamushtey, to heal badly
(Alagiepsh, the good healer, with herbs etc.
(sagiepu[s], to heal well

Q. And when you were sick, did you ever have yourself healed (badly)?
Q. Are you an evil healer (a medicine man)?
Q. How often have you cured the sick in this manner?
Q. Don't cure in this manner, because it is evil, you deceive the people, and there is no reason for [giving] you beads in payment. (Beeler 1967:25-27)

Apparently these lines from the Chumash Confesionario were intended to investigate the influence of healers, medicine men, and/or rain makers among the Chumash, practitioners whom the Spaniards obviously found threatening to their spiritual power base. From the interview questions, one the impression that these spiritual specialists were believed to be able to manipulate weather and food productivity with scatterings (offerings) of seed and beads.

At the Lowie Museum (Appendix I) is a piece of blue cloth wrapped around some seeds, collected by two archaeologists Franklin Fenenga and Fritz Riddell. The cloth and seeds is said to be part of the "outfit" of the Ventureno Chumash weather shaman, "Somik", who lived at Tejon in the 1870s. This cache of seeds was identified by botanists as snapdragons (*Antirrhinum majus*), *Coreopsis tinctoria*, *Coreopsis lanceolata*, and *Cosmos bipinnatus*. All species are not native to California, although all genera have native species in North America. It is impractical to decipher what these seeds meant to this shaman, but the considerable evidence regarding the activities of these spiritual guides invites speculation. The seeds could have been cast on the ground as part of an offering. Such an offering made near a kitchen midden or other suitably disturbed area would have a predictable result. Of course, such an offering would have quite limited impact on the overall **effective** landscape and none of these are known to have been a food plant. But sprouted plants from such offerings could have served as reference plots near the village used to monitor growth and predict the harvesting schedule for nearby grassy slope "patch" sites. Or the seeds may have been planned for experimental observations. With the information available, it must be assumed that the seeds in Somik's outfit were not an accident.

Bean (1972) has argued that for the Cahuilla, rituals and social institutions had regulatory functions related to resource redistribution, conservation that far outweighed the alternative of inter- and intra-group conflicts and resource competition. The Cahuilla, whom inhabited a more arid environment than the Chumash, nevertheless relied upon control or ownership of specific resource patches to ensure the conservation of crops so that these were not overexploited. This tie to a specific landscape, and the knowledge related to its microenvironmental constraints and fluctuations, gave individuals with the long-term local knowledge of a specific territory a distinct home range advantage.

LESSONS OF A SEDENTARY NATIVE CALIFORNIA SOCIETY

Sedentary here is considered a permanency in the neighborhood, a perception of home range and territoriality that is passed on generationally, inherited by those who follow tradition. Historically much of the anthropological literature has reserved the term sedentism to refer to people who occupied sites year long. Yet an equally viable definition would be that they maintained residence at the same locality through long periods of years. **Sedentism** is the state of staying in one place. Due to a western bias, the term has often been defined (either implicitly or explicitly) as inhabiting one house or compartment all year long, for a period of years. In contemporary North American societies that usually translates from three to thirty years. In many--

even most--contemporary North American communities, it is now unusual to stay in one house for more than a generation. But in Native North American communities, sedentism may be measured by spending hundreds, or even thousands of years in one locale, rather than a specific dwelling. Of course, many residents of such a community travel away from their homes to obtain resources, to visit relatives and trading partners; this diversity in cultural strategies provides a valuable change of pace and enrichment through pleasure, sport, and work.

For over 50 years it was a commonly held assumption in California archaeology that the native population did not occupy permanent settlements. They were considered not to be sedentary, but rather semi-sedentary or even transient. This assumption has no scientific basis in either the archaeology, or the historic or ethnographic record. Many, perhaps most Native Californians today live within 100 or 200 miles of where their ancestors did 10 or more generations ago. Several important mission register researchers including Chester King, Randy Milliken, Bob Gibson, John Johnson and Bob Edberg have documented back five or six generations through mission records for hundreds, perhaps thousands of decendants of the coastal belt of missions from the San Francisco Bay Area to San Diego.

Apparently the typical pattern, at least for the Chumash, was the occupation of residence sites for hundreds of years at a time, with small excursions to special activity sites seasonally. Often prime habitation locations were reoccupied even after a hiatus caused by Spanish imposed rule. This makes perfect sense from the standpoint of managing the diverse resources that were exploited by the Chumash. It was only due to disease and cultural circumstances surrounding the invasion by Anglo-americans that several of these permanent occupation areas were finally abandoned.

Anthropogenic mosaics surrounded woodland communities, with grasslands burned off in patches, and in the chaparral, fires sweeping up canyons favoring food shrubs over non-food, with some help from human selection. Chumash weather shaman provided spiritual guidance in reading and manipulating those meteorological aspects of the landscape that could not be directly controlled. Local knowledge facilitated the extraction of a wide range of resources. Food resources found within a few hours travel apparently always were more common than imported food items, although all but special use sites produced some evidence of long distance trade and/or travel.

The Chumash traditional resource management strategies were diverse, wide range, and apparently rather successful. Their overall adaptation allowed them to be supported at relatively high numbers, and perhaps at times at the expense of their neighbors. Overall the natural rich diversity and productivity of their region was enhanced by resource management strategies that reduced the spatial scale and increased the periodicity of naturally occurring disturbance regimes. The long term result of the cessation of these practices accompanied with other management schemes of Anglo-Americans, was a radical modification in many aspects of the landscape. Contemporary resource managers are only beginning to recognize the legacy of Native American resource management strategies.

This study has been dedicated to recovering some of the information lost with the passing of the last generation of traditional Chumash practitioners. Their descendants, living Native Californians, are now requesting from our generation of scientists a return of their past. Their grandparents entrusted some of this traditional knowledge of places and resources to early ethnographers and curators. To this information, I have added the evidence recovered from archaeological excavation and ecological survey. Native

Californians feel the need to renew their bond with the past by obtaining access to the resources and information they once solely controlled. Their request is not unreasonable. By passing back this information, we enrich and honor both their traditions and our own.

CHAPTER 8

ECOLOGY OF SEDENTARY SOCIETIES WITHOUT AGRICULTURE: PALEOETHNOBOTANICAL INDICATORS IN NATIVE CALIFORNIA

OBJECTIVES RECONSIDERED

I have argued that Native Californians were able to maintain one the highest aboriginal populations densities in North America by social maintenance of trade alliances, by storage (both in the form of food and non-perishable wealth items, in particular shell beads), and by increasing the productivity of their naturally diverse resource base through land management practices (such as burning and clearing).

A series of propositions or hypotheses were developed regarding resource management schemes and environmental constraints and cultural dynamics:

H. 1) Resource management strategies such as burning and clearing can be detected archaeologically through identification of specific plant taxa responses to various disturbance regimes and then assessing the frequency of disturbance indicator species relative to non-disturbance species in archaeological deposits.

The majority of this work has been directed toward developing techniques and accumulating data to test the above assertion. Through review of botanical literature regarding herbaceous and grassland species of the region and field studies related to woody shrub species it is now evident that most plant taxa that were economically important to the Chumash would have benefited in terms of fruit production due to intermediate disturbance regimes that served to prune the plants and clear away competition.

A more difficult part of this problem is attempting to distinguish between human derived and non-human derived disturbance. Using Minnich's (1983) work as a baseline for predicting chaparral fires, it is safe to assume a forty year interval for fires without human intervention or encouragement.

Economically important Chumash species benefited from disturbance frequencies a great deal more rapid than that. The archaeological and historical evidence appears to indicate that grassland areas north of Point Conception were subjected to fires at intervals that encouraged fire follower species such as bulbs and many herbaceous small seeded taxa. The presence of lupine in deposits of both *Talepop* in the Santa Monicas and in a site north of Point Conception suggests a periodicity of less that seven years as a norm.

H. 2) Aboriginal resource management, which in this case was an early stage of plant husbandry, may have been gradually altering the morphology of various seeds and nuts. Archaeological plant remains may provide evidence of extinct species, enlarged seed size, or various other types of modifications resulting from selective pressure.

For the most part, the evidence for plant modification from selective pressure remains modest. On the other hand, information from CA-SLO-165 in Morro Creek Canyon (Chapter 6) offers tantalizing evidence of the possibility of enlarged grass caryopses of a species of Hordeae or Aveneae at dates between 5000 and 6500 B.P. (Singer n.d.). In terms of size they most resemble *Avena* sp., in terms of variability of central venation (dorsal groove) they resemble *A. fatua* and several *Hordeum* spp. The embryo, which apparently readily detaches from the caryopsis is morphologically like that of *Hordeum* sp., in particular *Hordeum pusillum*, although they are substantially larger than previously recognized specimens of this taxon. But this limited information needs the concrete substantiation or refutation that only time and a great deal more research can resolve. There remain two basic questions: are these specimens of the crop plants identified elsewhere in North America? And if they are, were they introduced prehistorically through trade or historically through European contact and its subsequent disturbance of the native habitat?

H. 3) During the Late Prehistoric Period, Native California groups' exploitation patterns emphasized locally available resources with supplements from other areas through trade. Several patch types were managed and utilized directly by each local group and several others were exploited indirectly through trade.

Trade has been demonstrated historically by a series of previous authors (Sample 1950; Davis 1961; Bean 1974; King 1974; Heizer and Elsasser 1980). Archaeobotanical evidence provided a basic outline for Chumash diet, identification of important crop plants and thereby evidence for the exploitation of a variety of patch types. A study of the variable effects of disturbance on important Chumash plant crops (Chapter 4) has demonstrated that in general Chumash crops do respond favorably to clearing and burning at intermediate levels of disturbance.

H. 4) After European contact, during the early Mission Period, native inhabitants living away from the missions continued to rely on native foods with the missions being utilized to supplement native foods.

A logical test for this hypothesis is derived by archaeological analysis of the mission period deposits of *Talepop* (CA-LAn-229) and *Helo'* (CA-SBa-46). Analysis of these remains indicated a continued reliance on native species; only *Talepop* (CA-LAn-229) produced evidence of concomitant exploitation of Euro-american plant and animal species, in particular corn, beans, wheat and beef. This difference is likely due to the differences in the activities pursued by the Chumash after the imposition of Spanish missionary rule. From historic records it is evident that the Chumash who were sent back to Rancho de Ortega after the first abandonment of *Talepop* were involved in raising cattle and attempting to grow corn, beans and wheat. This is precisely what the archaeological deposits indicate. Whereas, after the arrival of Spaniards, the occupants at *Helo'* with their fleet of boats were employed in fishing and other boating activities. The *Talepop* subsistence base was more radically disrupted by Spanish rule than the subsistence activities at *Helo'*. But in both cases they continued to rely on some traditional food resources.

H. 5) A drastic decrease in resource management practices during this period and the introduction of Old World plant species and cattle resulted in less productivity of native resource. Thus, mission foods would have been a more substantial dietary supplement than the trade items had been prior to contact.

A decrease in resource management has been previously documented by in the form of the prohibition of burning issued by Spanish Governor de Arrillaga in 1793. Historic documentation has confirmed that the Chumash did utilize prescribed burning as well as intellectual management techniques employed by weather and spiritual specialists including weather forecasting and religious offerings of seeds, beads and prayers. The differences between *Talepop* and *Helo'* in relative changes in diet discussed above can be taken as one line of indirect evidence related to this hypothesis.

Direct botanical evidence for decreased environmental productivity is a great deal more difficult to test, although the widespread early presence of European "weedy" plant species is evident from early mission adobe studies (i.e. Hendry 1934) and from archaeological deposits from the historic levels of *Talepop* (CA-LAn-229) and *Helo'* (CA-SBa-46). Evidence for absence or presence of changes in frequencies of crop plants, resulting from microhabitat alterations due to a change in environmental regimes, could only be identified through study of specific taxa. Preliminary field studies of key Chumash species indicated that manzanita berries and red maid seeds recovered from site deposits of the Century Ranch Site Complex did occur in higher frequencies than are available on the present landscape within that general vicinity. Thus an inference has been made that these two particular species, both known to benefit from moderate burning and clearing, did decrease on the landscape due to a cessation of management practices. An alternative possibility is that they were never common in the area and they were imported through trade and/or travel to the *Talepop* area. In either case they were common enough in the general resource catchment in order for them to occur relatively high frequencies at *Talepop*.

Any proto-domesticated plants that might have been becoming dependent upon native management practices would have been the most vulnerable to these new competitive factors, particularly in light of the concurrent forced neglect by the native inhabitants. As stated above, morphological evidence for "proto-domesticated" plants remains very tenuous at present, although not entirely absent.

REVISED RESEARCH QUESTIONS FOR FURTHER STUDY

The current study has provided a more accurate depiction of native landscapes and land use at local and regional levels in non-agricultural societies such as Native California. In order to fully ascertain all the factors affecting human/environmental interactions in such a setting, it has proven necessary to utilize diverse data sets drawn from archaeology, botany and ecology. As stated earlier best test cases for such research questions simply do not exist in the real world of multiple disturbance caused landscapes; nevertheless, this present study has sparked a number of more refined questions to direct future research regarding the role of anthropogenic disturbance in Native North America:

1) When is a field anthropogenic? How can we recognize non-agricultural, but managed field situations, such as those that apparently occurred north of Point Conception in the late 1700s? Can anthropogenic disturbance be distinguished from non-human caused disturbance?

In 1972 Henry Lewis proposed four means of testing his hypothesis regarding human set fires in SW Asia and the important role this strategy had prior to and during the period of domestication of plants and animals in that region. His tests include:

1) examining evidence of ash lenses to determine if they are remains of hearths or other cultural features, or if they resulted from areal burning;

2) ethnographic analogies;

3) evidence of "unnatural" seasonality of burns;

4) pollen evidence of changes in frequencies of plant species (e.g. increase in cerealia pollen).

Charred plant remains, not pollen, provide the best direct evidence that people were (or were not) exploiting specific resources, such as an increase in cereals (or other grass and herbaceous plants) or a decrease in shrubs and perennials. Even if frequency changes could be identified through the pollen record, it would be difficult to determine whether it was caused by burning or climatic fluctuations.

The region of California and the area above Point Conception in particular provides our best evidence of possible "seed fields". Archaeological evidence from recent sites excavations and ethnographic and historic evidence indicate extensive use of fire as a landscape manipulation tool. The presence of lupine seeds and several kinds of bulbs in such high frequency suggest collections in areas than had been burned within the last seven years. A great deal more work is needed in this dune area.

2) How does a resource manager in a given microhabitat assess intermediate levels of disturbance, or the levels most beneficial for the resource(s) in question?

Minnich (1983) predicts that with no human intervention, the length of time between fires in the California chaparral averages 40 years and can extend to 70 years. From the point of view of a resource manager it may be appropriate to consider an intermediate level of disturbance as any period of years less than the 40 years necessary to generate a plant's own source of fire fuel, and yet enough years after a fire to allow regrowth of the plant's fruiting stems and branches for ample fruit production. Based on field survey it can be argued that this mixture for most woody shrubs is 10 to 20 years, for oaks 5 to 20 years, for grassland 5 to 10 years. In both cases, it was not a question of imposing an artificial regime onto a landscape, but rather it would have been a matter of changing scale of disturbance, fine tuning it to enhance productivity and diversity. Traditional resource managers gained this knowledge through experience over generations. For modern managers, the information is still obtainable, but more problematic to acquire this information within their rather limited time framework.

3) How can the potential resource base of diverse landscapes be assessed?
Pulliam (1988) has recently argued that population ecology theory may require substantial revision because it does not recognize that populations occur in a mosaic of patches. According to Pulliam ecologists often make the mistake of focusing only on one habitat and ignoring the mosaic of neighboring habitats.

Following the procedure outlined above it should be possible to study suites of resources produced from a mosaic of patch types, to identify each element's environmental needs and to assess the contribution of each resource element to a society's diet, land use and landscape. This procedure, while still much in need of revision, provides our best yet effort toward interactive human/environmental reconstructions and depictions.

It is evident that the Chumash economy was dependent upon a complex strategy of scheduling and land management to enhance and ensure plant resource productivity. The rewards were a wealth of storable plant crops, which when added to the wealth of coastal resources, gave them the ability to support a relatively dense and stable population without agriculture. The diversity of plant resources exploited throughout the Santa Barbara region and the wide range of variation between microenvironments compels us to reevaluate earlier models of Native Californian subsistence. The widely cited ecological model by Baumhoff (1963) and a later refinement by Gages (1979) simplify Native Northern California subsistence to a tripartite diet of fish, acorns, and deer. Although these are indeed important items throughout much of Native California, the diet of Central and Southern Californians appears to have been a great deal more diverse.

A great deal more research is required before the full scope of Native Californian management practices and their microenvironmental impacts can be determined. The above approach is offered as a feasible set of methods for environmental analysis. With some refinement and further study, this approach should contribute to a more complete understanding of the complex plant food production and management strategies of Native California in particular and those of Native North America as a whole.

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APPENDIX 1

LOWIE MUSEUM INVENTORY, 1988

ETHNOBOTANICAL MATERIALS

NOTE: Comments Within " " Were Noted On A Label Curated With Specimen.
H: Height (Thickness); W: Width; L: Length
PHOTO/SKETCH: Made by J.E.H., 1988; SUPP.: See Append. 3

SUPP.	PHOTO	SKETCH	CABINET #	DRAWER #	CATALOG #	DESCRIPTION/COMMENTS
			14	1		Skipped, too heavy to handle
			"	2		Skipped, too heavy to handle
			"	3	1-220776	L. Dawson's materials: acorns, pinenuts, etc.
			"	"	1-220777	L. Dawson's materials: acorns, pinenuts, etc.
			"	"	1-220778	L. Dawson's materials: acorns, pinenuts, etc.
			"	"	1-220783	L. Dawson's materials: acorns, pinenuts, etc.
			15	4	CALIFORNIA UNSPECIFIED	
			"	4	1-14041	10 Large Nuts-cf. Buckeye
			"	"	1-14038	Jar of berries; too cloudy to see: "Manzanita Seed"
			"	"	1-19768	Jar of (wormy?) mealy material; big chunks
			"	"	1-14040	Jar of ground meal; brown; powder
			"	"	1-19769	Sage seeds; Large and lenticular; Aprox. 1/4 cup
			16	1	"DIEGUENO" - MESA GRANDE	
			"	"	1-13744	Three tubers-about 6" long; Fibrous
						"Tolache roots" "Waterman, 1907" "Datura metuloides"
	X		"	"	1-64612	Devil's Claw (Martynia); Fiber pod Approx. 18" long
			"	"		"Martynia Lousianica"; Diegueno Manzanita Res.
						Collected by B. Gerow" 1940
	X		"	"	1-12996	Brown Seeds, some w/mottling; cf. Salvia
						"Sage seeds used as food"
			"	"	1-12965	Leaves and pods; looks like Datura
						S.A.Barrett, 1907
			"	"	1-14489	(Originally #149) Trifoliate Leaves;
						Looks like sage brush-Artemisia sp.
			18	1	1-64614	Unknown Plant, Branch w/leaves-no seeds;
						Plant for dyeing yellow" Martinez Res.;
						Collected by B. Gerow 1940"
			"	"	1-64615	Ditto, but different plant; "Dyeing black"
			"	"	1-14410	"Specimen of tcia" T.T. Waterman's notes: Acc.#57
						"Seeds used for food when parched and ground"
						(Mixed w/other seeds); Cahuilla Res.
						Also few Salvia seeds in bottom of tray;
						Fuzz throughout; cotton from Museum?
						"Salvia plant, from which chia seeds
						"Are obtained; Cahuilla"; Old acc #342
						Old acc.#342; "Thistle sage (Salvia carduacea)
						"See letter from H.M. Hall;
						Letter not in vault 7/6/90 J.E.H.

SUPP.	PHOTO	SKETCH	CABINET	DRAWER	CATALOG	DESCRIPTION/COMMENTS
					VENTURENO CHUMASH	
			19	1	1-84644	(ACC. 953) Coll. by Fenenga and Riddell;
			"	"	TO	Part of a Weather Shaman's outfit, originally
			"	"	1-84667	put together and used by Somick, a Ventureno
			"	"		Chumash who lived at Tejon in the 1870's
			"	"		although his Tubatulabal descendants
			"	"		inherited the outfit, none were using it,
			"	"		The other part of the material is said
			"	"		to be owned by a private collector
			"	"		Somewhere in the Kern River Region
			"	"	1-84662	Mixed Seeds and Seed Pods in Piece of blue shirt
			"	"		Composites, grasses and unknown pods--"Stash";
						Ca. 70 cc of Plant material
						"Tied in Rectangular pc. of blue denim shirt.
						"Plant Material: Antirrhum majus, Coreopsis tinctoria,
						"Coreopsis lanceolata, Cosmos bipinnatus"
			"	4	KAWAIISU	
			"	"	1-28032	Says #25
			"	"	1-25017	Part of large tuber; appears quartered long way;
						Measurements: 1.25" x 1.25" x 4.5"
			"	"		Coll. By Gifford, 1928: Site 'C' 20" Deep
			"	"	1-28028	Paper thin cross section of Unknown;
			"	"		Root?; 1" X 2" X 2.5"; "Fungus"
			20	2	TUBATULABAL; SO. FORK OF KERN RIVER;	
						Coll. By E.W. Voegelin, 1932
	X	X	"	"	1-19798	Brown object w/basketry/textile impression
			"	"		29.3 gm; 2 cm X 2-3 cm X 5.5-6 cm;
	X		"	3	1-28781	Soaproot bulb "for detergent and fibers"
X	X		"	"	1-28573	Grass stems w/seed; "Pealed twigs for
						basketry manufacture" "Found buried in shallow
						Pit underneath rocks above Anyx, 2, side of
						Chimney Canyon, near mouth of Canyon.
					TUBATULABAL	
			"	"	1-28788	2 Pine cones-some kind of fire pine
			"	"	1-28789	String of Pine nuts (Approx. 30-35)
			"	"	1-19799	Looks like soil sample; lots of organics,
						but hard to see through glass
						"Tubatulaboal S. Fork Kern River" "Salt grass ball"
X	X		"	"	1-28782	Jar of seeds-looks like large Salvia again;
						Great difference in size--maybe 2 types;
						i.e. #1: Approx. 1 mm X 2 mm X 3 mm
						#2: .75 mm X 1 mm X 2.25 mm
						Chia and other seeds";
						Note: .5 gm Subsample From Jar
						Contained 97 Small And 95 Large Salvia seeds
						See Also, Append. 3
			"	4	KOSO (PANAMINT)	
					1-235195	"Panamint, Indian Camp, Inyo Co. Dec. 1897"
						Code 8.3 "Basket Material" "Dia. 13 cm."
						"Devil's Claw" Panamint 30-32 cm long

SUPP.	PHOTO	SKETCH	CABINET	DRAWER	CATALOG	DESCRIPTION/COMMENTS
			20	5	YOKUT	Fir needle and soaproot brooms
			"	6	CHUKCHANSI YOKUTS	
			"	"	1-10454	Several Jars of Leaves, presumably tobacco
			"	"	1-10458	Jar of "Powder"-No visible seeds, but jar Walls dirty; Unable to open w/out breaking
			"	"	1-3956	Jar of acorns--"Necklace of acorns" Coll. By A.L. Kroeber 1/8-17/1904
	X	X	"	"	1-4007/8	"Mano Shaped" "Cakes of brown material; Smells Like Tobacco Could be Same as Tubatulabal Item # 1-19798 above One almost whole 4 cm X 7 cm X 10 cm (Photo) "Tobacco; Coll. by A.L. Kroeber 1/8-17/1904"
	X		"	7	1-10391	(2 Jars) of "Unspecified Tubers" "For Food" Coll. by "Barrett, 1906"; some could be Brodiaea, Or more Likely Mariposa Lilies; Unsure
			"	"	1-10389	(5 Jars) "Ground Manzanita Berries" "Ready for Leaching and Making to Cider"
			"	"	1-10417	(1 JAR) "Digger Pine Nuts" ; Roughly processed With other cone parts sometimes attached
X			"	"	1-10440	(Jar) Tarweed? Also Few Other Seeds in Jar; "Unspec. Dark Brown Seeds"; "Used as Food" Coll. by "S.A. Barrett, 1906"
			"	"	1-10418	(3 Jars) "Dried Elderberries"' "Used as food" Coll. by "S.A. Barrett, 1906"
X			"	"	1-10390	(3 Jars) Looks Like Composite--Tarweed?; Also Bit Grass Etc.; Unspec. Flat Black Seeds Note: #'s 10440 and 10390 look same to Me (Without Opening Jars)
X	X		"	"	1-10438	(1 Jar) "Unspec. Small Angular Seeds" Not much to elaborate here, except brown.
X			"	"	1-10388	(3 Jars) "Unspec. Brown seeds" ; Salvia sp.; Possibly 2 Kinds; 1 Lenticular, 1 Trigonous.
X			"	"	1-10441	(1 Jar) "Unspec. Glossy Seeds" "Used as Food" "Glossy LT. Brown Seeds--S.A. Barrett 1906" Salvia sp. can't distinguish from this and # 10388.
			"	8	CHUKCHANSI YOKUTS, MADERA CO.	
					1-4022	"Live Oak Acorns" "'Tcasis' used as food; Coll. by "A.L. Kroeber 1/8-17/1904"
					1-4021	"White Oak Acorns" "Kemexi'; Used as Food; Coll. by "A.L. Kroeber, 1/8-17/1904"
			"	"	1-10416	"Sugar Pine Sugar" (3 JARS) "used as medicine; Coll. by "S.A. Barrett 1906" Big chunks of dark brown material
X			"	"	1-4055	"Unspec. Black Seeds; "Food; 'Gacun'" (Chia?); "Gathered on Plains; A.L. Kroeber 1/8-17/1904" Cheno-Ams; Looks like Amaranth through Glass
			"	"	1-4034	"Wild Onion Seed; Food; 'Ceetin'; Coll. by "A.L. Kroeber 1/8-17/1904"
X			"	"	1-4023	"Unspec. Seeds; Foods; 'Tcanit Seeds'"; (Salvia) Coll. by "A.L. Kroeber 1/8-17/1904"
X		X	"	"	1-4033	"Unspec. Seeds" "Food 'Tcilelak, Seeds from Plains" Tan color; looks like Grass; Looks like #4023 Coll. by "Kroeber 1/8-17/1904"

SUPP.	PHOTO	SKETCH	CABINET	DRAWER	CATALOG	DESCRIPTION/COMMENTS
					CHUKCHANSI YOKUTS, CONT.	
X			20	"	1-4032	"Unspec' Seeds" "Food; 'Ce'ekin' Seeds" "Grows about hills, White Flower: Kroeber 1/1904" Cf. Boraginaceae: Amsinckia or Plagiobothrys
			"	"	1-4031	"White Oak acors" "Food 'Wimi'" Kroeber
			"	"	1-4020	"Manzanita Berries" "'Aptcu', "Manzanita Berries, Used as Food"; Crushed or Partly Decomposed
			"	"	1-4030	"Unspec.' Red Berries" Toyon? "Food, 'Goco', "Red Berries; from a large bushin the hills"
			"	"	1-4019	"Unspec' White Roots:; Cacomites?
			"	"	1-4018	"Digger Pine-Nuts"
X			"	"	1-4025	"Unspec. Looks like #'s 10390 & 10440
			"	"	1-3984	"Black Acorns" "Food"
			"	"	1-4024	"Unspec. Red Berries" "Food, 'Taxati' Red berries: Possibly Manzanita--can't open jar w/out breaking
			"	"	1-3983	"Black Acorns" "(Food)"
			"	"	1-4027	"Elderberries" "Food, 'Uceta'"
			"	"	1-4026	"Unspec. Seeds" "Food, 'Golgol'; Angular and Brown; "Small Seeds Growing in Foothills"
			"	"	1-1054	"Unspec. Seeds Food 'Xe'lic'" "Seeds Gathered"' Relatively Large Salvia sp.
			"	"	1-4051	"Wild Potatoes Food, 'Dena'"
X			"	"	1-4043	"Unspec. Small Seeds" "Food, 'Kiaunum' "Small Seeds' Growing in Hills; White Flower" Small Brown Angular Seeds
			"	"	1-4085	"Buckeye" (2 Fruits) "Food and Fish Poison"
X			"	"	1-10462	Unspec. Angular Seeds; Used as food"
			"	"	1-10463	Meal Made from #10462"
			"	"	1-10460	(2 Jars) "Unspec. Dark Brown Seeds; Flat Dark Brown Seeds Used as Food" Also Some other Seeds--Grasses, Etc.; May Characterize a Field
			"	"	1-4045	"Used as Medicine"; Big Chunk of Wood with (Fungus) attached; Wood is not Ring Porous
			"	"	1-10392	Unidentified stems W/leaves
			"	"	1-10387	Stems w/leaves and flowers attached; Lots of Fragments; Tan Seeds" (Or Floral Parts?) "Aromatic Herb used to make Beverage--Not Medicine"
			"	"	1-10461	"Cake from Seed Meal; Yokuts; Made from #10460" 8 mm X 7 mm X 10 mm Lots of Different Seeds Visable; (i.e. Composites and Grasses)
			"	9	1-3957	Soaproot Bulb
			21	1	YOKUT	
			"	"	1-10827	(2 Jars) "Unspec. Small Black tubers" ""Tibus" Blackish tubers or rhyzomes "Used as food. These grow about Tulare Lake." "They have a flavor like that of Chestnuts." "Yokuts, Dunlaps, Fresno CO."

SUPP.	PHOTO	SKETCH	CABINET	DRAWER	CATALOG	DESCRIPTION/COMMENTS
					YOKUT, CONT.	
			21	3	1-27036	Lots of Gaming Pieces made of Walnut
			"	"	1-27037	Lots of Gaming Pieces (Walnut)
			"	"	1-10792	Rattles made of Pods--Cocoons of Silk Moths
			"	4	1-10860	"Salt Grass Seed Meal; Used as food; 'A lil'" Light brown--Mostly looks like Dirt with some Small woody frags.--stem frags?--Achene coat frags? L. Dawson says Yokuts beat the plant w/sticks To release resinous glands
			"	"	1-10861	(2 jars) "course acornmeal"
			"	"	1-10862	(2 jars) "fine acornmeal"
X			"	"	1-10854	"Unspec shiny black seeds" "Kecin" "Used as food"; Centrospermae (can be opened)
			"	"	1-10866	(2 jars) "Kak'ati" can't open
			"	"	1-10865	(2 jars) "shelled acorns-pawiv"
			"	"	1-10864	"shelled acorns" "Ecin"
			"	"	1-10863	(2 jars) "shelled acorns" "Toxit"
			"	"	1-14020	"pine nuts"
			"	"	1-10726	"Leaves of tepes"; very hirsuit "used as greens"
X			"	"	1-10867	"Unspec seeds" "Kaw'a" "used as food" Salvia sp.
			"	"	1-14042	"Black oak acorns"
			"	"	1-157428	"Salt from 'Alit'" "salt grass"
			"	"	1-10759	"Unspecified Lichen" "eaten with salt as greens, "Not Cooked"
		X	"	5	1-10807	"pitch" pine nuts--small, not P. edulis Or P. monophylla; more Talepop size; 3.5 mm X 4.1-4.8 mm X 6.5-7.5 mm "Used as Food"
			"	"	1-10805	"Crushed manzanita berries" cider "Made by soaking in water for a short time"
X			"	"	1-10773	"Unspec seeds" "used as food" "Used to make pinole" 2 types of seeds- One composite (tar weed?) "lu'ku" Black ones (Kiziyi'n) grow in the plains; The brown ones (U'wun) grow in the mountains" And one shiny black seed--Centrospermae; red maids? also grass and few others-could open!
X			"	"	1-10721	"Unspec. shiny black seeds; 'Kasyin'; "Parched and ground as a food" Not Amaranth; Possibly Chenopodium or Red Maids
			"	"	1-10809	"Black oak acorns"
			"	"	1-10808	(2 jars) (1 can) "Black oak acorns"
			"	"	1-10806	"Sugar Pine nuts" "tcono' Kic" used as food
			"	"	1-198228	"Tachi Yokuts" "Sweet Grass with exudite" "Coll. by Barrett 5/20/1961, Santa Rosa Rancheria
X			"	"	1-10810	"Yokuts" "used as food" Big bag of Salvia sp. Very small light brown seeds 'Tafi'ua'
X	X		"	"	1-198227	Unidentified Grass stalks w/seed

SUPP.	PHOTO	SKETCH	CABINET	DRAWER	CATALOG	DESCRIPTION/COMMENTS
					YOKUTS, CONT.	
			21	7	1-10790	Calif. Bay leaves attached to stem
			"	"	1-14023	Grass stalks-looks like grass caryopses,
						But are all gone, sob!
			"	"	1-10821	Unknown in jar--lichen?
			"	"	1-10829	Unknown rootlets
			22		YOKUTS, WESTERN MONO, MONO	
			"	4	WESTERN MONO	
			"	"	1-10945	Worm eaten pine nuts
			"	"	1-19750	Tobacco cake rectangular cake
			"	"	1-14043	Tobacco cake; mono-shaped; small;
						From Manache' Tribe"
			"	5	1-10928	Very large soaproot! "Tsuk ci'b" 80 x 80 mm!
						"The fibre from the old leaves of soaproot
						"Is used in making the soaproot brush common
						"Throughout the southern Sierra region.
						"The fresh bulb itself is used in washing, etc."
			"	"	1-21686	"Salvia w/columbaria" cymes with seed
X			"	"	1-21687	Jar of composite seeds--tarweed? Cf. Madia sp.
			"	"	1-10948	(formerly #937) Herbaceous plant;
						"Watercress introduced"
X			"	"	1-21685	Salvia sp. seed "S. Columbariae"
						Mono, North Fork, Madera Co.
		X	"	"	1-102158	Crushed manzanita berries (seeds present) "for cider"
						Collected Fenenga and Riddell Sept. 1948
			"	"	1-102159	Unknown tuber or fungi "Willow fungus" cut in strips
						Collected Fenenga and Riddell Sept. 1948
X			"	"	1-102160	Salvia sp. seed; "chi beda" "a food when cooked"
						Collected Fenenga and Riddell Sept. 1948
			23	2	EASTERN MONO	
			"	"	1-211560	2 Pine cones
			"	"	1-10484	4 Jars of pine nuts; Pinus edulis or P. monophylla
						6.0-7.5 mm X 7.5-10 mm X 13-18.5 mm
X			"	"	1-211559	Salvia spp. seed; pasida"
						Also one grass seed (11.0 mm long); Dawson, 1958
X		X	"		1-211558	Sisymbrium sp. '"A'tsa"; With long mustard-like pod
X		X	"	"	1-211563	"Mentzelia albicaulis seeds" "Ku'ha"
	X		"	"	1-211561	"Corns of Cyperus sp. (sèdge)" "Tib'us" "grass nuts"
						Black "bulbs" appear same as 1-10827 from Yokut area!
						This sample also contains stem/leaf material
X		X	"	"	1-211564	"Wyethia mollis" "A'ko"; Large composite seeds
			"	"	1-211562	"Rosa Pisocorpa" "Chiav'uhya" Rosehips
			"	"	1-26980	Leaves and stem; Malva? "Desert mallow"
						"Used in pottery making" 'Remnant of tag: "Blackbe...."
						Big Pine, Inyo Co. J.H. Steward, July, 1927
			"	"	1-211575	Stem w/leaves attached; looks deciduous;
						15 cm long; tobacco?
			"	"	1-211565	"Black oak (emetic?) acorn meal" :Wi'ya"

SUPP.	PHOTO	SKETCH	CABINET	DRAWER	CATALOG	DESCRIPTION/COMMENTS
					EASTERN MONO, CONT.	
			23	5	1-41789	Black tubers look like sedge (1-211561 above) "commonly called grass nuts" "J.L. Davis 1936"
X			"	"	1-26967	"Used as Emetic" Winged seeds (samara) Coll. by J.H. Steward, Big Pine, July, 1927
	X		"	"	1-26972	2 florets of Salvia columbariae Coll. by J.H. Steward, Big Pine, July, 1927
			"	"	1-26971	"Pasida" "Chia food seed" Grows in foothills, formerly abundant; Bishop Coll. by J.H. Steward, Big Pine, July, 1927
X			"	"	1-26970	"Kuhe" (from Bishop) angular seeds; Identified above (1-26968) as Mentzelia albicaulis Coll. by J.H. Steward, Big Pine, July, 1927
X			"	"	1-26968	"pak"-large seeds (Helianthus annuus): H:1.2 - 1.5 mm X W:1.5 - 2.5 mm X L:3.5 - 4.0 mm; pasida-small seeds (chia?) "sunflower chia"; Tub'us -nuts (grass nuts?); Cyperus corms from Bishop "grass nut seeds"; Quite a variability in the Helianthus seeds In size shape and color tan, mottled to dark gray Look like 1-41789 above Coll. by J.H. Steward, Big Pine, July, 1927 See also Append.3
					MIWOK	
			24		1-10357	Gaming pieces - walnut shells, etc.;
			"	1		Acorn with stick stuck in it
			"	"	1-10356	Mistletoe "alola"
X			"	2	1-10308	(2 jars) tobacco flowers; "Nicotiana attenuata" "Green leaves considered best for smoking"; "Refuse stems and seed pods of ripe tobacco"
X			"	"	1-10309	"Seeds of tobacco saved for plantings" Same as 1-10308.
			"	"	1-10243	Tobacco leaves; "Wawona; Mariposa Co."
			"	"	1-10307	Leaves, probably tobacco
		X	"	"	1-10503	Big cluster of catkins and stems w/few leaves "Nest of Bottletit. The killing of a bottletit "at any season, or the disturbance of a nest during nesting season, brings an immediate thunderstorm"
			"	"	1-10021	Tobacco pods
			"	3	1-10139	Six acorn nut meat halves
X		X	"	4	1-10196	Seed pods; unknown mustard?; "Seeds used as food" "Godetia; (See also see drawer 7) (See also #'s 1-10310, 1-10249, 1-2901) "Seed pods are gathered in this manner and Allowed to dry and shell out"
X		X	"	"	1-10206	(1 vial, 1 jar seeds) Small flat brown composite seeds (tarweed?) and a few grass caryopses "Unspec. seed" "used as food" (4 more jars in drawer #6) "Coll. west of Jamestown"

SUPP.	PHOTO	SKETCH	CABINET	DRAWER	CATALOG	DESCRIPTION/COMMENTS
					MIWOK, CONT.	
	X	24	4		1-10209	Berries with large seeds; "Sour berries, ground and leached like Manzanita cider or soaked and decanted" Rhus sp.?
		"	"		1-10205	strips of "food" -fungus mushrooms used as food. Looks like something above
		"	"		1-10064	"Hazel nuts" (concur) "used as food"
X	X	"	"		1-10164	"Unspec. seeds" "used as food" composite w/buds Looks like one at Talepop 7.0-8.5 mm Somewhat similar to 1-10197; "Specimen shows "The material as it is harvested before separating "The seed from the chaff."
		"	"		1-10232	(2 jars) "Sugar Pine nuts"
		"	"		1-9904	(1 jar) "Sugar Pine nuts" (2 jars in next drawer)
		"	"		1-10233	(2 jars) Sambucus glauca" note inside: "This bottle 1-10233 was moldy March 1937 and was washed and sifted to take out mold debris and powder L.L.L."; Concur on Sambucus ID
X		"	"		1-10249	"Unspec. seeds" "used as food"; Fine angular seed Looks like 1-10196 above, only more glandular; Also other grass, etc. seeds as well Mariposa Co., Bull Creek, 9 mi. East of Coulterville S.A. Barrett, 1906; Barrett #372, Lowie #9896
X		"	"		1-10292	"Used as food" ; Ident. as "Madia sativa" (1 vial) (2 jars) seeds look like 10206 etc tarweed?
		"	"		1-9930	Hazel nuts
		"	"		1-10269	"Used as food" "dried clover" "Lupinus" Wads of leaves and flower parts without stem (1 more jar in drawer #6)
		"	"		1-10270	"Dried clover" wads of flower parts/leaves
X		"	"		1-10272	(2-3 jars) "Madia sativa"; Looks like 1-10206 above, But different sample with grass seeds, and also another sample; see also 1-10292 below; "flat curved black seeds used as food"
	X	"	"		1-10250	"Root of water plant" reddish in color "Pond lily or cattail" "used as food" "Pulverize and mix with acorn meal for bread"
		"	"		1-10275	"Arctostaphylos tomentosa" "Used as a medicine" Looks like manzanita to me!
		"	"		1-10290	(2 jars) "Dried shredded mushrooms"
X	X	"	"		1-10208	"Clover used as food" "Asclepias mexicana" Leaves and flower parts and 4 dark red berries (1 more jar in Drawer #6)
		"	"		1-10205	(2 jars) fungus strips "mushrooms"-food
		"	"		1-10193	Herb leaves, flowers and twigs "dried clover"
X		"	"		1-10310	(1 vial, 1 jar) "Mentzelia sp." "used as food" Like 1-10249 and 1-10196 above; "Small angular Brown seeds; Miwok, Knight's Ferry, Tuolumne Co. Barrett # 5310; acc.# 9896; Cf. Clarkia sp.

SUPP.	PHOTO	SKETCH	CABINET	DRAWER	CATALOG	DESCRIPTION/COMMENTS
					MIWOK, CONT.	
			24	5	1-9904	(2 jars) "Sugar pine nuts" (1 jar in Drawer #4)
			"	"	1-9929	(4 jars) "Acorn meal" (3 more jars in Drawer #6)
			"	"	1-10273	(2 jars) "Arctostaphylos tomentosa" "Berries used in cider"
			"	"	1-10290	(2-3 jars) "Dried shredded mushrooms
			"	"	1/9908	"Acorns"
			"	"	1/9909	"Quercas lobata"
			"	"	1-10073	"Dried clover" (leaves) "food"
			"	"	1-10192	(8 jars) Arctostaphylos manzanita" "Berries into cider" (7 more jars in Drawer #6)
			"	"	1-9930	(2 jars) "Corylus rostrata californica" (Hazelnut?) Also in Drawer 4 above
			"	"	1-10181	"Sugar Pine nuts" (1 more jar in Drawer #6) food
			"	"	1-10063	"Sugar Pine nuts" food
			"	"	1-9945	Acorn meats
			"	"	1-10209	(Also in cabinet, 4 drawer #4 above) Sour berries -can't open!
			"	"	1-10062	"Dried leaves" "found in High Sierras, used as food" No se, but too small for tobacco (2 more jars in drawer #6)
X		X	"	"	1-10271	"Food" "Unspec seeds" similar appearance to "Madia" above, but larger
X			"	"	1-10197	"Unspec seeds" "flat curbed seeds used as food" Similar in appearance to 1-10271; Somewhat similar from 1-10206 H:.7-.75 mm X W:1.7-2.5 mm X L:4.0-5.0 mm Miwok, Chicken Ranch
			"	"	1-9909	2 acorns; Q. agrifolia?
X			"	"	1-10177	"Kotca" "Miwok Chicken Ranch, 1.5 mi West of Jamestown Tuolumne Co." ('Cheno-am-port' -Redwoods?) "used as food"
X			"	"	1-10178	"Unspec seeds" "food" Can't open -glass dirty!
			"	6	1-10192	A. manzanita used for cider (8 jars total, 1 of them in drawer #5)
			"	"	1-9929	(3 jars) Acorn meal 4 more jars in drawer #5 (total of 7 jars)
			"	"	1-10208	See drawer #4 "Asclepias mexicana" "Clover"
			"	"	1-9903	(3 jars) "Digger (?) pine nuts" H:7.2-8.1 mm X W:8.8-10.7 mm X L:18.2-22.2 mm
			"	"	1-10181	"Sugar pine nuts " (see drawer #5)
			"	"	1-10206	See drawer #4 "Unspec seeds" (4 jars here)
			"	"	1-10269	See drawer #4 "Lupinus"
			"	"	1-10193	"Dried clover" Like 1-10270 drawer #4
			"	"	1-10062	See drawer #5 "Dried leaves"

SUPP.	PHOTO	SKETCH	CABINET	DRAWER	CATALOG	DESCRIPTION/COMMENTS
					MIWOK, CONT.	
			24	7	1-10711	"Bulbs of aiisa" "used as food" Miwok, Chicken Ranch, Tuolumne Co. Look like onion 12 mm X 15 mm
X			"	"	1-10348	"Madia Sativa" "Bear Creek, Mariposa Co." H:.7-.8 mm X W:1.5-1.9 mm X L:2.8-4.2 mm "food" (3 jars and 1 vial) Note inside: "Miwok F24-7 tarweed seed"
			"	"	1-10370	"Pine nuts" relatively large H:6.5 mm long X W:7.5 mm thick, L:8.5 mm
			"	"	1-10714	"Manzanita berries"
X		X	"	"	1-10209	(6 jars) "Sour Berries"; Rhus trilobata?
			"	"	1-10713	"Manzanita berries"
X			"	"	1-10472	"Unspec light brown seeds" "Obtained around Pacayune" "Miwok, Mariposa, Mariposa Co.
		X	"	"	1-19555	Bulbs 65 x 75mm
			"	"	1-10193	"Dried clover"
			"	"	1-10073	Large bag -dried clover, too?
			"	"	1-10196	Pods on stalks; angular seeds-Mentzelia? See also 1-10310 and 1-10249 and Drawer #4
			"	"	1-19554	Unknown small tubers
			"	"	1-10250	Unknown Rhyzome
X		X	"	8	1-10301	Seed/flower parts unknown; Light gray-tan; "Used as medicine" "Euphorbia/Serpyllafolia" "cure for rattlesnake bite"; (also jar in drawer #11)
		X	"	"	1-10320	20 cm short stalks with empty florets attached Used as medicine" "Centaurium venustum"
			"	"	1-10116	same as 1-10320 above, but bound together Dr. Lawson notes specimens may reflect processing technique; both have pink flowers
			"	"	1-10279	Stick, red seeds along stem; variable size; Medicine?" Hard to read notes "Chamachatia foliolosa
			"	9	1-10118	Flower buds (look like chia-but no seeds) "Monardella lanceolata" "used as medicine" Unknown # -"Loud '37 suggest is same species as 1-10291. Both taste like sage family; Both have squared and red round stems" January 1937
			"	"	1-10244	Flower stems, leaves "Monardella odoratissima"
			"	"	1-10303	Flower buds-tiny; "Sambucus glauca"
			"	"	1-19560	"Dryophanta echina" "(osten-sacken)" "Family Cynipidae" Familiy Cynipidae"; The raspberry gall on leaves "of blue oak (Q. douglasii)"; Echinage shaped, Approx. 10 mm all dimensions, more or less
X			"	11	1-1030	(See also drawer #8) (2 jars) "Euphorbia serpyllifolia"
			"	"	1-10322	"Angelica Roots" "medicine"
			"	"	1-10303	(2 jars) "Sambucas glauca" flowers; Also in Drawer #9
			"	"	1-10299	"Solidago californica"; "medicine" (ground)
			"	"	1-9999	"Root of Angelica"
			"	"	1-10375	"Unspec root" "medicine, Beberis aquifolium"
			"	"	1-10327	(2 jars) "Stem of Cupressus"; "medicine"
			"	"	1-10225	"Unspec roots" Peppery odor medicine"
			"	"	1-10284	"Fragments of unspec root"

SUPP.	PHOTO	SKETCH	CABINET	DRAWER	CATALOG	DESCRIPTION/COMMENTS
					MIWOK, CONT	
			24	11	1-19561	"Wene" -unknown stems or rootlets
			"	"	1-10323	Leaves and stalks, few flowers and no seeds (1 jar, 1 box) "Scutellaria augustifolia" "medicine" "Used as food"
		X	"	"	1-10182	Stalks with leaves and flowers, seeds fuzzy
			25	1	1-9924	28 large bundle of leaves on stems; Large hollow stalks
			"	"	1-10003	Looks like Calif Bay leaves
			"	"	1-10210	"Sun fern", "Pellaia ornithopus. ostrea"; Tiny leaves on this herb; no se
			"	"	1-10244	Monardella odoratissima "drunk as beverage"; "Used as medicine"; Probably sage cymes; Pinkish w/sample of leaves
			"	"	1-10286	Bundle of stalks with leaf fragments; "Centaurium venuaruim"; "medicine"
			"	"	1-10291	Stalk-few leaves "Trichostema lanceolata"; "Medicine" (see either 1-10198 or 1-10208 above)
			"	"	1-10298	Equisetum stalks "used as medicine"
			"	"	1-10302	Serrated leaves "Eriodoctyon californicum"; "Medicine" approx. 6 cm long x 2 cm wide
			"	"	1-10306	Stalks fuzzy, few leaves, few composite heads; "Yarrow" "Achilla mellifolium" "medicine"
X		X	"	"	1-10502	Unknown stems with seed pods; L:2.0 mm X W:1.5 mm Bunch of so-called tarweed "tumo" "Used as medicine" "Hemizonia visgata" Miwok, Chicken Ranch, Tuolumne Co.
X			"	2	1-10021	Seed pods on stalks; tobacco also bag of pods; "Miwok, Rich Gulch, Calaveras County Purchased while being dried prior to preparing for smoking" "Nicotiana attenuata"
			"	6	COAST MIWOK	
			"	"	1-9909	Jar of acorns (Q. agrifolia?)
			"	7	MAIDU	
			"	"	1-2325	Soaproot Brush
			26	1	1-211619	1 can of acorn nutmeats (1 jar)
			"	"	1-211620	1 empty jar, 1 full can of acorn meal
			"	"	1-211621	1 jar, 1 can acorn meal
			"	"	1-7443	Dried leaves of something unknown
			"	"	1-7468	Looks like a branching lichen (?)
			"	"	1-7446	Pods on stalks, possibly of Lily family (?)
			"	2	1-7433	1 cannister of unknown tubers
		X	"	"	1-7417	"Gooseberries" 1 cannister of nasty looking Black pods with reddish spines
			"	"	1-7430	Dead grasshoppers
X			"	"	1-7424	"Madia sativa" (measurements through glass-- Can't open! ca.: Th:.5 mm, W:1.5 mm, L:5.0 mm; Also grass seed
X		X	"	"	1-7419	"Wyethia angustifolia" seeds and pods;

SUPP.	PHOTO	SKETCH	CABINET	DRAWER	CATALOG	DESCRIPTION/COMMENTS
					MAIDU, CONT.	
						Approx. 1.0 mm long "#Ca 1904"
			26	2	1-7439	2 cones (pine?)
			"	"	1-7416	"Cakes made of lopbo"
			"	"	1-7421	Mushrooms
			"	"	1-7407	"Unspec. bulbs" -button shaped disks; Approx. 10 mm wide (through glass)
			"	"	1-7436	"Pinus lambertiana nuts"
			"	"	1-7415	"Crataegus berries" sample has leaves
			"	"	1-7418	"Unspec. roots"
			"	"	1-7402	"Unspec. acorns and leaves" (not agrifolia)
			"	"	1-7408	"Unspec. roots"
X			"	"	1-7414	"Unspec. seeds"; Angular; Like Mentzelia in Cabinet 24, Drawer #4 and #7
			"	"	1-7420	"Lewisia nevadensis"; Tubers
			"	"	1-7404	"Quercus kelloggii"; Acorns
			"	"	1-7438	"Amelancher pollidu berries" hard to see -moldy
X		X	"	"	1-7423	"Unspec. seeds" tannish/green, Four-sided slightly winged (through glass)
			"	"	1-7437	"Manzanita berries"
			"	"	1-7432	"Unspec. leaves"
			"	"	1-7427	"Unspec. stalks and leaves"
			"	"	1-7400	2 acorns
			"	"	1-7428	"Aquilegia formosa leaves" tan leaves on stalks
		X	"	"	1-7422	Unspec. seeds tan/green (can't open jar)
			"	"	1-7425	"Unspec. bulbs" (Through glass) Relatively large; Measurements: H:15-23 X L:15-23 X W:10-25mm
			"	"	1-7426	Stalks with buds like 1-7446, Drawer #1?
			"	"	1-7434	"Rosa Pisocarpa berries"
X			"	"	1-7405	Unspec. seeds" "R.B. Dixon" ca.1904 Grass seed-maybe even Hordeum!!!
			"	"	1-7403	Quercus chrysolepsis"; acorns
		X	"	"	1-7406	Unspec. seeds"; trigonous
			"	"	1-7401	Q. wislizeni"; acorns
			"	"	1-7409	Unspec. bulb"; Allium? 10 mm X 12-15 mm (measurements through glass)
			"	"	1-7412	Unspec. bulbs" with black bark
X			"	"	1-7413	Unspec. seeds"; Small reddish seeds; Hard to see through glass--possibly grass
			"	"	1-7410	Rubus glauci folius"; moldly black berries
			"	"	1-7411	Sugar of Pines"
			"	3	1-2202	Unknown leaves and stalks
			"	"	1-12207	Acorn meal"
		X	"	"	1-7440	Allium Paruum bulbs"
			"	"	1-12204	Unspec. stems" (Lily buds?) "Medicine"
			"	"	1-7442	Ribes Sanguineum Var. Berries"
			"	"	1-12208	Unspec. root" "Medicine"
			"	"	1-7444	Lilium washingtonian plants" Fungus?
			"	"	1-7441	1 Cannister of fruits; Looks like a small Prunus; Choke Cherry?; H:4.5 mm X W:5.0 mm X L:6.5 mm

SUPP.	PHOTO	SKETCH	CABINET	DRAWER	CATALOG	DESCRIPTION/COMMENTS
					MAIDU, CONT.	
		X	26	3	1-14717	Tuber Frag.
			"	"	1-12204/3	2 box Mint Fam." Leaves
			"	"	1-12205	Leaves and stalks with floret heads; Composites? Not Necessarily
			"	"	1-12206	Oak" Gall "Medicine"
			"	12	POMO	
		X	"	"	1-13463	Large amount of beads made of Black berries (fruits) Rhus?; Approx. 5 X 5 mm
			27	1	1-2910	Seaweed 127"
			"	"	1-14010	Acorns, "Q. agrif."
			"	"	1-14002	Ground Meal; Acorn?
			"	"	1-14013	4 Buckeye fruits
			"	"	1-2894	Buckeye frutis # 14
			"	"	1-2890	Ground meal; cf. Acorn
			"	"	1-4454	Containers: A,B,C,D,E,F: Burnt Mush? Dr. Dawson says this is acorn bread made by mixing Red dirt" with black oak acorns Black bread; Pomo Ind. 1904, Barrett"
			"	"	1-14008	Same as 1-4454 above
			"	"	1-13998	Shelled acorns" "White Ash" (like 1-2890 above)
			"	"	1-4088	Seaweed cakes"
			"	"	1-14003	Can't open jar and can't see because too cloudy!!! "Tan bark oak acorn meal"
			"	"	1-14009	Acorns
			"	"	1-109238	Acorn Nutmeats
			"	"	1-223865	Acorn Bread" Barrett, Kashia Pomo, 1962
			"	"	1-1102	Acorn Nutmeats; Tag loose--jar broken; Could also be 1-2888
			"	"	1-2887	Charred Acorn Nutmeats
			"	"	1-2907	Fungus?
			"	8	1-144935	Red dirt used in making acorn bread" "Kashia"
			"	"	1-2913	Jar of Composite heads; measured through glass: Seeds ca. 7.5 mm long; Heads ca. 12 mm X 14 mm Barrett, 1902; Asylum, Near Ukia" "Indian Wheat" Food seeds" Heads ca. 12 X 14 mm
X			"	"	1-2909	(#1123) Legume seeds, likely lupine Dark red approx, 4.5 mm long
X		X	"	"	1-2904	(Composite" Seeds "Madia"; Barrett
X			"	"	1-2367	Like Scirpus?
X			"	"	1-2900	Like Asclepias mexicanus "Hemizonia" (See above) Black and mottled 1.0 mm X 1.5 mm X 2.5 mm
			"	"	1-2097	Looks like small seeded Salvia
X		X	"	"	1-2898	Buttercup Seeds" "Food" Looks like Datura seeds
X		X	"	"	1-2899	Composite; "Madia elegans" "Food"; "3" "Dje-ca'"; .3 -.5 mm X .75 - 2.0 mm X 3.5 - 5.0 mm;
X		X	"	"	1-2905	"7" "Ka-la'-pw" Food"; New seed, dark reddish brown, unknown
X			"	"	1-2901	Unknown Seed; "Bois Duralia Densiflora"; "Food"

SUPP.	PHOTO	SKETCH	CABINET	DRAWER	CATALOG	DESCRIPTION/COMMENTS
					POMO, CONT.	
		X	27	8	1-2906	Pa-co-te'-do" "Sprouts eaten raw"; Pinkish tan, Looks like seed coat halves, almost sunflower-like
			"	"	1-2897	Pe-cel sa" 6/21/02 "Food" Look like sage seeds
			"	"	1-2904	Composite seeds; "4" "Ho'm tea" "Madia nanala?" Like Talepop? Deep Black Composite 1-2 mm X 4-5 mm
		X	"	"	1-2901	(2 vials) Unknown brown seeds; Approx. .5 mm X 1 mm X 1.5 mm; Variable shapes, slightly resembels 1-10196 in form (Cab. 24, Dr. 4) 1 Vial has flower parts as well; tan and fuzzy
X			"	"	1-2900	Hemizonia" "Food" "A-la" "5"; Coloring variable From black to mottled tan/brown; Trigonous with hook; Like 1-10208 (Cab 24, Dr.4, Asclepias mexicana?); H:1.0 mm X W:1.5 - 2.0 mm X L:2.5 - 3.0 mm
X		X	"	"	1-2903	Composite Seed (Like 1-7419, Cab. 26, Dr. 2?) "Wyethia agustifolia" "Ca lam" 5.5-7.5 mm X 1.5 - 2.75"
		X	"	9	1-14011	(2 Jars) Bay nut; "Umbellularia californica"
X		X	"	"	1-2917	"#1131" 1 large jar, 1 small jar, 1 vial; "Food" Grass; some tan, some dark brown; "Wild Oats" See also Append.3
		X	"	"	1-2902	(3 Jars) Reddish w/tan (venation) seed; "Food" 1 Jar Says "Seeds of Carum kelloggii"; 1 Jar says "Ca-bu'm"; See #2893" Pomo, Yokaia Rancheria, 7 mi. South of Ukiah; Barrett 8/1902; Barrett's # 1116; "Uv i" "Boil, wash is ases or in oven"
			"	"	1-2914	Leaves-Smells like tobacco
			"	"	1-2918	Crushed manzanita berries
			"	"	1-2895	Jar of manzanita berries
			"	"	1-14001	Jar of manzanita berries
X		X	"	"	1-2891	(2 Jars) (#1105) "Tarweed" "Ka la' yo" Food" Trigonous, black or brown seeds
			"	"	1-2918	Ba-kai"; Crushed manzanita berries
			"	"	1-2919	Ba-kai'-so" Crushed manzanita berries w/seeds
X			"	"	1-2893	"Umbelliferae (Wild parsnips)" "Shaboo'm yo" Same as 1-2902? "Carum kelloggii" (#1107) H:.75 - 1.0 mm X 1.5 - 2.5 mm X 3.5 - 6.5 mm Same as first 3 lines of 1-2902; Barrett's # 1107; Muni"=Skewer, found Feb. 1909; "Same name applied to the Chinese for which the skewer is made"
		X	"	"	1-2896	Pepperwood nuts roasted" "Ba he' yo" (#1110) Shell thickness: .7 - 7.5 mm inside of shell porous
X			"	"	1-2922	(1136) Moisture of leaves, seeds and stems Predominantly tobacca w/leaves
			"	"	1-2892	Tarweed" "Cha wa'ya ya" "Flour" (#1106) Pulverized composite seeds (Powder, Meat and Seed Coats
			"	"	1-2914	Smoked" husks from buckeye? Bark? Probably Pine cone covers

SUPP.	PHOTO	SKETCH	CABINET	DRAWER	CATALOG	DESCRIPTION/COMMENTS
					POMO, CONT.	
			27	9	1-2895	(#1109) Jar of manzanita berries
			"	"	1-2921	(#1135) Jar of tobacco leaves
X		X	"	"	1-4462	(2 Jars) Grass seed, shiny, but with hairs; Hordeum, in glumes "seeds used as food"
			"	10	1-2920	Unknown stalks/stems; "Kelp food"
			"	"	1-2378	Look like leaves or fungus
			"	"	1-14000	Pine nuts
			"	"	1-14012	Pomo food: pine nuts" (Also whole pine cone)
			"	"	1-2911	(#1125) "Fish eggs"
			"	"	1-2915	Bulbs-Allium?
			"	"	1-2916	Unknown bulb
			"	"	1-2927	(1 Jar, 1 vial) Unknown black chunks "#1155"
			"	"	1-2908	#1122; Small bulbs
			"	"	1-14005	Unknown; like 1-2920; Kelp dried and used for food"
		X	"	11	1-2870	Tuber; metal tag #1002
			"	"	1-2924	fern frond bud
			"	"	1-2869	Like 1-2870; H:63.5 mm X 42.5 mm X 120 mm
			"	"	1-198226	Tuber with stalk and leaves
			"	"	1-2880	Unknown tuber
			"	"	1-2874	Stalks or roots
			"	"	1-2871	Root
			"	"	1-2882	Metal tag #1014; Unknown tuber
			"	"	1-2878	Metal tag #1010; Small soaproot bulb
					1-14006	Angelica root; Collected by L. Dawson; Lomatium (Leptotaenia) californica;
			"	"	1-198195	Looks like 2 big blobs of pine pitch
			28	1-3	1-XXXXXX	Fiber material from various unid. plants
			"	4	1-XXXXXX	Same as 1-3 with few samples having flowers And leaves attached
			"	"	1-198192	Stalks and leaves; unknown
			"	"	1-198225	Unknown grass with florets (spikes); No seeds, but flower parts
			"	"	1-198190	Fuzzy leaves, woody stalks--unknown
			"	"	1-2644	One hunk of fiber; Fiber from root of Psorales macrostachya"
			"	5	1-2872	Unknown Root or Tuber frag.
			"	"	1-2885	Unknown Root or Tuber frag.
			"	"	1-2886	Unknown Root or Tuber frag.
			"	"	1-2881	Unknown Root or Tuber frag.
			"	"	1-2876	Unknown root or tuber frag.; Metal tag #1008
			"	"	1-79883	Yellow lupine root for fiber; S.W. Pomo"
			"	9	YUKI	
			"	"	1-11914	Jar of leaves "tobacco" "Indian tobacco" Woyo'" Collected by Barrett, July-Aug. 1907
			"	"	1-12033	Jar of ground green leaves; Smells like tobacco
			"	"	1-11910	Unknown bulbs in envelope; "Yuki food bulbs"
			"	"	1a-11910	Unknown black fibrous material-tuber?

SUPP.	PHOTO	SKETCH	CABINET	DRAWER	CATALOG	DESCRIPTION/COMMENTS
					YUKI, CONT.	
			28	9	1-11970	Envelope with seeds (Unknown); Used as food
			"	"	1-12051	Basket frag.?
			"	"	1-11955	Tubers eaten without cooking"
			"	"	1-11954	Bulbs used as food"
			"	"	1-11884	Jar of unknown brown chunky material
X		X	"	"	1-11911	(2 Jars) Unthreshed grass seed, possibly Avena Unthreshed seeds"; Supplementary Cat. #1, p.91
			"	"	1-11908	Acorn nutmeats
X		X	"	"	1-12029	Jar composites (tarweed?); mottled tan w/black
X		X	"	"	1-11909	Three Jars composite heads; Seeds used for food"; Like 1-2903, Cab. 27
			"	10	YUKI:ROUND VALLEY	
X		X	"	"	1-12013	Cannister of composite seeds and chunks of Charcoal (Conifer?); Tarweed? Same as 1-12029?
			"	"	1b-11912	Jar of Bay nuts
			"	"	1a-11912	Jar of manzanita berries
			"	"	1-11913	Jar of unknown black material; full of bugs; Acorn meal; Barrett's catalog, p.19 "Pinole" So't" "Made of barley only in this case" It is to be mixed with native seed meal"
			"	"	1-11953	Unknown fibrous tuber
		X	"	"	1-11953	Unknown bulbs
X			"	"	1-11917	Jar of seeds, looks like 1-2902 (Cab. 27) Anise Seeds; Carum kelloggii? ; "8.1" Yuki, Round Valley; Barrett 7/1907; Barrett's # 1409; "Tunstanta"; Made by Sally, Mother of George Ward Wailaki
			"	"	1-11916	1 Jar unknown brown powdery material; acorn meal
			"	"	1-11915	1 Jar of powder, same as 1-11916, only Lighter--acorn; 1 Jar with chunks of brown material--moldy
X			"	"	1-11969	Jar of seed mixture including grasses, Composites, Datura(?); Field seeds?; See additional comments, Appendix 3
X			"	"	1-11991	Seeds of various kinds, parched and used as foods" Similar to sample 1-11969, Cat. 1, p. 89; "8.1" See additional comments, Appendix 3
X			"	"	1-11981	Wild oats" "Used as food" Tufted grass; Like 1-2917, Cab. 27
X			"	"	1-11992	Food" Jar of seeds mostly "tarweed"; H:1 mm X W:1.25-1.5 mm X L:4-5 mm
			"	"	1-12011	3 Jars of acorn nutmeats "Yuki food"; Black oak Acorns, shelled and ready for grinding"
			"	"	1-12012	Unknown chunk of brown material; Acorn meal?
			"	"	1-12030	Like 1-12012, only lighter
			"	"	1-12031	Like 1-12012 and 1-12030
			"	"	1-12050	Unknown bulbs or fruit pods, can't see
			"	11	YUKI	
			"	"	1-11971	Dried leaves and stems; Unknown
			"	"	1-11900	Dried leaves and stems; Unknown
			"	"	1-11972	Ditto, but looks like Happlopappus; "Eriodictyon californicum" "Yerba santa"
		X	"	"	1-11956	"Angelica root" "Medicine"

SUPP.	PHOTO	SKETCH	CABINET	DRAWER	CATALOG	DESCRIPTION/COMMENTS
			29	6	WINTUN	
			"	"	1-3905	Jar of tobacco leaves (w/seed pods)
			"	"	1-2930	(#1158) Unknown tubers (Roots) 1 Jar
			"	"	1-27961	Metal tag #30; Eucalyptus pod
			"	7	1-16579	Long string of flowers; Like a tight Lei
			"	"	1-223863	Sand bar willow root, from Wintun County;
						Trinity River Valley, Willow Creek
			"	"	1-2883	Metal Tag #1015; Piece of Large Root Unknown
		X	"	"	1-27957	Metal tag # 27; String of seeds; Possibly small
						Pine Nut; TH: 2.0 mm X H:6.5 mm X W:3.5 mm
			"	"	1-10600	String of 5 acorns; "Musical Instrument"
X			"	"	1-3905	Jar of seeds, presumably "tobacco";
						Coll. by Barrett, little Stony Creek, 1903
		X	"	"	1-2929	Unknown bulb
			"	"	1-2923	Shreaded bark of unknown stems
			"	8	ACHOWAMI	
			"	"	1-39824	"Atsu ga wi/Modoc" Unknown tubers
			"	"	1-39701	"A p warige" Dixie Valley tobacco"
			"	"	1-24307	"Achomawi: Shasta" Unknown root
			"	"	1-24308	"Achomawi: Shasta" Unknown root
			"	"	1-24309	"Achomawi: Shasta" Unknown root
			"	"	1-39699	"Dixie Valley Apwarige Petsku" "Root eated"
						Unknown too/bulb with 3 joined limbs
			"	"	1-24119	Unknown bulbs small and tan
			30	4	WAILAKI	
			"	"	1-12165	Unknown root "Milkweed" "Medicine"
			"	"	1-12195	"Wailaki Indians" Jar of acorn nutmeats
			"	"	1-12081	Jar of berries; "Thimble berries"
			"	"	1-12184	2 Jars manzanita berries
X		X	"	"	1-12080	Jar of composites; like 1-11909, Cab. 28; "Food"
						TH:1.75 - 2.0 mm X W:2.0 - 2.5 mm X L:7-8.5 mm
			"	"	1-12194	"Wailaki Indians" Bay nuts (1 Jar)
X		X	"	"	1-12078	"Wailaki Indians" Jar of mixture of seeds
						See also Appendix 3
			"	"	1-752	Unknown root
			"	"	1-12166	"Unknown root" Jar like 1-12080; Hard to open
			"	"	1-12079	"Bay nuts"
			"	"	1-12183	Unknown leaves and stmes
			"	5	WHILKUT	
			"	"	1-2713	Strings of seeds
			"	6	NONGATL	Van Dugen R. about Bridegeville
		X	"	"	1-10516	String of Sead shells and seeds; "Said to grow
						In ground like beans" "Nit cok"; Dyed pine nuts?
						Dark reddish brown; 5.5 - 6.0 mm X 1.25 mm
			31	2	MODOC	
			"	"	1-27251	String of pine nuts? ; mostly dyed black
						H:6.0 - 7.5 mm X W:10 mm X L:19 - 25 mm
			32	9	KLAMATH	
			"	"	1-12257	5 Jars, 1 Vial; Seeds of Pod "78"
						Nuphar, Poly-sepalum; "Wodash pods"
						Separated and parched before grinding
			"	"	1-12278	2 Jars Pods w/seeds; Nuphur Poly-sepalum
			"	"	1-12279	Seeds Nuphur Poly-sepalum
			"	"	1-12282	Unknown Roots"

SUPP.	PHOTO	SKETCH	CABINET	DRAWER	CATALOG	DESCRIPTION/COMMENTS
					KLAMATH LAKE, CONT.	
			33	2	1-29834	Crushed Nuphur seeds
			"	"	1-14302	Unknown roots
			"	"	1-14304	Small red seed; Sisymbrium sp.?
			"	"	1-14305	Unknown Bulbs
	X		"	"	1-14113	Unknown Composite seeds; "Food"
			"	"	1-12707	Unknown Tan bulbs
			"	"	1-14114	Unknown black tubers.
			"	"	1-14308	Unknown tan bulbs
			"	"	1-12850	Unknown roots
			"	3	ALL	Add. Materials Collected from Northern Calif.
			"	4	ALL	Add. Materials Collected from Northern Calif.
			"	5	ALL	Add. Materials Collected from Northern Calif.
			"	6	ALL	Add. Materials Collected from Northern Calif.
			"	7	ALL	Add. Materials Collected from Northern Calif.
			"	9	ALL	Add. Materials Collected from Northern Calif.
			"	10	ALL	Add. Materials Collected from Northern Calif.
			"	11	ALL	Add. Materials Collected from Northern Calif.
			34	ALL	ALL	Add. Materials Collected from Northern Calif.
			35	ALL	ALL	Add. Materials Collected from Northern Calif.
			36	ALL	ALL	Add. Materials Collected from Northern Calif.

APPENDIX 2

LOWIE MUSEUM INVENTORY, 1988

ARCHAEOBOTANICAL MATERIALS

CABINET	DRAWER	CATALOG	SITE	DESCRIPTION/COMMENTS
24	1		CA-ALA-307	Numerous "Charcoal" Samples from ALA-307 (West Berkeley); Some with Nutshell in Them
"	2		CA-ALA-307	Same as Previous samples
"	3		CA-ALA-307/9	More Charred Plant Remains
"	4			ALA-309 has dirt from P#1 and F4 fill
"	5		CA-AMA-3	Barnert Cave; Acorn and bulb frags
"	6	1-27074	CA-AMA-3	Big Sample of "Charcoal from Screened diggings"
"	7		CA-AMA-3	Acorn, bulbs and sticks
"	11	1-127434		One Match Box and One Bag; Grass; "Calamagrostis?" (No embroyos)
"	12	1-1281413		Charred plant material "charcoal"
"	"	1-128412		Bag of Acorn, Pine Nuts and Buckeye shell
"	"	1-128409		Grass Stems, undetermined plant frags; Large Bag w/plant matter
"	13	1-127114		Full of Heavy Bags of "Screenings"
25	3		CA-CCo-138	Hotchkiss Mound; Lots of Cordage!!!
"	"	1-39100		Tin from cremation (Bur. 13-1); Approx. 1.5 liters of sand and fine charcoal Residues left from screening; "Larger chunks of wood, acorns, and cordage used for C-14 samples 9/30/57"
26	2		CA-INY-222	Lots of match boxes full of "seed"; Mostly Pine Nuts and Prunus nutshells; Looks like 1/4" screenings to me
"	3		CA-INY-222	Contents same as Drawer #2
27	8		CA-LAS-1	Coll. by Franklin Fenenga and Fritz Riddell
"	"	1-74875	CA-LAS-1	Vial of Seeds from Lassen Site in 1942; Tommy Tucker Cave" "8-21-1940"
28	4	1-160222	CA-LAS-194	Lots of large plant fragments; C14 sample
"	6		MARIN CO.	Botanical (Carbon) from Marin Co.; Nos. 307, 92 and 115 (Feat. 4)
"	13/14			Lots of Dung; Not necessarily Human!!!!
"	15	1-237969	CA-SAC-56	Cordage Remains w/soil
		1-237970	CA-SAC-56	Cordage Remains w/soil
		1-237971	CA-SAC-56	Cordage Remains w/soil
		1-237972	CA-SAC-56	Cordage Remains w/soil
		1-237973	CA-SAC-56	Cordage Remains w/soil
28	15	1-237974	CA-SAC-56	Cordage Remains w/soil
		1-237975	CA-SAC-56	Cordage Remains w/soil
		1-237976	CA-SAC-56	Cordage Remains w/soil
		1-237977	CA-SAC-56	Cordage Remains w/soil
29	3	1-56975	CA-SAC-6	Various nutmeats and berry frags; Acorn, manzanita and other taxa
"	"	1-58015	CA-SAC-6	Same as 1-56975
"	"	1-2475	CA-SAC-6	Same as 1-56975

CABINET	DRAWER	CATALOG	SITE	DESCRIPTION/COMMENTS
"	10		SANTA BARBARA CO.	
"	"	1-88406,	CA-SBa-XXX	Bags W/Seeds
"	"	1-88409	CA-SBa-XXX	Bags W/Seeds
"	"	1-95247	CA-SBa-XXX	Bags W/Seeds
"	"	1-96945	CA-SBa-XXX	Bags W/Seeds
"	"	1-97026	CA-SBa-XXX	Bags W/Seeds
"	"	1-97125	CA-SBa-XXX	Bags W/Seeds
"	"	1-97139	CA-SBa-XXX	Bags W/Seeds
"	"	1-97167	CA-SBa-XXX	Bags W/Seeds
"	"	1-97211 to	CA-SBa-XXX	Bags W/Seeds
"	"	1-97388	CA-SBa-XXX	Bags W/Seeds
"	"	1-97390	CA-SBa-XXX	Bags W/Seeds
"	"	1-97599 to	CA-SBa-XXX	Bags W/Seeds
"	"	1-97605	CA-SBa-XXX	Bags W/Seeds
"	"	1-97786	CA-SBa-XXX	Bags W/Seeds
"	"	1-120435	CA-SBa-XXX	Bags W/Seeds
"	"	1-121338	CA-SBa-XXX	Bags W/Seeds
"	"	1-200383	CA-SBa-XXX	Bags W/Seeds
"	"	1-200384	CA-SBa-XXX	Bags W/Seeds
"	"	1-200385	CA-SBa-XXX	Bags W/Seeds
"	"	1-204677	CA-SBa-XXX	Bags W/Seeds
"	"	1-204682 to	CA-SBa-XXX	Bags W/Seeds
"	"	1-204691	CA-SBa-XXX	Bags W/Seeds
"	"	1-200391	CA-SBa-518	Bags W/Seeds
"	11	1-97452	CA-SBa-205	Section of House Floor Feature 17-8
"	"	1-97453		Section of House Floor Feature 17-6
"	15	1-62249	SAN DIEGO CO.	Tubular Can of Grass Seed, Coll. by John Dixon, June, 1938, Cave near Jacumbra, San Diego Co., Cat. also says: "black, brown, speckled white seeds, two types squash cantalope seeds, watermelon seed, Two types C. Pepo seed, barley and wheat" Note: only Squash and grass found in drawer;
29	15	1-62244	SAN DIEGO CO.	Cucurbita moschata (Pima/Papago Type) and C. mixta (HC 1953), Identified by T.W. Whittaker, USDA LaJolla, CA; See in Acc. Envelope 3/8/1944; A.E. Treganza to E.W.G
30	3	1-156312	CA-SBr-118	Trench A; SQ 24-72"; (M.J. Harner); 2/15/1952; UCAS 126; Palo Verde Seeds; 4.5" X 10.5" D
"	"	1-74444	CA-SBr-XXX	Ceudidium floridum Benth. (C. Torreyanum Sarg.); (#1948-J) "Tansy Mustard Seed" "Found in Olla" "Prob. Sisymbrium altissimum" "Descuriania primata" Coll. by Harry Godwin, 1948; Sheephole Mtns, San Bernardino
"	4	1-156417 to 1-156419	CA-SBr-XXX	9 Cannisters of Dirt w/charcoal; Looks Good!!!!
"	"	1-156416	CA-SBr-XXX	Grass Floret, No Seeds
"	7		SOLANO/SUTTER COUNTIES	
"	"	1-81346/5		Looks like Unscreeen Charcoal
"	9	1-151620		Looks like Unscreened Charcoal
"	"	1-152002		Looks like Unscreened Charcoal
"	"	1-152142		Looks like Unscreened Charcoal

APPENDIX 3

SUPPLEMENTAL NOTES ON CALIFORNIA ETHNOBOTANICAL MATERIALS

AT THE LOWIE MUSEUM

CABINET	DRAWER	CATALOG NO.	COMMENTS/DESCRIPTION
20	3	1-28782 to 1-28789	Coll. by E. W. Voegelin; Tubatulabal; 1932; 4 mi. N of Weldon, Miranda Rancheria
20	8	1-3943 to 1-4100	"Kroeber 1/8-17/1904, Madera Co."
21		1-10712 to 1-10975	"Barrett, Feb. 1907, Yokuts"
21		1-10738 to 1-10778	"Yokut; Indian Village of Ticitcu, at the confluence of Mill Creek w/Kings River, Fresno Co."
21		1-13946 to 1-14911	Ditto
22	4	1-21670 to 1-21723	E.W. Gifford, Aug., 1918
27		1-2576 to 1-2944	POMO; Barrett; ca. 1901/2
32/3		1-12221 to 1-12955	KLAMATH RES., Barrett, 1907
TOBACCO			
20	6	1-10454 to 1-10458	Chukchansi Yokut; Tobacco leaves; "Smoking" "pulverized for medicine"; "S.A. Barrett, 1906"
23	2	1-211575	Eastern Mono; Stem w/leaves attached; looks deciduous; 15 cm long; tobacco?

CABINET	DRAWER	CATALOG #	COMMENTS/DESCRIPTION
24	2	1-10021	"Bundle of Indian tobacco *Nicotiana attenuata*; Miwok, Rich Gulch, Calavaras Co.; S.A. Barrett, 1906; "Purchased while it was being dried preparatory to removing leaves, etc., for smoking."; Tobacco w/seed capsules
24	2	1-10243	Tobacco leaves; "Wawona; Mariposa Co."
24	2	1-10307	Miwok: Leaves. Cf. tobacco
24	2	1-10308	(2 Jars) Tobacco stems and flowers; Miwok; "*Nicotiana attenuata*; "Refuse stems and Seed pods of ripe tobacco" "Green leaves considered best for smoking"
24	2	1-10309	(2 Jars) "Seeds of tobacco saved for plantings; Tobacco; Miwok, Big Creek, 2 mi. NE of Groveland, Tuolumne Co.; S.A. Barrett, 1906; "seeds are sown broadcast in ashes of burnt areas either without any cultivation or after scratching sufficiently to mix earth and ashes a little. The only benefit accruing from planting in ashes is size of leaves; flavor does not change"
29	6	1-3905	Jar of tobacco leaves w/seed capsules Native tobacco; Wintun; L. Stony Creek; S.A. Barrett 12/22/1905
27	9	1-2922	"Leaves smoked Pomo, Pinoleville; Mixture of leaves, seeds and stems; Predominantly tobacco w/seeds; (#1136) S.A. Barrett, 1901

CABINET	DRAWER	CATALOG #	COMMENTS/DESCRIPTION
PATCHES			
19	1	1-84662	"Ca. 70 c.c. of plant material Ventureno Chumash, Coll. by F. Fenenga and F. Riddell, Nov. 1948; "Tied in rectangular pc. of blue denim shirt. Plant material; *Antirrhinum majus, Coreopsis tinctoria, Coreopsis lanceolata, Cosmos bipinnatus*" "Part of a Weather Shaman's outfit, originally put together and used by Somick, a Ventureno Chumash who lived at Tejon in the 1870's, although his Tubatulabal descendants inherited the outfit, none were using it. The other part of the materials is said to be owned by a private collector somewhere in the Kern River Region."
18	1	1-14410	T.T. Waterman's notes: Acc #57; "Specimen of *tcia*; Seeds used for food when parched and ground (mixed w/other seeds)" Cahuilla Reservation.
23	2	1-26968	"Sunflower" "chia" and "groundnut seeds"; E. Mono, Bishop, Inyo Co. J.H. Steward; July, 1927; "*Pak*" (*Helianthus annuus*) H:1.2-1.3 mm X W:1.5-2.5 mm X L:3.5-4.0 mm; *pasida*--"sunflower chia"; *Tub'us*--nuts (grass nuts?); *Cyperus corms* from Bishop "grass nut seeds"; Quite a vaiability in the Helianthus seeds in size, shape and color (tan, mottled to dark gray); Look like 1-41789 (same drawer).

CABINET	DRAWER	CATALOG #	COMMENTS/DESCRIPTION
20	3	1-28782	"Chia and other seeds" Tubatulabal 4 mi. North of Weldon, Miranda Rancheria, Kern Co., E. W. Voegelin, 1932; Great difference in size of *Salvia* spp. (2 species?); Note: .5 gm Subsample from jar contained 97 small and 95 large *Salvia* seeds; i.e. #1: Approx 1 mm X 2 mm X 3 mm; #2: .75 mm X 1 mm X 2.25 mm.
24	4	1-10249	"Unspec. seeds" "Used as food" "Fine angular seeds used as food" Miwok, Looks like 1-10196 above, only more glandular: Also other grass, etc. seeds as well. Mariposa Co., Bull Creek; 9 mi. East of Couterville. S.A. Barrett, 1906; Barrett's #372, Lowie #9896.
28	10	1-11969	YUKI ROUND VALLEY Supplementary catalog-1, p.91; Six diff. kinds as follows: "*wi'*, *tcomiel*, *yuksi'l* (2 kinds), *vensu'k*, and *kupin*, are mixed in just as they were gathered, 8.1; "Mixed seeds" "Six different kinds as follows: *wi* , *tco'mi'l, yuksi'l* (two kinds), kusuk, and *kufcin*, are mixed in just as they were gathered 8.1; Yuki, Round Valley, see Barrett's field cat. #1134; "uncleaned and unseparated seeds of 6 diff. kinds; a few of each kind are separated in envelopes with names written on envelopes."
28	10	1-11991	"Seeds of various kinds, parched and used as food, Yuki Round Valley; July 1907; Barrett's #1162; "*woot*=pinole; *wuvl*=seeds mixed to make pinole. Pkgs. of separate seeds insides, use care in opening and keep separate."

CABINET	DRAWER	CATALOG #	COMMENTS/DESCRIPTION
30	4	1-12078	1 Jar mixutre of seeds; "Seeds used as food" Wailaki, Round Valley; Barrett's notes acc #1065; to'-ka: Buttercup seed lo'tan kan. It looks as though these were both generic names for seeds. From Jim Matcato and Sister Sally Brown."
33	1	1-12787	Mixed batch of angular seeds, grass, etc.; "Food" "Lolas" Avena and barley?
GRASSES			
28	9	1-11911	(2 Jars) "Unthreshed grass seeds" Yuki Round Valley, Barrett 7/1907; Barrett's # 1043; "ko p"; wild oat-like grain. Supplementary Cat.#1, p.91.
28	10	1-11981	"Used as food" Tufted grass; Like 1-2917 "Oats. Said to be wildoats; used as food" Yuki, Round Valley, July 1907; Barrett # 1148: "*Wocet Kaletc*"
27	9	1-2917	#1131; 1 large jars, 1 small jar, 1 vial;"Food" Grass: some tan, some dark brown; "Wild oats, food" Pomo, Coyote Valley, Mendicino Co.; 10/8/1902; Barrett's # 1131; "Wilk (or Milk?)" "Made by Wailaki seed beater"
27	9	1-4462	(2 Jars) Grass seed, shiny, but with hairs; "Seeds used as food Pomo Indians, Burk Ranch, Ukiah Valley 6/3/1904"; Barrett # (no number); acc. # 148-150; *Hordeum*, in glumes "seeds used as food"
26	2	1-7405	"Seeds--Maidu Indians; R.B. Dixon; ca. 1904; "*ok wam*"; Cf. *Hordeum* sp.

CABINET	DRAWER	CATALOG #	COMMENTS/DESCRIPTION
33	1	1-12708	(2 Jars) grass seed; "Seed (*skolaiam*)" "Used as food" Klamath River Res., Ore.; S.A. Barrett # 1976
21	6	1-198227	"Salt Grass" Kings Co., 5 mi. South of Lemoore, near Hanford. Tachi Yokut Tribe, Santa Rosa Rancheria; Am. Indian Film Project 5/20/61; S.A. Barrett

SOUTHWESTERN CULTIGENS FROM ARCHAEOLOGICAL CONTEXTS

29	15	1-62239 to 1-62252	"Barley" Cave near Jacumbra, San Diego Co., T18S R8E; pottery cache, coll. by John Dixon 1943-P; Also photographed for museum 13-2160; Tubular can of grass seed; Also collected 1-62239 to 162252, tepary beans, *Phaseolus acutifolius* (black, brown, speckled, white); Squash seeds--*Cucurbita moschata* (Pima/Papago types according to T. W. Whittaker, USDA); *C. mixta* (HC 1953); Cat. also says cantalope; *Cucumis melo*; *Cucurbita pepo* (two types); 2 watermelon (red and black seeded); wheat, sorghum vulgare (a warm region species) and corn cobs; Identified by A.E. Treganza; See 3/8/1944 letter, acc #1943P