# OVERVIEW OF THE PREHISTORY OF THE STANISLAUS NATIONAL FOREST

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## PREFACE

This Overview is a summary of the prehistory of the Stanislaus National Forest (Forest) and surrounding lands. It is intended as a baseline study that should periodically be revised and updated. It is a part (Unit 11, Volume B) of the 7-volume Framework for Research and Management of Archaeological Resources in the North-Central Sierra Nevada (R. Jackson et al. 1994) and it can guide future research in the Forest.

Chapter I contains a description of the present-day natural landscape of the Forest. We use the term landscape in the broadest cultural and geographic sense that includes the natural features, plants, animals, and people of the region. This chapter discusses physiography, hydrology, geology, geomorphology, climate, vegetation, and wildlife. The second half of this chapter summarizes paleoenvironmental data for the region. Chapter I gives the reader some appreciation for the forces that have shaped the modern landscape. From our limited human perspectives, we tend to forget that the landscape we see today may have been significantly different in the past. Changes in climate and habitat may have had profound effects on people living in the area in the past. Prevailing climatic conditions have fluctuated over time. Vegetation communities and wildlife associations have developed in response to these climatic oscillations. Glaciers have advanced and retreated. In some ways the most profound changes have happened in the last 150 years in response to mining, logging, grazing, fire suppression, and the displacement of Native American inhabitants of the area.

Chapter 2 discusses these Native American groups, Sierra Me-wuk and Washoe, the people living in and using the area when Europeans first arrived. It is important to remember that the cultures recorded by Kroeber, Powers, Merriam, Gifford and others in the late 19th and early 20th centuries had already been significantly altered by at least a century of interaction with Europeans. While this ethnographic information can be used as a starting point for understanding the prehistory of the region, we should never forget the magnitude of these impacts.

# CHAPTER 1. NATURAL LANDSCAPE OF STANISLAUS NATIONAL FOREST

## 1.1 Introduction

The Stanislaus is one of the nation's oldest national forests. On February 22, 1897, a large section of the north-central Sierra Nevada was set aside as the Stanislaus Forest Reserve under the jurisdiction of the Government Land Office. Later, stewardship was transferred to the U.S. Forest Service and the former Stanislaus Reserve was subdivided into the present day Stanislaus, Tahoe, Eldorado, Sierra, and Toiyabe national forests. Located between Lake Tahoe and Yosemite National Park, in one of the most scenic parts of the Sierra Nevada, the Stanislaus National Forest (Forest) averages five million recreational visitors a year. This recreational use is balanced with timber harvesting, grazing, biotic preservation, soil conservation, and watershed management. It is the mandate of the Forest Service to most effectively manage the scenic, natural, cultural, and historic resources of the forest "in the greatest good for all."

Today, the Forest covers 1,090,543 acres of land (441,338 hectares) between the Mokelumne River on the north and the Merced River on the south.  Forest lands extend from the blue oak woodlands of the Sierra foothills on the west to the crest of the Sierra Nevada on the east.  The Forest shares boundaries with Eldorado National Forest on the north, Toiyabe National Forest on the northeast, Yosemite National Park on the southeast, and Sierra National Forest on the south.  Calaveras Big Trees State Park is located entirely within the northwestern portion of the forest. Privately held land flanks the Forest on its western edge. The Forest is located between 38'40" and 37'37'30" north latitude and 119'37'30" and 120'23' west longitude.

The Forest lies within a transition area between the heavily glaciated granitic highlands of the southern Sierra and the lower, forested summits of the northern Sierra.  Elevation ranges from approximately 840 feet (256 m) along the lower reaches of the Middle Fork of the Tuolumne River, north of Groveland, to 1 1,570 feet (3,527 m) at the summit of Leavitt Peak, 3 miles (4.8 km) south of Sonora Pass. The majority of the Forest is heavily vegetated with conifer species. Glaciated granite basins and peaks characterize much of the alpine environment. Southwest-trending ridges separate the deep river canyons of the Mokelumne, Stanislaus, Tuolumne, and the Merced rivers which flow westward to empty into the Sacramento or San Joaquin rivers in the Central Valley (Figure 1.1-1).

The following description of the present-day natural environment of the study area takes an explicitly natural history approach. Its basic intent is not to exhaustively describe all nuances of the natural landscape but, instead, to emphasize aspects of the natural environment that were important to prehistoric peoples inhabiting the region. Numerous references throughout the overview direct the reader to more detailed information regarding selected environmental attributes.

Nature provided water, food, medicine, shelter, clothing, raw materials, and less tangible spiritual and aesthetic qualities for the native peoples who lived in the Stanislaus region prior to European settlement. People have been part of the Sierran ecosystem for at least the last 8,000 years. Just as the natural world affected humans, people have to a greater or lesser degree affected their surrounding environment. As archaeologists and anthropologists, we tend to make a clear distinction between nature and culture. The native inhabitants of the north-central Sierra may have had a somewhat different view. According to Ron Goode, North Fork Mono Tribal Chairman, gatherer, and soapstone carver:

> We refer to natural resources as cultural resources because we feel that everything has life or a spirit, therefore is respected as such... The archaeologist looks at plant life and calls the plant a natural resource

> because it's a resource in its raw state. The Indian sees the same resource and calls it a cultural resource, because they know the value this resource will produce and its affect on our culture. When I look at baywood I see bows, shelter covering and medicine, to me this is a cultural resource... It's the same when I pick up a soapstone rock, even before I rub the stone I've visualized an image, maybe a bear, eagle, or snake. Likewise when I approach a clump of wormwood, it's not a natural resource to me because I have great reverence for this plant because of its spiritual and religious significance in our culture as well as its extraordinary heating powers. This same viewpoint is held by the basket maker, food gatherer, medicine preparer and all other cultural resource users (Goode 1992).

Perhaps it would be premature to turn over the management of all "natural resources" in the Forest to the Forest Archaeologist or Historian. Nevertheless, it would be important to keep this perspective in mind when working with other forest resource managers and the local Native American community. This more holistic outlook could be incorporated into the philosophy of "whole ecosystem management" emerging within the Forest Service today.

## 1.2 Physiography and Hydrology

Bounded on the west by the Central Valley of California and on the east by the Great Basin of Nevada, the north-central Sierra Nevada Mountains are:

> ... essentially an enormous piece of the earth's crust that rose thousands of feet along a series of faults, or fractures, on its eastern side, tilting westward in the process to form an asymmetrical mountain range with a broad, gently sloping western flank and narrow, precipitous eastern escarpment. Ranges formed in this way are known as tilted fault blocks (Whitney 1979:18).

The west slope of the study area is a broad, gently-sloping ramp rising eastward from the floor of the Central Valley. The lower reaches of the west slope comprise a fairly narrow belt of undulating foothills and broad valleys extending gradually upwards to an altitude of approximately 2,500 feet (760 m).

Above 2,500 feet, topography becomes extremely rugged. It is characterized by a series of southwest- trending ridges, often termed "divides," which separate deep river valleys or canyons. These river canyons have steep slopes and often are several hundred or more meters deep from their floors to the tops of adjacent ridges. Among the rivers which have carved these gorges within the Forest are the Mokelumne, Stanislaus, Tuolumne, and Merced rivers, each of which has several forks. A short segment of the upper Calaveras drainage extends into the Forest to Dorrington. Prominent divides or ridges within and adjoining the Forest (north to south) include Bailey, Summit Level, Star, Grant, Dodge, Cherry, Jawbone, and Pilot ridges (Figure 1. I - 1).

Above the river canyon country, the land surface rises steadily to the main crest of the Sierra Nevada. This is a single main divide separating watersheds of the east and west slopes. On the eastern edge of Stanislaus forest, the crest extends from Reynolds Peak on the north, through Ebbets, Tryon, Arnold, Disaster, Boulder, Stanislaus, Sonora, Leavitt, and Grizzly peaks, many of which are more than 10,000 feet (3,050 m) in elevation. Natural passes-such as Ebbets, Wolf Creek, Sonora, Emigrant, and Mono-would have provided natural corridors for people, trade goods, and animals moving back and forth between the Central Valley and the Great Basin (even plants if we consider a geological time scale). Modern roads traverse two of these passes (Ebbets and Sonora). East of the crest, and outside the Forest, the land surface slopes downward toward high desert basins like Antelope and Bridgeport valleys. The east slope is drained by the Carson and West Walker river systems.

In contrast to the southern Sierra, extensive tracts of high altitude, glacially scoured terrain occur relatively infrequently and intermittently in the north-central Sierra. The most conspicuous area of Sierran “alpine” or "high country" found within the Forest is the Emigrant Wilderness located in the east-central part of the Forest.

At upper elevations, many natural meadows and lakes occur. This is especially the case near the Sierran crest in the Emigrant Wilderness area. Numerous lakes and reservoirs have been created within the Forest area by damming river and stream waters. Smaller lakes have been enlarged through the construction of dams such at Salt Springs, Alpine, Utica, Spicer Meadow, Donnell, Beardsley, Pinecrest, Lyons, and Cherry lakes. Many prehistoric sites have probably been inundated by these construction projects.

Topographic data for the study area are available from a number of sources. The study area is completely covered by USGS topographic maps. These are available in a variety of series, including 7.5' quadrangle maps, 15' quadrangle maps, 30x60-minute series maps (1:100,000 scale), and lx2-degree series maps (1:250,000 scale). Descriptions of the region's physiography/topography are contained in numerous guidebooks and other popular accounts (Grodin and Grodin 1983; Mandel et al. 1989; Schaffer et al. 1977; Winnett 1976, 1979; Wood 1977). Atlases depicting the study area include DeLorme Publishing Company (1986), Donley et al. (1979), and Hornbeck and Kane (1983), among others.

## 1.3 Geology and Geomorphology

It is necessary to consider the geologic and geomorphological features of the Forest and the surrounding region to fully understand prehistoric human settlement and resource use in the area. Important lithic resources such as chert, obsidian, basalt, rhyolitic tuff, petrified wood, quartzite, and soapstone were used by prehistoric peoples for both flaked and groundstone tools, as well as other items. Geological features figured prominently in the determination of boundaries between populations and the movement of people within the area. An understanding of geomorphological processes may help pinpoint areas in which former land surfaces may be buried through soil movement, perhaps assisting in the location of older prehistoric sites.

As Norris and Webb (1990:63) note regarding the general geology of the Sierra Nevada:

> An important section of the earth's outer crust is exposed in the Sierra Nevada. The rocks are mainly igneous and metamorphic units of diverse composition and age, including volcanic and metasedimentary interlayered rocks. In the central and southern Sierra, plutonic igneous rocks, mostly silicic (granitic), form the multiple intrusions of the Sierra Nevada batholith and constitute 60% of the exposed rock ... Sedimentary and volcanic rocks that overlie the basement are most prominent in the central and northern Sierra.

A variety of geological and geomorphological processes have contributed to evolution of the Sierran landscape (Hill 1975; Norris and Webb 1990; Whitney 1979). Plate tectonics have been the basic geological driving force leading to development of the Sierran landscape. Formation of the Sierra Nevada began during the Paleozoic Era some 475 million years ago with sea floor deposition of sediments originating from the ancestral North American continent which was drifting west. Towards the end of the Paleozoic, these sea floor sediments became folded as the Pacific plate collided with the North American plate. Paleozoic deposits are exposed on the western edge of the forest in the upper foothills zone (Figure 1.3-1). These Paleozoic strata include metasedimentary and metavolcanic rocks such as slate, phyllite, greenstone, homfels, gneiss, graywacke, crystalline limestone, and chert.

During the subsequent Mesozoic Era, which began ca. 225 million years B.P., these sea floor sediments were increasingly folded, tilted, and fed into the subduction zone formed between the Pacific and North American plates. Rocks on the subducting Pacific plate melted, forming magma. Some of this molten rock was expelled from volcanoes. The rest cooled in place, forming the ancestral Sierra Nevada batholith. As time progressed, many of the sea floor volcanic and sedimentary rocks became metamorphosed. Crustal uplifting began, forming a folded mountain range, which was the Nevadan Mountains, the proto-Sierra Nevada. About 130 million years B.P., the proto-Sierra began to be leveled by subsidence and pronounced erosion. Mesozoic granitic rocks are exposed throughout the forest from the upper foothills to the Sierra Crest. Pockets of intrusive Mesozoic gabbro are exposed along upper Beaver Creek and the Clavey River. Intrusive, ultrarnafic soapstone which outcrops east of Kinsley (Soapstone Ridge) was an important prehistoric trade item.

At the beginning of the Tertiary Period of the Cenozoic Era, some 65 million years B.P., the proto-Sierra had eroded into a gentle rising plain with a few hills and ridges to the east. Around 30 million years ago, extensive volcanic activity began to bury the northern portion of the Sierra under ash and mud. These mudflow and ash deposits formed a volcanic plain of andesitic lahar referred to as the Mehrten Formation. Remnants of the Mehrten Formation are exposed along the west-trending ridges which slope down from the crest. Due to the porosity of these andesitic mudflows, groundwater often emerges as springs and stream flow at, or just downslope of, exposed contact areas between the Cenozoic volcanics and underlying, impermeable Mesozoic granites. Archaeological sites are often located close to these springs (Jackson 1988). Uplift of the northern portion of the Sierra began ca. 10 million years B.P.

The aforementioned Tertiary pyroclastics are largely andesitic. Pockets of Valley Springs rhyolitic tuff and Eureka Valley tuff, some of which have evidence for prehistoric quarrying activities, are found throughout the Stanislaus River drainage. This tuff often underlies deposits of fine-grained basalts which are also suitable for flaked stone tools. Other outcrops of fine-grained basalts occur in the southern part of the Forest such as at Jawbone Lava Flat.

During the Quaternary Period of the Cenozoic Era, which has lasted approximately the last 2.5-3.0 million years, volcanic activity and uplift has continued in the Sierra. The principal loci of these processes, however, shifted southward. Sierran glaciation commenced at the beginning of the Quaternary, which has been characterized by numerous periods of glacial advance and retreat. During the Holocene Epoch (i.e., the last 10,000 years) slow uplift, intermittent volcanic activity, and glacial advance and retreat have continued to occur. Glacial deposits are found in many localities within the Forest. These glacial till deposits are more common in the eastern part of the forest, generally above 6,000 feet (1,830 m) and especially in the alpine lake country of the Emigrant Wilderness (Figure 1.3-2). Broad valleys with deep deposits of Pleistocene and Holocene alluvium such as those around Bear Valley, Sand Flat, Mattley Meadow, Dorrington, Pinebrook Reservoir, and Hulls, Brownes, Ackerson, and Buck Meadows may have older buried sites such as those found at Clarks Flat (Peak and Crew 1990) and Gabbot Meadow (Peak and Neuenschwander 1991).

In summary geological processes that have produced the present-day configuration of the study area include faulting, tectonic uplift, glaciation, erosion, alluvial deposition, and volcanism. In shaping the north-central Sierra Nevada landscape, these forces have influenced prehistoric human adaptations in the study area in many ways by creating:

- a series of trans-Sierran travel corridors such as mountain passes and west-side ridges;
- alluviated lowland valleys which may have been foci of prehistoric human settlement;
- changes through time in configuration of lakes, wetlands, and meadows;
- glacial advances and retreats;

- culturally significant rock resources such as chert, petrified wood, basalt, vitric tuff, soapstone, and obsidian.

Several prehistoric quarry areas or culturally important mineral deposits have been identified within the Forest during archaeological reconnaissance. Quarry areas are identified as outcroppings of geologic materials at which flaked stone tools, tool fragments and cores are present, as well as tools for extracting and reducing quarry materials such as hammerstones. Raw material or mineral sources identified include basalt, vitric tuff (rhyolite), quartz, chert, petrified wood, salt, and soapstone.

For more than a century, numerous scholars have studied the geology and geomorphology of the Sierra Nevada. Relevant details in the previous discussion have been summarized in a number of general works (i.e., Alt and Hyndman 1975; Hinds 1952; Howard 1979; Norris and Webb 1990; Oakeshott 1978; Wahrhaftig and Bin-nan 1965), and in specific overviews (i.e., Bateman and Wahrhaftig 1966; Durrell 1966, 1987; Hill 1975; Slemmons 1966). Geologic guidebooks for the north-central Sierra include those of Evans and Matthews (1968) on geologic studies in the Lake Tahoe area, Hauge (1973) on environmental geology of the north central Sierra foothills, Hulbe's (1975) guide to Stanislaus River geology, Jenkins' (1948) fieldtrip guide along Highway 49 through the Mother Lode Country, and Marshall and Marshall's (1982) consideration of the geology of the western Sierra Nevada. Geologic mapping covers the entire Forest and surrounding area of the north-central Sierra Nevada at both the 1:250,000 scale and the 1:750,000 scale (Jennings et al. 1977).

## 1.4 Climate

Within the Sierra Nevada, a combination of Mediterranean (summer drought), highland (montane with summer thunderstorms), and microthermal (variation due to local typographic conditions) climates occur (Donley et al. 1979; Hornbeck and Kane 1983; Whitney 1977).  Mean annual temperatures range from 59-70-F (15-21-C). In the foothills the average temperature of the coldest month is between 43-48'F (6-9'C), while along the crest, it is below 27'F (minus 3'C). The average temperature of the warmest month is 75-81'F (24-27'C) in the foothills, and below 47'F (15'C) along the crest. Average length of the annual frost-free season ranges from 240-300 days at lower elevations, and less than 120 days at higher elevations.

Sierra Nevada means "snowy mountain range" in Spanish, an appropriate appellation because the Sierra is one of the snowiest places in North America.  The west slope of the Sierra receives between 20 and 79 in. (50-200 cm) of precipitation per year. Amounts characterizing any particular area depend upon elevation and latitude. A marked rainshadow effect is observed on the east side of the Sierra, where precipitation rates rapidly drop from over 39 in. (100 cm) to less than 20 in. (50 cm) annually.

Below 2,000 feet (610 in), almost all precipitation falls as rain. Above 6,000 feet (1,800 in), virtually all occurs as snow. The first snows of the season usually occur between mid-September and November, with snow usually persisting on the ground after mid-November. Snowpack increases in depth during the winter months, generally reaching its maximum depth in March. After mid-March, the winter storm regime tapers off, and spring thaw commences. This proceeds from lower to higher elevations, working its way upslope from mid-March to mid-July.

Although the overwhelming majority of Sierran precipitation falls between October and March, summer thunderstorms are fairly common, especially during July and August. Generally these occur only locally. These usually do little to relieve the characteristic drought of Sierran summers, which tend to be dry when compared to other mountain regions of western North America.

## 1.5 Modern Vegetation

The botanical literature on the north-central Sierra Nevada is filled with a confusing array of biotic provinces, life zones, vegetation communities, and species associations. There are perhaps as many schemes for classifying vegetation as there are researchers doing the classification. "Vegetation units" are artificial human constructs created for the general purposes of mapping, description, classification, and management. Schemes vary according to the scale of the study and the particular species of interest to researchers. For example: range managers may be primarily interested in grass, forb, and browse species; wildlife managers may focus on the key food plants for the game species they are studying; and foresters are primarily interested in harvestable timber species. The cultural resource manager is in the awkward position of having to integrate these various classification schemes into a model that helps explain prehistoric land use and predict the distribution of archaeological sites on the landscape.

Part of the problem is related to a debate that has occurred in plant ecology for the last fifty years. Is a 44 plant community" a real, functioning, interdependent, and self-perpetuating biological "entity" (the Community Hypothesis)? Or is a "plant community" a chance overlap in time and space, of individual species with similar ecophysiological requirements (the Individualistic Hypothesis)? Certainly if we consider the total array of plants, animals, and soil organisms within a biotic community we discover a vast number of mutually interdependent biological relationships. And yet, very few of these species occur exclusively within one "mapping unit."

Compounding the problem for the archaeologist and paleoecologist is the fact that these plant communities change over time. Differences may be imperceptible within the lifetime of one person but these changes may be very dramatic on a geological or archaeological time scale. Disturbance factors such as fire, flood, or landslide will drastically alter species composition and vegetation structure. Grazing, mining, logging, and fire suppression have modified the forest over the last 150 years. Exotic species of plants and animals have been introduced, but this factor has been much more significant in the valley grassland than the Sierran forest. Vegetation also changes over time in response to climatic fluctuations. The species mixtures that we recognize as certain plant communities today may not have even existed in the Late Pleistocene or Early Holocene.

It is impossible to know how the prehistoric inhabitants of the north-central Sierra Nevada "mapped" their local environment. Like traditional gatherers everywhere, they knew for example, exactly where the sweetest and most productive groves of black oak trees were, or which were the best meadows to hunt deer. It would probably be inconsequential to them that "black oak usually occurs as an understory tree or in openings in the 'Yellow Pine Forest' or 'Sierran Montane Forest.'" They probably used "species associations" as only general guidelines for finding desired plants and animals. Traditional gatherers, and most wildlife species, also tend to focus more on ecotones and disturbed areas where elements from several different plant communities come together. It is these "fuzzy boundary areas" that shift the most over time.

With these considerations in mind, we have chosen to rely most heavily on Kinchier's (1977) classification system for the natural vegetation of California. He defines 54 vegetation communities which are mapped for modern California as a whole at a scale of 1:1,000,000. Within the Forest, six of these vegetation associations occur. They include: blue oak-gray pine forest, chaparral, Sierran yellow pine forest, Sierran montane forest, upper montane-subalpine forest, and alpine communities. These are mapped in Figure 1.5-1. Table 1.5-1 gives concordances between Kinchier's (1977) communities, Merriam's (1898) life zones, and the "wildlife habitat relationship" system developed by Mayer and Laudenslayer (1988). Mayer and Laudenslayer (1988:23-39) includes an excellent correspondence table for vegetation classification systems.

Basic data for plants inhabiting the study area may be found in two principal types of sources: general and regional floras, or various forms of areal vegetation mapping. Comprehensive California floras include Jepson (1925, about to be reissued) and Munz and Keck (1973). Griffin and Critchfield (1972), Jepson (1910), and Sudworth (1908) present detailed accounts regarding the distribution of various species of forest trees in California. California's shrubs are treated by McMinn (1959), while Crampton (1974) details California's grasses. Weeden (1986) is an accurate and easy-to-use general flora for the Sierra Nevada.

Table 1.5-1. Correspondance of biotic provinces, life zones[1], vegetation communities[2], and wildlife habitat relationships[3] for the north-central Sierra Nevada.

| BIOTIC PROVINCE | LIFE ZONE | VEGETATION COMMUNITY | WILDLIFE HABITAT RELATIONSHIP |
|---|---|---|---|
| Californian | Lower Sonoran | California Prairie | Annual Grassland[4] |
| | Upper Sonoran | Valley Oak Savanna | Valley Oak Woodland[4] |
| | | Chaparral | Chamise-Redshank Chaparral<br>Mixed Chaparral |
| | | Blue Oak-Gray Pine Forest | Blue Oak Woodland<br>Blue Oak-Gray Pine<br>Valley Foothill Riparian |
| Sierran | Transition | Sierran Yellow Pine Forest | Ponderosa Pine<br>Dry Meadow |
| | Canadian | Sierran Montane Forest | Montane Chaparral<br>Montane Hardwood<br>Montane Hardwood Conifer<br>Montane Riparian<br>Sierran Mixed Conifer<br>White Fir |
| | Hudsonian | Upper Montane-Subalpine | Red Fir<br>Lodgepole Pine<br>Aspen<br>Juniper<br>Subalpine Conifer<br>Subalpine Lucustrine<br>Wet Meadow |
| | Arctic/Alpine | Alpine | Alpine Dwarf Shrub |
| Great Basin | Transition | Jerry Pine Forest | Jeffery Pine[4] |
| | Upper Sonoran | Juniper-Pinyon Woodland<br>Sagebrush Steppe | Pinyon Juniper[4]<br>Sagebrush[4] |

[1]Merriam 1898; [2]Kiiehler 1977; [3]Mayer and Laudenslayer 1988; [4]outside Stanislaus Forest boundaries.

The major vegetation types of the Forest, particularly stands of economically important timber trees, are mapped at a scale of 1:62,500 (Burks, 1940).

Kuchler (1977) describes the structure, dominant taxa, other characteristic components, and general location of each of his vegetation associations. Mayer and Laudenslayer (1988), developed as a standardized resource management tool, discuss in detail 52 natural and anthropogenic habitats constituting the California Wildlife-

Habitat Relations System. These habitats are described in a consistent fashion with respect to structure, composition, succession, wildlife considerations, and distribution. Excellent general community descriptions are presented by various researchers in Barbour and Major (1988). These include oak woodland (Griffin 1988), chaparral (Hanes 1988), montane and subalpine (Rundel et al. 1988), and alpine (Major and Taylor 1988).

Table 1.5-2 lists 136 common and ethnobotanically important plant taxa that occur in the north-central Sierra Nevada. This may represent only 10-15% of the total mushroom and vascular plant flora of the Forest (Storer and Usinger 1973:58). This table includes plant community association, elevational range, ethnographic uses, and gathering season. It also contains information about whether the taxon is fire tolerant or a fire increaser. This compendium also lists whether or not the taxon has been identified in archaeobotanical research conducted in the north-central Sierra, some of which will be discussed later. Most of this catalog was initially developed by Ron Goode and Joanna Clines for the North Fork Mono of Sierra National Forest (Goode 1992). It has been expanded and adapted for the Forest. Data for the percentage of the forest in each community and the proportion of prehistoric sites in each habitat were abstracted from Woolfenden (1988).

Vegetation communities in the study area are distributed in a series of north-south trending belts, whose locations are correlated closely with elevation. Other pertinent factors include slope, exposure (aspect), soil, geological substrate, topography, proximity to streams, and recent disturbance history (fires, logging, landslide, floods, etc.).

Blue oak-gray pine forest, with interspersed zones of chaparral dominates the foothills region on the western edge of the Forest up to about 3,000 ft. (915 in). This is an open to closed woodland community with blue oak, gray pine (also called bull or digger pine), various other evergreen oaks, and assorted chaparral shrubs. Approximately 44% of the culturally significant plant resources in the forest may be found in this zone (Table 1.5-2).

Foothills chaparral communities are composed of several dominant genera--chamise, manzanita, yerba santa, and ceanothus (California lilac, buckbrush). Chaparral communities are most common along the western edge of the Forest, on steep rocky slopes with shallow soil. This is a very dense community that is difficult to travel through or survey. All chaparral species are adapted to frequent natural burning. Approximately 38% of the culturally significant plant taxa in the forest are found in the chaparral (Table 1.5-2). At higher elevations, generally above 3,000 ft. (915 m), chaparral takes on a more montane character. Manzanitas are still prevalent, but gooseberries, currants, mountain whitethorn, chinquapin, bitter cherry, huckleberry oak are common associates. Today montane chaparral is very common on heavily logged areas, old bums, and expanses of granite.

At slightly higher western mid-slope elevations (3,000-6,000 ft., 915-1,850 m, depending on slope, aspect, and soils), Sierran yellow pine forest is found (ca. 15% of the Forest area; Woolfenden 1988:Figure 1). Common components of this community include ponderosa pine, incense cedar, white fir, sugar pine, black oak, bear clover (mountain misery), canyon live oak, and several manzanita species. Today ponderosa pine forest is a tall, moderately dense, fairly closed-canopy community with a well developed shrubby understory. Prior to extensive logging and fire suppression, old-growth yellow pine forest would probably have been far more open and park-like. Young conifers and shrubs would have been relatively rare, limited to forest edges, natural openings in the canopy, or recent bums. Black oak groves were probably common features in the pre-Gold Rush era Sierra. Approximately 71% of the culturally important plant resources occur in the yellow pine forest (Table 1.5-2).

Yellow pine forest intergrades farther upslope (4,000-7,000 ft., 1,230-2,150 m) with Sierran montane forest (also called mixed conifer forest), which is the dominant vegetation community on the western Sierra Nevada slope (approximately 40% of the Stanislaus area according to Woolfenden 1988:Figure 1). Ponderosa pine, white fir, Douglas fir, sugar pine, incense cedar, and black oak are the dominant species; other characteristic components include madrone, dogwood, Jeffrey pine, western yew, California nutmeg, bigleaf maple, California bay, and canyon live oak. Understory species include manzanita, several buckbrushes, mountain misery, chinquapin, bitter cherry, and various berry species, among others. Groves of giant sequoia, such as those found in Calaveras Big Trees State Park, are generally included in this community. The major differences between yellow pine and mixed conifer forests, are the diversity of tree species and density of the stands, both of which are greater for the Sierra montane forest.

Above the Sierran montane forest at higher elevations (above 6,580 ft., 2,000 m) along the west slope and main crest of the Sierra, upper montane-subalpine forest occurs, dominated by red fir and lodgepole pine. Other trees within this community are western juniper, Jeffrey pine, sugar pine (at lower elevations), mountain hemlock, and quaking aspen, particularly near open streams or meadow margins; whitebark pine, foxtail pine and western white pine occur at higher elevations. Common shrub species include manzanita, mountain whitethorn,

Table 1.5-2. Conspicuous and ethnobotanically important plants of the north-central Sierra Nevada.

| Common Name | Scientific Name | Fire | Ebot | Cha | Opw | Ypf | MCf | Saf | Mea | Rip | Season | Use | Elevation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Clover | Trifolium spp. | + | + | | | | | | + | + | Mar-Jun | G | all |
| Mint Tea | Pycnanthemum californicu | + | + | | | + | + | + | + | + | all | M | all |
| Lupine | Lupine spp. | + | + | + | + | + | + | + | + | + | May-Ju | G,M | all |
| Wild Onion | Allium spp. | + | | + | + | + | + | + | + | + | Mar-Jul | R,G | all |
| Mariposa Lily | Calochortus spp. | + | | + | + | + | + | + | + | + | Apr-Jul | R | all |
| Wild Buckwheat | Eriogonum spp. | + | + | + | + | + | + | | + | | May-Aug | S,M | all |
| Currant | Ribes cereum | + | | + | | + | + | + | | + | Jul-Sep | F | 5000-12500 |
| Reedgrass | Calamagrositis spp. | + | + | | | | | | + | + | Jun-Sep | S | 5000-12500 |
| Hairgrass | Deschampsia spp. | + | + | | | | | | + | + | May-Aug | S | 3300-12500 |
| Whitebark Pine | Pinus albicaulis | | | | | | | + | | | all | W | 7000-12000 |
| Pussy Paws | Calyptridium spp. | + | + | | | + | + | + | + | | May-Aug | S | 2000-12000 |
| Needlegrass | Stipa spp. | + | + | + | + | + | + | + | + | + | Jun-Aug | S,U | <11500 |
| Greenleaf Manzanita | Arctostaphylos patula | + | + | + | + | + | + | + | | | Jun-Aug | F,M,W | 4000-11000 |
| Angelica | Angelica spp. | + | | | | + | + | + | + | + | all | R,U | 3000-11000 |
| Yampah | Perideridia spp. | + | | | | | | | + | + | Jun-Aug | R | 3000-11000 |
| Sierra Iris | Iris missouriensis | + | | | | | | | + | + | all | U | 3000-11000 |
| Chinquapin | Castanopsis sempervirens | + | | + | | + | + | + | | | Sep-Nov | S | 3000-11000 |
| Native Barley | Hordeum spp. | + | + | | | + | + | + | + | + | May-Jul | S | <11000 |
| Mountain Hemlock | Tsuga mertensiana | | | | | | | + | | | all | W | 9000-10500 |
| Western White Pine | Pinus monticola | | | | | | | + | | | all | M,W | 8000-10500 |
| Western Juniper | Juniperus occidentalis | | | | | | | + | | | Aug-Oct | F,U,M,W | 6500-10500 |
| Lodgepole Pine | Pinus contorta ssp. Murrayanna | + | | | | | + | + | + | | all | U,W | 6000-10500 |
| Tiger Lily | Lilium spp. | + | | | | + | + | + | + | + | May-Sep | R,M | 4000-10500 |
| Lovage, Osha | Ligusticum spp. | + | | | | | | | + | + | Jun-Sep | R,M | 4000-10500 |
| Bromegrass | Bromus spp. | + | + | + | + | + | + | + | + | + | May-Aug | S | <10500 |
| Quaking Aspen | Populus tremuloides | + | | | | + | + | + | + | | all | M,W | 6000-10000 |
| Pinemat Manzanita | Arctostaphylos nevadensis | + | | + | | + | + | + | | | May-Aug | F | 5000-10000 |
| Currant | Ribes nevadense | + | | | | + | + | + | | | Jun-Aug | F | 3000-10000 |

| Common Name | Scientific Name | Fire | Ebot | Cha | Opw | Ypf | MCf | Saf | Mea | Rip | Season | Use | Elevation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Huckleberry Oak | Quercus vaccinifolia | + | | + | | | + | + | | | Aug-Oct | N,W | 3000-10000 |
| Bear Clover | Chamaebatia foliolosa | + | | | | + | + | + | | | all | M | 2500-10000 |
| Willow | Salix spp. | | | | | | | | | + | all | U,W | <10000 |
| Wild Rose | Rosa spp. | + | | | | | | | | + | all | F,M | <10000 |
| Sagebrush | Artemisia tridentate | | | | | | | + | | | Aug-Oct | S,M,W | <10000e |
| Bracken Fern | Pteridium aquilinum | + | | | | + | + | + | + | + | Mar-Jul | G | <10000 |
| Fescue | Festuca or Vulpia spp. | + | + | | + | + | + | + | + | + | Jun-Sep | S | <10000 |
| White Sage | Salvia spp. | + | | + | + | + | | | | | all | M | <10000 |
| Biscuit Root | Lomatium spp. | + | | | + | + | + | | | | Apr-Jun | R | 3000-9500 |
| Morel | Morchella elata | + | | + | + | + | + | + | | | Mar-Jun | G | <9500 |
| Brown Cup Mushroom | Peziza syvestris | + | | + | + | + | + | + | | | Feb-Jul | G | <9500 |
| Black Cottonwood | Populus trichocarpa | | | | | | | | | + | all | W | 4000-9300 |
| Douglas Fir | Pseudotsuga menziesii | | | | | + | + | + | | + | all | U,W | 7000-9000 |
| Red Fir | Abies magnifica | | | | | | + | + | + | + | all | W | 6500-9000 |
| Pinyon Pine | Pinus monophylla | | | | | | | | | | Aug-Oct | N,M,W | 6000-9000e |
| Current | Ribes viscossimum | + | | + | | + | + | + | + | + | Jun-Aug | F | 5000-9000 |
| Jeffrey Pine | Pinus jeffreyi | + | | | | + | + | + | | | all | B,W | 5000-9000 |
| Bitter Cherry | Prunus emarginata | + | + | + | | + | + | + | + | + | Aug-Oct | F | 4500-9000 |
| Wild Strawberry | Fragaria platypetala | | | | | + | + | + | + | + | Jul-Sep | F,M | 4000-9000 |
| Mountain Whitethorn | Ceanothus cordulatus | + | | + | | + | + | + | | | all | W | 3500-9000 |
| Wormwood Sage | Artemisia spp. | + | | | + | + | + | + | + | + | all | M | <9000 |
| Coral Mushroom | Ramaria scatesiana | + | | | + | + | + | + | + | + | Mar-Jun | G | <9000 |
| Cauliflower Mushroom | Sparassis crispa | + | | | + | + | + | + | + | + | Nov-Mar | G | <9000 |
| Goosefoot | Chenopodium spp. | + | + | + | + | + | + | | + | + | May-Sep | S,G | <9000 |
| Gooseberry | Ribes roezlii | + | | | + | + | + | + | | + | Sep-Oct | F | <8500 |
| Sweet Cicely | Osmorhiza spp. | + | | | + | + | + | + | | | Apr-Jul | R,M | <8500 |
| Snow Plant | Sarcodes sanguinea | + | | + | | + | + | + | | | Feb-Jun | G,M | 4000-8000 |
| Tarweed | Madia spp. | + | + | + | + | + | | | + | + | Jun-Sep | S | 3000-8000 |
| Sugar Pine | Pinus lambertiana | + | + | | | + | + | + | | | Sep-Dec | N,B,M,W | 3000-8000 |
| Camas | Camassia spp. | + | | | | | | | + | + | May-Aug | R | 2000-8000 |
| Watercress | Rorippa nasturtium aquaticum | | | | | | | | + | + | all | G | <8000 |

| Common Name | Scientific Name | Fire | Ebot | Cha | Opw | Ypf | MCf | Saf | Mea | Rip | Season | Use | Elevation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Panic Grass | Panicum spp. | + | + | | | | | | + | + | May-Aug | S | <8000 |
| Horsetail | Equisetum spp. | | | | | | | | + | + | all | M,U | <8000 |
| Thimbleberry | Rubus parviflorus | + | | | | + | + | + | + | + | Jun-Sep | F | <8000 |
| Monkey Flower | Mimulus cardinalis | + | | | | + | + | + | + | + | May-Nov | M | <8000 |
| Giant Sequoia | Sequoiadendron giganteum | + | | | | + | + | | | | all | W | 5000-7500 |
| White Fir | Abies concolor | | | | | + | + | + | | | all | W | 3500-7500 |
| Black Oak | Quercus kelloggii | + | ? | | + | + | + | | | | Sep-Nov | N,U,W | 2000-7500 |
| Coffeebery | Rhamnus californica | | | + | + | + | + | + | | | all | U,M,W | <7500 |
| Ryegrass | Elymus spp. | + | + | + | + | + | + | | + | + | Jun-Aug | S | <7500 |
| Spanish Clover | Lotus purshianus | + | + | | | | | | + | | May-Jun | G | <7500 |
| Deerbrush | Ceanohus negrimus | + | | | | + | + | + | | | all | U | 2500-7000 |
| Sheep Sorrel | Rumex spp. | + | | | | | | | + | + | Apr-Jul | G | <7000 |
| Arrowhead | Sagittaria latifolia | | | | | | | | + | + | Jun-Nov | R | <7000 |
| Yew | Taxus brevifolia | | | | | + | + | | | + | Aug-Oct | F,M,W | <7000 |
| California Netmeg | Torreya californica | | | | | + | + | | | + | Aug-Oct | S,W | <7000 |
| Milkweed | Asclepias spp. | + | | + | + | + | + | | + | + | Aug-Dec | M,U | <7000 |
| Raspberry | Rubus leucodermis | + | | | | + | + | | | + | Jun-Sep | F | <7000 |
| Elderberry | Sambucus glauca | + | + | | + | + | + | + | + | + | Aug-Oct | F,G,U | <7000 |
| Blue Elderberry | Sambucus mexicana | + | + | | + | + | + | + | + | + | Aug-Oct | F,G,U | <7000 |
| Hazelnut | Corylus cornuta | | + | | | + | + | + | + | + | Aug-Nov | N,U | <7000 |
| Wild Strawberry | Fragaria californica | | | | | + | + | + | + | + | Jul-Sep | F | <7000 |
| Mule Ears | Wyethia spp. | + | | | | + | + | + | + | + | all | G,M | <7000 |
| Miner’s Lettuce | Claytonia perfoliata | + | + | | | + | + | + | + | + | Feb-Jul | G | <7000 |
| Deer Muhly | Muhlenbergia rigens | + | | | | + | + | + | + | + | all | U | <7000 |
| Incense Cedar | Calocedrus decurrens | + | | | | + | + | | | + | all | U,M,W | 2000-6500 |
| Giant Puff Ball | Calvatia gigantean | + | | + | + | + | + | | + | + | Oct-May | G | <6500 |
| Cottonwood | Populus fremontii | + | | | | | | | | | all | W | <6500 |
| Sierra Plum | Prunus subcordata | + | + | | | + | + | | | + | Jul-Sep | F | 4000-6000 |
| Pacific Dogwood | Cornus nuttallii | + | | | | + | + | | | + | all | M | 3500-6000 |
| Golden Cup Oak | Quercus chrysolepis | + | ? | | + | + | + | | | + | Sep-Nov | N,W | 2500-6000 |
| Ponderosa, Yellow Pine | Pinus ponderosa | + | | | + | + | + | | | | all | B,M,U,W | 2000-6000 |

| Common Name | Scientific Name | Fire | Ebot | Cha | Opw | Ypf | MCf | Saf | Mea | Rip | Season | Use | Elevation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mountain Mahogany | Cercocarpus betuloides | + | | + | + | + | | | | | all | U,W | 2000-6000 |
| Manzanita | Arctostaphylos mariposa | + | + | + | + | + | | | | | Jul-Aug | F,M,W | <6000 |
| Chokecherry | Prunus virginiana | + | | + | + | + | | | | + | Aug-Oct | F | <6000 |
| Gooseberry | Ribes amarum | + | | + | + | + | | | | + | Sep-Oct | F | <6000 |
| Toyon, Christmas Berry | Heteromeles arbutifolia | + | | + | + | + | | | | + | Sep-Jan | F | <6000 |
| Red Maids | Calandrinia ciliata | + | + | + | + | + | | | + | + | Apr-May | S,G | <6000 |
| Balsam Root | Balsamorhiza spp. | + | | | + | + | | | + | + | Apr-Jul | S,R,M | <6000 |
| Buckbrush | Ceanothus cuneatus | + | | + | + | + | + | | | | all | U | <6000 |
| Oyster Mushroom | Pleutotus ostreatus | + | | + | + | + | | | + | + | Oct-Apr | G | <6000 |
| Coccoli Mushroom | Amanita calyptra | + | | + | + | + | | | + | + | Mar-Jul | G | <6000 |
| Flannel Bush | Fremontodendron californicum | + | | + | + | | | | | | all | U | <6000 |
| Buckeye | Aesculus californica | | | | + | + | | | | + | Sep-Dec | N,U | 2000-5000 |
| Big Leaf Maple | Acer macrophyllum | | | | | + | | | | + | all | W | 2000-5000 |
| Cattail | Typha latifolia | | | | | | | | | + | Mar-Jun | R,G,U | <5000 |
| Tule | Scirpus acutus | | | | | | | | | + | all | S,R,U | <5000 |
| White Alder | Alnus rhombifolia | | | | | | | | | + | all | M,U,W | <5000 |
| California Bay | Umbellularia californica | | + | | | + | | | | + | Sep-Nov | N,M,W | <5000 |
| Mistletoe | Phoradendrom spp. | | | | + | + | | | | | all | M | <5000 |
| Redberry | Rhamnus crocea | | | + | + | + | | | | | Nov-Jan | F,M | <5000 |
| Dogbane Hemp | Apocynum cannabinum | + | | + | + | + | | | | | all | U | <5000 |
| Soaproot | Chlorogalum pomeridianum | + | | + | + | + | | | + | | Feb-Jul | U | <5000 |
| Brown Field Mushroom | Agaricus cupreobaunneus | + | | + | + | + | | | + | + | Oct-May | G | <5000 |
| Field Mushroom | Agaricus campestris | + | | + | + | + | | | + | + | Oct-May | G | <5000 |
| Thistle | Cirsium spp. | + | + | + | + | + | | | + | + | Jul-Oct | G | <5000 |
| Yerba Santa | Eriodictyon spp. | + | | + | | | | | | | all | M | <5000 |
| Chamise | Adenostoma fasiculatum | + | | + | | | | | | | Jun-Aug | S,M,W | <5000 |
| Live Oak | Quercus wislizenii | + | ? | | + | + | | | + | + | Sep-Nov | N,U,W | <4500 |
| Blue Oak | Quercus douglassii | + | ? | | + | + | | | + | | Sep-Nov | N,M,U,W | <4500 |
| Blackberry | Rubus vitifolius | + | + | | | | | | | + | Aug-Oct | F,M,U | <4000 |
| Wild Grape | Vitis californica | + | | | | | | | | + | Sep-Nov | F,U | <4000 |
| Western Redbud | Cercis occidentalis | + | | | | + | | | | + | Nov-Mar | U | <4000 |

| Common Name | Scientific Name | Fire | Ebot | Cha | Opw | Ypf | MCf | Saf | Mea | Rip | Season | Use | Elevation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wild Celery | Apiastrum augustifolium | + | | + | + | + | | | + | + | Apr-Jul | R,G | <4000 |
| Valley Oak | Quercus lobata | + | ? | | | | | | + | + | Sep-Nov | N,U,W | <4000 |
| Mustard* | Brassica spp. | + | | + | + | + | | | + | + | Feb-May | G,S | <4000 |
| Chia | Salvia columbarariae | + | + | + | + | + | | | + | | May-Oct | S | <4000 |
| Thistle Sage | Salvia carduacea | + | | + | + | + | | | + | | May-Oct | S | <4000 |
| Tarweed | Hemizonia spp. | + | + | + | + | + | | | + | | May-Oct | S | <4000 |
| Gray Pine | Pinus sbinana | + | + | + | + | + | | | | | Aug-Dec | N,U,W | 1000-3000 |
| Grass Nut | Brodiaea spp. | + | + | + | + | + | | | + | + | Apr-Jul | R | <3000 |
| Sycamore | Platanus racemosa | | | | | | | | | + | all | U,W | <3000 |
| Nettle | Urtica spp. | + | | | | | | | + | + | all | G,U | <3000 |
| White Root | Carex spp. | | | | | | | | + | + | all | U | <3000 |
| Salt Grass | Distichlis spicata | + | | | | | | | + | | Apr-Oct | S | <3000 |
| Sourberry | Rhus trilobata | + | | + | + | + | | | | | May-Aug | F,U,M | <3000 |
| Jimsonweed | Datura meteloides | + | | + | + | + | | | + | + | all | M | <3000 |
| Sunflower | Helianthus spp. | + | | + | + | | | | + | + | Jul-Sep | S,M | <3000 |
| Wild Tobacco | Nicotiana spp. | + | | + | + | | | | + | + | Jun-Oct | M | <3000 |
| % of Taxa | | 75 | 27 | 38 | 44 | 71 | 47 | 40 | 53 | 64 | | | |
| % of Forest Area | | | | 4 | 6 | 15 | 40 | 25 | 2 | 1 | | | |
| % of Sites in Community | | | | 2 | 1 | 56 | 24 | 14 | 2 | 1 | | | |

Key: Fire – Fire tolerant/fire increaser. Ebot – Identified archaeobotanically. Cha – Chaparral (foothill or montane). OPw – Blue oak/gray pine woodland. YPf – Yellow pine forest. MCf – Sierra montane/mixed conifer forest. SAf – Subalpine forest. Mea – Wet or dry meadow. Rip – Riparian forest. G – Edible greens/vegetable. R – Edible root. M – Medicine/ceremonial. F – Edible fruit. S – Edible seeds. N – Edible nuts. B – Edible inner bark. U – Utilitarian (cordage, baskets, etc.). W – Wood. e – East of Sierra crest. * - Introduced species. ? – Identified only to genus.

mountain heather, various berries, and willows. This community covers roughly one-fourth of the Forest area (Woolfenden 1988:Figure 1).

True alpine vegetation is rare in the forest, limited to areas above timberline on the highest peaks along the crest. This community is characterized by grasses, forbs, and dwarf shrubs (often cushion plants). Growing season is very short and the habitat is deceptively xeric (because of exposure and high winds) despite heavy winter snowfalls.

East and below the main crest adjacent to the Forest, a combination of subalpine, Sierran montane forest, and northern Jeffrey pine forest occurs. Below these communities, stands of pinyon-juniper woodland appear.

Throughout most of the forested portions of the study area, pockets of meadow occur. At lower elevations these are predominantly dry grasslands with numerous members of the grass, lily, sunflower, umbel (carrot), and pea families. At higher elevations they tend to be wet and boggy with grasses, sedges, rushes, lilies, umbels, horsetails, and mosses. While the total acreage of meadows in the forest is rather small (2%), they tend to be very productive places for human gatherers and wildlife. More than half of the ethnobotanically important plants in Table 1.5-2 occur in meadows.

Corridors of riparian forest extend from nearly the crest to the Central Valley. Although these riparian forests may vary little in species composition from their surrounding communities they generally are extremely productive in ten-ns of food for humans and game. Willows and alders tend to be the dominant riparian trees at higher elevations; sycamore, willows, and cottonwoods at lower. At least 64% of the culturally important flora of the area may be found in these riparian corridors.

Plant resources significant as food sources to the prehistoric human inhabitants of the Forest include a variety of greens, roots/bulbs/corms, grass seeds, fruits/berries, and tree crops. All of these manifest a high degree of seasonal availability and abundance (Table 1.5-2). During late winter and early spring, a variety of greens and mushrooms would have been available. From mid-spring until early summer, a diverse suite of liliaceous and amarillid bulbs and corms, along with umbelliferid roots, would have been harvested. Late spring through summer would have produced a bounty of grass and other small seeds from a host of species. A plethora of fruits and berries, especially those produced by members of the manzanita and rose families, would have been consumed from mid-summer into late fall. Various nuts, especially pine nuts and acorns, as well as other tree crops, would have been gathered during the late summer and fall.

The diversity, availability, abundance, and productivity of these food and other plant resources vary markedly within the Forest. Key variables include the season of the year, proximity to water, and elevation. Growing season tends to decrease roughly two weeks with each 1,000-foot (305 m) jump in elevation. Inspection of data on the seasonal availability of Sierran plant resources presented in Table 1.5-2 indicates late spring to mid-fall would have been the period of maximum diversity, availability, abundance, and productivity of plant resources, most of which could have been easily stored. In contrast, winter and early spring would have been the leanest months. This is the period when stored foods and hunting would have been most critical to survival.

Table 1.5-2 was partly inspired by a study on Nisenan ethnobotany for the Auburn Reservoir area (1,000-3,000 ft., 305-915 m) by Erskian and Ritter (1972). They examined the seasonal and elevational distribution of plants that were important to the Nisenan peoples of the northern Sierra. Most of the economically important plants in the Auburn area could have been gathered between April and June (Erskian and Ritter 1972:Figure 1). Regarding elevation they found:

Of the total number of plants reported, 72 per cent are found at sea level. The modal class occurs at 3000 feet, and a high proportion, 74 per cent, can be found at 5000 feet. Of the total reported flora utilized, 51 per cent are food plants. Seventy-four per cent of these plants can be found at sea level. The modal class for food plants occurs at 2000 feet. At 5000 feet only 68 per cent of the food plants can be found. This may indicate a maximization of flora between 2000 and 3000 feet. (Erskian and Ritter 1972:29)

Data for the Stanislaus area reflects a higher elevational focus. Seventeen percent of the plants in Table 1.5-2 could be harvested in spring or early summer, 23% in mid-summer, and 26% in late summer or early fall. Only 4%, mostly mushrooms, could be picked in the colder months between October and May. The remaining 30% are medicinal or utilitarian plants that could be gathered at any time. Regarding elevation, 66% of the plants in Table 1.5-2 occur below 2,000 ft. (610 m), the modal range is between 3,000 and 5,000 ft. (915-1,524 m, 74%), 70% between 5,000 and 9,000 ft. (1,524-2,774 m), and relatively few economic taxa occur above 9,000 ft. (2,774 m, 29%). If food availability is a major factor determining human settlement, then we would expect to find most of the sites in the Forest to occur between 3,000 and 5,000 ft. (which, as we shall see in Chapter 4, is the case).

Studies of past Sierra Nevada fire history are relevant since this seems to have been an important means by which prehistoric peoples in this region actively managed natural resources. Roper Wickstrom (1987) provides a Sierra Nevada-focused literature review of issues concerning Native American use of fire. A comprehensive model of Native American use of fire technology in the Sierra Nevada and other parts of California has been presented by Henry Lewis in a series of works (i.e., Lewis 1973, 1980, 1982, 1985, 1990; Lewis and Ferguson 1988). Various aspects of Sierra Nevada fire history are reviewed by a number of workers (i.e., Kilgore 1973a, 1973b; Kilgore and Briggs 1972; Kilgore and Taylor 1979; Parsons 1981; Vankat 1977; Vankat and Major 1978; Wagener 1961; Warner 1980). These have considered past fire history and incidence, the eco-historical role of fire in shaping various vegetation communities, and past human involvement in forest fires.

Fire was probably an extremely important tool for managing the productivity of plant resources in the Stanislaus area in the past. Fully 75% of the plants listed in Table 1.5-2 tolerate or benefit from frequent burning. As we shall see in the section on paleoenvironment, evidence for increased fire frequency in the past seems to be coincidental with human settlement in the north-central Sierra.

Historic period vegetation change has profoundly affected the flora of the Sierra Nevada and the composition and distribution of its vegetation associations. Historic period lumbering and fire suppression have had considerable effects on the region's vegetation. These changes are most pronounced within the lower to middle elevations of the Forest in areas affected by historic mining, and hydroelectric and water impoundment activities, ranching and farming, as well as by the growth of towns and expansion of transportation corridors.

## 1.6 Fauna

The vertebrate fauna of the Sierra Nevada has been described in numerous accounts. These include all-inclusive natural histories in which Sierran physical environmental variables are often considered along with biotic environmental variables. Bakker's (1971) popular treatment of Californian habitats, for example, describes several different types of Sierran environments in terms of their physical characteristics, plants, and animals.

Prehistoric peoples inhabiting the study area exploited a selected constellation of vertebrate species for food and other uses. Critical factors determining a particular specie's harvestability included its distribution, availability, abundance, productivity, amenability to capture, and so forth. Among the vertebrate taxa displaying these attributes are various species of salmonid (i.e., salmon and trout) and other freshwater fishes, especially minnows of various species, suckers, sunfish, and freshwater surfperch. Birds included so-called upland game which consist of a number of species of quail, grouse, pigeons, and doves. Economically significant mammals are represented by a host of upland game species (i.e., rabbits, pikas, tree squirrels, marmots, ground squirrels), fur-bearing carnivores, and artiodactyl herbivores (i.e., tule elk, deer, bighorn sheep).

For native peoples inhabiting the west Sierran slope of the study area, salmon and trout formed a highly important fisheries resource. Five species of anadromous salmon (i.e., chinook, coho, sockeye, pink, chum) originally inhabited the Sacramento-San Joaquin river system (Clark 1929; Fry 1979; Hallock and Fry 1967; Moyle 1976; Skinner 1962; Wang 1986). Of these, the most numerous by far were chinook or king salmon *(Oncorhynchos tshawytscha).* These make two annual spawning runs (Clark 1929; Fry 1961; Hallock and Fry 1967; Hallock et al. 1957; Hatton and Clark 1942; Moyle 1976; Rutter 1908; Skinner 1962; Van Cleve 1945; Wang 1986). The spring run lasts from March until June, peaking in May, while the fall run takes place from late August until December, reaching its height in September-early October. Prior to historic period disturbance, salmon spawning took place in all the major rivers within the Forest (Clark 1929; Fry 1961; Hatton 1940; Hatton and Clark 1942; Skinner 1962; Van Cleve 1945). This probably occurred mainly on suitable gravel bars, beds and riffles occurring along river stretches situated in the Sierra foothills and lowermost mid-slopes up to impassable falls or rapids.

Rainbow trout *(Salmo gairdneri)* were present in the Sacramento,-San Joaquin system both as native year-round residents and anadromous steelhead rainbow trout. The latter enter the main stems of the Sacramento and San Joaquin rivers between early august and late November, with a migratory peak occurring near the end of September (Hallock et al. 1957, 1961). These fish remain in the main stems until October-November when falling water temperatures and increased stream flows due to the advent of winter storms allow them to ascend tributaries to spawn. Spawning is often done on the same gravel bars and riffles used by salmon. This pattern contrasts with the winter runs of steelhead characterizing many coastal streams in central and northern California (Murphy and Shapovalov 195 1; Shapovalov and Taft 1954; Skinner 1962; Withler 1966).

Upland game birds inhabiting the Forest lands include California quail *(Callipepla californica),* mountain quail *(Oreortyx pictus),* sage grouse *(Centrocercus urophasianus),* blue grouse *(Dendrogapus obscurus),* band-tailed pigeon *(Columbafasciata),* and mourning dove *(Zenaidura macroura)* (Grinnell et al. 1918; Mallette 1969; McLean 1958). All are year-round residents of many parts of the region. Some species, though, annually migrate with the advent of winter from higher to lower elevations. These include quail, especially mountain quail (Ahlbom 1990a, 1990b; Edminster 1954; Grinnell et al. 1918; Johnsgard 1973; Leopold 1977, McLean 1930), band-tailed pigeons (Green 1990a; Grinnell et al. 1918; Neff 1947; Smith 1968), and mourning doves (Cowan 1952; Green 1990b). In contrast, blue grouse often move upslope with the start of cold weather, taking shelter in timbered areas (Bendell 1955; Grinnell et al. 1918; Hoffmann 1956; Wing 1947; Zwickel et al. 1968). As a consequence of their annual migratory and/or reproductive cycles, many of these bird species form population aggregates during various times of the year.

Upland game mammals inhabiting the Forest area include a variety of tagomorph and rodent species. These species often occur in great numbers, follow population "booms and busts" from year-to-year, and, in the case of some species, form annual population aggregates or live colonially. Lagomorphs include pikas *(Ochotona princess),* and several species of jack rabbits *(Lepus* spp.) and cottontail rabbits *(Sylvilagus* spp.). Pikas are found at higher elevations in the study area (Harris 1990; Smith and Weston 1990), while jack rabbits (Bittner and Rongstad 1982; Dunn et al. 1982; Lim 1987; Orr 1940; Zeiner et al. 1990) and cottontails (Chapman 1974, 1975; Chapman and Willner 1978; Chapman et al. 1982; Orr 1940; Zeiner et al. 1990) occur throughout the study area. All lagomorph taxa are active year-round.

Rodent species include tree squirrels, marmots, and ground squirrels. The former are represented by three species within the Forest region: western gray squirrels *(Sciurus griseus),* Douglas' squirrel *(Tamiasciurus douglasii),* and northern flying squirrel *(Glaucomys sabrinus).* Gray squirrels mainly inhabit lower and mid-slope mixed conifer and oak woodland habitats, being closely associated with oaks (Asserson 1974; Harvey 1990a; Ingles 1947; Steinecker 1977; Steinecker and Browning 1970). Douglas' and northern flying squirrels prefer higher elevation conifer habitats (Harvey 1990b; Harvey and Polite 1990, Wells- Gosling and Heaney 1984). All tree squirrels are active year-round and are non-migratory.

California ground squirrels *(Spermophilus beecheyi)* are found throughout the region. They are non-migratory, often live colonially, and may estivate/hibernate depending on local conditions (Evans and Holdenreid 1943; Fitch 1948; Grinnell and Dixon 1918; Linsdale 1946). Other burrowing sciurids dwell in high elevation habitats of the Forest area. These include yellow-bellied marmots *(Marmotaj flaviventris),* Belding's ground squirrel *(Spermophilus beldingi)* and the golden-mantled ground squirrel *(Spermophilus lateralis).* All are non-migratory, live colonially, and often hibernate from early fall until late spring (Bronson 1979; Frase and Hoffmann 1980; Grinnell and Dixon 1918; Jenkins and Eshelman 1984; Johnson 1990; Lee and Funderberg 1982; McKeever 1964; Orr 1949; Polite and Harvey 1990; Tomich 1982).

Many have argued that deer *(Odocoileus hemionus)* were the most important terrestrial mammal resource for prehistoric peoples inhabiting the Forest and adjacent regions of the north-central Sierra Nevada. General distributional ranges for Sierra Nevada and other California deer populations are presented in several sources (i.e., Anderson and Wallmo 1984; Cowan 1936, 1959; Dixon 1934; Hall 1927; McLean 1940; Wallmo 1981). Longhurst et al. (1952:23, Figure 5) map relative summer population densities of California deer. They observe most parts of the study area have high (10+ per sq. mi.) or medium (5-9 per sq. mi.) deer densities (also see McLean 1940:142, Figure 60). Year-round deer range also is found in the Sierra Nevada foothills (Longhurst et al. 1952:24, Figure 6). Winter range occupies a relatively narrow western Sierra midslope area. Significant expanses of winter range also occur to the north and south of Lake Tahoe.

The annual patterning of Sierra Nevada deer migrations has occupied the attention of many scholars for over half a century. Russell's (1932) classic study of seasonal migration of deer in the Yosemite region set the tone for a host of subsequent published and unpublished investigations. These often have been done as a consequence of game management concerns. Sierran deer migration studies of note include ones carried out in the northern Sierra (Leach and Hiehle 1957), the central Sierra (Browning et al. 1973; Leopold et al. 1951; Loft et al. 1989), southern Sierra (Bertram and Rempel 1977; Cornett et al. 1983; Schneegas and Franklin 1972), and east side of the Sierra (McLean 1940:154, Figure 67).

The annual pattern of up and downslope movement of deer generally involves a fairly rapid downslope movement of animals in October-November to their winter ranges, usually initiated by occurrence of the first major winter storm(s) of the year. Deer winter ranges are most frequently found between 1,635-A,900 ft. (500-1,500 in) elevation on the west slope of the Sierra. Deer remain in their winter ranges generally until mid- to late spring (i.e., from April to early June). During this period they begin to gradually drift upslope to summer range, following the spring thaw line. Spring migration routes are not as discrete or predictable as fall routes.

Following a program of broadscale archaeological survey on the Forest, a distinct correspondence between the distribution of prehistoric sites and the behavior of migratory deer was noted (Woolfenden 1988). Archaeological surveyors frequently noted deer trails near prehistoric site areas, and would often follow the trails from one site to another. Although these empirical observations do not indicate an inherent relationship between deer migratory behavior and prehistoric settlement, the correlation "provides a model that imparts a dynamic relationship to the static distribution of sites within the context of the Sierran environment and incorporates the testable hypothesis that populations of human hunter-gatherers and deer have similar response functions to mountain geography and variations in climate and phrenology" (Woolfenden 1988:225).

Bighorn sheep *(Ovis canadensis)* currently occupy limited tracts of range along the crest and eastern slopes of the southern Sierra Nevada west of the Owens River Valley (Dunaway 1970; Grinnell 1912; Hopkins 1990; Jones 1950; Monson and Sumner 1980; Riegelhuth 1965; Shackleton 1985; Weaver 1972). Historical and archaeological data suggest bighorns were originally continuously distributed along the entire main crest of the Sierra and adjacent east side regions (Barrett 1965; Cowan 1940; Jones 1950; Monson and Sumner 1980; Ober 193 1; Pippin 1979; Schulz and Simons 1973). Like deer, Sierra bighorn populations migrate between summer and winter ranges (Buechner 1960; Dunaway 1970; Jones 1950; McCullough and Schneegas 1966; Riegelhuth 1965; Weaver 1972; Wehausen 1983). Animals spend the summer in alpine habitats situated at high elevations near or on the Sierran main crest, and, sometimes, west of it. Downslope movement occurs during early winter into canyons on the east slope of the Sierra. Winter ranges typically are about 330-6,540 ft. (100-2,000 m) below the summer range on lower slopes of the east side. As soon as snow begins to melt in mid- to late spring, bighorns gradually move back upslope.

## 1.7 Paleoenvironment

In the approximately 8,000 years that people have been present in the Sierra Nevada, the natural landscape has changed significantly. Some of these changes may be understood through multidisciplinary studies that cross the fields of archaeology, botany, zoology, geology, pedology, hydrology, and climatology. Some of these studies include:

- Late Quaternary glacial geology;
- The Late Quaternary pollen record;
- Holocene dendrochronological and dendroclimatic data;
- Archaeobotany and zooarchaeology;
- Present day biogeography.

### 1.7.1 Glacial Geology

Several periods of glacial advance have occurred within the study area and environs during the period of human occupancy. The most extensive of these was the Tioga glaciation of the Late Wisconsin (terminal Pleistocene), characterized by multiple periods of glacial advance in many localities. Radiocarbon and other forms of dating suggest an ending date of about I 0,000 years B.P. for the Tioga advance (Davis and Moratto 1988; Fullerton 1986; Porter et al. 1983). During this period an extensive ice cap covered most of the higher elevation portions of the Stanislaus and adjacent regions of the Sierra lying to the north and south. Porter et al. (1983:89-92) describe the Late Pleistocene Sierra as follows:

The natural environment in the Sierra Nevada was substantially different during Late Wisconsin glaciation than it is today. Only a few very small glaciers are today scattered along the crest of the High Sierra, but large ice fields and long valley glaciers formed a vast glacier complex during the Tioga glaciation... The largest glaciers draining the eastern slope were between 15 and 27 km long. By contrast, some on the western slope reached lengths of more than 60 km... The smaller glaciers probably reached a maximum thickness of between 250 and 350 m, but the largest ice streams draining the western slope were more than 1000 m thick... Much of the meltwater produced by glaciers draining the eastern slope was channeled into Lake Tahoe, Mono Lake, and the Owens-China-Searles-Panamint-Death Valley lakes system. Coarse, bouldery outwash fans that lie beyond end-moraine systems and that today are covered with sagebrush and trenched by small streams were actively aggrading surfaces. Meltwater on the western slope of the range was channeled down rocky canyons and spread out across the eastern margin of the Great Valley.

Glacial advances characterizing the Holocene were much less extensive than those typifying the Late Pleistocene. Recent estimates for one Late Holocene glacial advance suggest climatic differences were roughly 10-20% of those associated with full glacial conditions (Clark et at. 1992).

Several periods of Holocene glacial advance have been postulated. The earliest of these, the Hilgard, may be either a very late Tiogan readvance or a distinct early Holocene event (Davis 1988:144; Fullerton 1986:167; Porter et al. 1983:92). Three other periods of glacial advance have been identified in the Late Holocene. These advances appear to be the Sierran expression of a world-wide intervals of cooler, wetter climate, which produced glacial expansion in many other regions. From oldest to youngest, these are the Recess Peak advance (ca. 3,000 B.P.), an unnamed event (1,100 B.P.), and the Matthes advances (several fluctuations between 800 and 200 B.P.).

The areal extent of the Tiogan advance, as well as earlier or more recent events may be appreciated by re-examining the distribution of glacial deposits in Figure 1.3-1. Although the above discussion presents only the most minimal outline of Late Quaternary glaciology, the affects on people would have been multifold:

- The Tiogan event would have completely closed mountain passes, blocking trans-Sierran travel. It also probably limited human settlement in the region to somewhere below 6,000 ft. (1,830 m).
- More recent events would have only intermittently blocked high mountain passes.
- Glacial meltwater would probably have extended flow from springs and small streams much further into the summer dry season than is the case today.
- At least during the Late Pleistocene, meltwater-fed streamflow may have covered the floodplains of the large rivers in the area making them unavailable for settlement. These floodplains would have been actively aggrading in the Early Holocene.
- Large pluvial lakes in the Central Valley and the high basins on the east side of the Sierra (Mono Lake to Death Valley) would have been ideal locales for human settlement during the Late Pleistocene.

As we shall see in the following section the retreat of the Tioga glaciers and subsequent climatic amelioration have shaped the plant communities we see in the Sierra Nevada today.

### 1.7.2 Palynology

Pollen analysis of Late Quaternary Sierran sediments began with David Adam's (1967) "classic" study of the palynological record from Osgood Swamp, located in the southwest comer of the Tahoe Basin. This locality yielded a 4.4-m core with pollen record extending from the present back to the Late Pleistocene, which, in many respects, has become the "type column" for the Sierra against which all subsequent studies have been compared.

Late-glacial pollen spectra are marked by low pine and high sagebrush and juniper- type percentages between about 15,000 and 10,000 B.P. The surrounding vegetation is interpreted as tundralike, with Great Basin elements like sage and shrubby junipers, and the treeline was at least 2,100 ft. (640 m) lower than it is today (between 11,000 and 12,000 ft., 3,360-3,670 m). The early Holocene (to ca. 7,000 B.P.) is distinguished by high percentages of pine and juniper-type pollen, some fir, and low levels of sagebrush pollen; essentially a modem subalpine forest community. The middle Holocene portion of the core (ca. 7,000 to 2,800 B.P.) is dominated by high pine; increasing amounts of fir; and higher than modern amounts of oak, alder, maple, and sedge pollen. This indicates warmer than present conditions with a Sierra montane forest (mixed conifer) surrounding a wet meadow. Essentially modem conditions are indicated for the last 2,800 years with high pine and fir; low juniper and oak; and up to 20% manzanita type pollen.

During the last quarter-century, pollen studies conducted in the Sierra Nevada have expanded and elaborated upon Adam's (1967) initial sequence. These include Balsam (Davis et al. 1985), Dinkey, and Exchequer Meadows (Davis and Moratto 1988), all of which are in the south-central Sierra in the Kings River watershed. Details of much of this work are summarized by Adam (1985:126-13 1) in his review of Late Quaternary pollen analyses in California.

One distinctive feature in the Exchequer Meadow sequence is the presence of sequoia pollen and incense cedar pollen and macrofossils at about 10,000 B.P. in an area that today has lodgepole pine and red fir (7,278 ft., 2,219 in). The nearest groves of sequoia today are located about 3 miles (5 km) away at 6,400 ft. (1,951 m). This led Davis and Moratto (1988:144-146) to conclude that the early Holocene may have been slightly warmer and possibly drier than present conditions. Charcoal fragment counts in the Exchequer core peak between 7,400 and 2,700 B.P. which may reflect an increased natural fire frequency during the mid-Holocene thermal maximum (Xerithermal or Altitherrnal) or significant levels of anthropogenic burning.

Closer to the Forest, Anderson (1990) found pollen sequences very similar to the Osgood and Exchequer cores in sediments from three high-altitude lakes near Yosemite National Park (Barrett Lake, Starkweather Pond, Tioga Pass Pond). To examine vegetation change at lower elevations, Anderson and Carpenter (1991) cored Woski Pond, in Yosemite Valley at the base of El Capitan (3,975 ft., 1,212 m). This pollen record documents paleoenvironmental change occurring in the last 1,550 years. Until about 650 years ago, a closed canopy coniferous forest, composed of ponderosa pine, white fire, incense cedar, and Douglas fir appears to have covered the valley floor. This was replaced by a more open community with grasses, oaks, sage, and shrubs. This apparent rapid changeover in vegetation is closely correlated with elevated charcoal concentrations, indications of increased erosion, and an apparent expansion of human populations. This strongly suggests the vegetation changes observed in the pollen record resulted from intentional human burning of vegetation, with people using this as a form of management to produce increased plant and food resources.
Recent pollen studies conducted by Roger Byme and others (i.e., Byme et al. 1991; Edlund and Byme 1991) at Lake Moran (7,800 ft.; 2,385 in), situated above the North fork of the Stanislaus River, were undertaken to examine the mid-Holocene increase in oak pollen noted in many Sierran cores. At Lake Moran they collected a record that spans the last 15,000 years. Prior to 12,500 B.P. an open vegetation, composed of sagebrush, juniper, and grass dominated the landscape, indicating effectively drier and colder climatic conditions than at present. Between 12,500 to 10,000 B.P., dense mixed conifer, closed canopy forest, composed of several conifer species that no longer grow together in the Sierra Nevada, became established around the lake. This was accompanied by increases in plant taxa normally associated with meadows. The presence of mountain hemlock, white pine, and lodgepole pine suggests a moister climate than that characterizing the Sierra today. Deep snowpacks may have been present late into the summer, ameliorating summer drought. Low charcoal

concentrations indicate that fires apparently only occurred rarely. Between 10,000 and 9,000 B.P., rapid increases in charcoal abundance are observed in the core. Lodgepole and white pines began to be replaced by ponderosa, Jeffrey pine, red fir, and white fir. After ca. 9,000 B.P., a small relative decrease in pine, coupled with increases in oak and bracken fem, took place. A more open forest came into being, with warmer summers acting to increase the relative proportion of oaks. Charcoal influx remained high until ca. 7,000 B.P. when it began to decline.

During the mid-Holocene (7,000-3,000 B.P.), diminished charcoal representation suggests a decrease in fire frequency occurred. Continued high representation of oak, sage, and bracken fem pollen indicate the forest remained drier and more open than is the case today. This oak pollen is of the "rough oak type" produced by black oak and could reflect an upward elevational expansion of this important food plant during this period. This could partially explain the presence of bedrock mortars in the Forest above the modern elevational limits of black oak, although these features are conventionally dated to a much more recent period. [Note: The intensive use of bedrock mortars is often linked with the Late Prehistoric Period and black oak usually occurs below 7,000 ft., 2,140 m.] At about 3,000 B.P., cooling and/or increasing moisture allowed fir, lodgepole pine, and sugar pine to re-establish themselves as forest dominants. Fire continued to remain less important as an ecological factor than it apparently was during the early Holocene.

As part of the North Fork Stanislaus River Hydroelectric Project (Peak and Neuenschwander 1991), Mackey and Sullivan (1991) collected and analyzed a 4-m core from Gabbot Meadow Lake at 6,550 ft. (1,995 m). This sequence was dated by four radiocarbon dates, a lens of Mazama Ash, and general meadow stratigraphy. Mackey and Sullivan were able to define four pollen zones based on the relative proportions of major pollen types. The earliest, which dates to sometime late in the Tioga/Wisconsin advance is dominated by sedge, oak, sagebrush, and juniper-type pollen suggesting a shallow, high alpine lake in a nearly treeless landscape dominated by sagebrush, shrubby junipers, and possibly huckleberry oak. Great Basin elements like sagebrush would imply a cool, dry climate. The next pollen zone which begins just prior to I 0,000 B.P. and ends around 8,800 i3.p. is characterized by high percentages of sedge pollen and increasing amounts of pine and fir. Mackey and Sullivan (1991:488) interpret this as near- modem climate with conifer forest fully established around an open, shallow lake. The Middle Holocene zone, which dates between 8,800 and 3,500 B.P., is distinguished by low levels of pine and sedge pollen; with abundant oak, grass, bracken fern, and rose family (possibly bear clover) grains. This is essentially the pollen assemblage one would expect from Ponderosa Pine forest (warmer, dryer conditions than now at that elevation). The most recent zone (3,500 B.P. to present) reflects essentially the same lodgepole pine,-red fir association found around Gabbot Meadow today.

The most recent pollen core relevant to the Stanislaus area was collected and analyzed by Edlund (1992) from Bunker Lake (6,540 ft., 1,995 m) in Eldorado National Forest. The oldest levels (I 3,000-11,450 B.P.) contain the sagebrush and juniper-type maxima present in most Sierran records. The next zone (11,450-9,750 B.P.) contains abundant pine and fir pollen which Edlund (1992) interprets as representing near modem conditions. The period from 9,750-5,850 B.P. is characterized by high oak, chinquapin, sagebrush, bracken fem, and alder percentages; essentially an open, montane chaparral community. The oak pollen is predominately the "smooth oak type" produced by huckleberry oak and not the black oak- type noted at Lake Moran (Byme et al. 1991; Edlund and Byme 1991). The last 5,850 years of deposits document essentially modem conditions which are corroborated by ponderosa, white pine, sugar pine, and fir macrofossils (cone fragments, twigs, needles) in the core. These are the dominant trees around the lake today.

The above summary of palynology in the Sierra presents a confusing array of species names, dates, and interpretations. Precise details within any one sequence vary with elevation, latitude, dating precision, sedimentation rates, local vegetation, lake size (small lakes yield a more localized record), specific research design of the project, and analyst. Nevertheless, several common features or interpretations emerge:
The late glacial period before 10,000 B.P. is generally agreed to be colder and drier than now.

- Greatest disagreement exists for the Early Holocene part of the record (10,000-ca. 7,000 B.P.). Davis and Moratto (1988) suggest that it was warmer and possibly drier than now in the southern Sierra. Other authors find near-modern or slightly cooler and moister conditions in the north- central Sierra.
- The Middle Holocene (ca. 7,000-3,000 B.P.) is generally agreed to be warmer and drier with an upward migration of oaks and middle elevation plant communities.
- The Late Holocene record (ca 3,000 B.P. to present) generally seems to reflect essentially modem conditions overall.

### 1.7.3 Dendrochronological Studies

The palynological sequences outlined above examine paleoenvironmental fluctuations in ten-ns of long periods lasting centuries or even several thousand years. Studies of the annual growth rings of trees are capable of resolving events with much finer precision; to the year or even season.

Dendrochronology and dendroclimatology began in the Sierra Nevada in the first decades of this century when astronomer A. E. Douglass and geographer Ellsworth Huntington measured the annual growth rings of 451 giant sequoias and developed a record of tree growth and climate that extended over 3,000 years (Fritts 1991:Forward by H. H. Lamb). These were the oldest known living trees until Edward Schulman and Wes Ferguson assembled a nearly 8,000-year-long chronology from living and dead bristlecone pine *(Pinus longaeva)* wood from the White Mountains in eastern California (Schulman 1958; Ferguson 1968).

Using living trees, dead snags, and old weathered remnants of bristlecone pine, Val LaMarche developed a 6,000-year record of temperature, precipitation, and timberline fluctuations for the White Mountains (LaMarche 1969, 1973, 1974, 1978; LaMarche and Mooney 1967; LaMarche and Stockton 1974). LaMarche's research suggested a generally warm dry period between 6,000 and 3,500 B.P. with timberline at one locality about 500 *ft.* (150 in) higher than present levels. His other study area demonstrated only a 325 foot (100 m) increase in timberline. These figures would suggest that average summer temperatures were perhaps 1.7-3.5'F (0.9-1.9'C) higher than now. To put this into some sort of perspective, the difference in mean annual temperatures between Sacramento and Sonora is 2.2'F (1.2'C). Timberline decreased to 160-230 ft. (50-70 in) above present levels by 2,000 B.P., and actually dropped below its modem elevation at 1700 A.D., contemporaneous with one Matthes advance. The last 1,000 years are characterized by a cool-dry interval around A.D. 900, warm-moist conditions at I 100, a warm-dry period centered around 1200, cool-moist conditions around 1500, cool-dry at 1750, warm-moist at 1900, and generally wan-n-dry conditions for the rest of this century. These intervals are correlated with nearby glacial moraine deposits dated at A.D. 850, 980, 1330, 1620, 1700, and 1890 (LaMarche 1974).

LaMarche's findings have been somewhat oversimplified in various archaeological attempts to summarize the Holocene climate for California (Moratto et al. 1978; Moratto 1984; and Moratto and Davis 1988), by reducing all variability to a warm-dry versus cool-wet dichotomy (Byme 1979:196-197). This comes from a misunderstanding of exactly how the upper treeline and lower forest border trees, that LaMarche sampled, respond to climatic variables. Timberline trees generally show enhanced growth in response to both warm temperatures and above average rainfall (LaMarche 1974:1044): a warm-wet versus cool-dry signal. Lower forest border trees also respond positively to precipitation but higher temperatures will slightly limit growth: the warm-dry versus cool-wet part of the record. The two cycles together can give any combination of cool-wet, cool-dry, warm-wet, and warm-dry conditions.

How well does the White Mountains' sequence hold up for the Sierra Nevada? After all, the White Mountains are in the rain shadow of the Sierra and conditions in the White Mountains are drier with greater temperature extremes. Louis Seuderi (1987a, 1987b) completed a similar study using foxtail pine *(Pinus hafouriana)* from Cirque Peak on the southeastern edge of Sequoia National Park. These tree-ring data were correlated with lichen-dated glacial moraines. For the period starting at 6,300 B.P. conditions were generally favorable for tree growth with timberline 223 ft. (68 m) above present levels (less than half of the maximum difference suggested for the White Mountains). Prevailing conditions began to cool and timberline dropped to 125 ft. (38 m) above present levels by 3,200 B.P. and only 39 ft. (12 m) by 2,400 B.P. Timberline remained at about this level until 1,400 B.P. when it dropped 33 ft. (10 m) below its present level (about the time of one of the unnamed advances mentioned in Section 1.7.1). Subsequent ring-width minima and dated moraines suggest that substantial temperature declines and glacial advances occurred around A.D. 810-880 (pre-Matthes), 1470-1550, 1610-1650, 1700-1710/1730, and 1810-1865. Less intense cold periods took place from A.D. 1190-1290 and 1320-1400 but no dated moraines were associated with these intervals (they may have been covered by later advances). Seuderi (1987a:220) suggests that the Matthes advances may have actually begun during these latter two intervals. These Matthes period advances were preceded by a period of marked warmth from A.D. 900 to 1190 (often referred to as the Medieval warm period), during which timberline rose 10 m or so in attitude. Another warm period appears to have occurred between A.D. 1500 and 1580. Most of these climatic intervals correlate well with the White Mountains sequence (LaMarche 1973,1974). Subsequent research by Scuderi has explored the relationship between tree growth and volcanic events (1990) or solar activity cycles (1993).

Several other dendroclimatic studies are relevant to the Stanislaus area. Hughes et al. (1990) observed that periods of extreme low growth recorded in giant sequoia were strongly correlated with severe droughts in the San Joaquin River drainage for the last 400 years. In a similar study Fritts (1991) reconstructed temperature and precipitation, for the years between A.D. 1600 and 1970, for six regions in western North America from a network of 65 climatically sensitive tree-ring chronologies and 77 sets of long-ten-n weather records. One of these regions covers California from the Pacific Coast to the Sierra crest. Fritts (1991:130) found that significant wan-n intervals centered around 1660, 1800, 1860, and 1930. Cold periods occurred around 1510, 1700, 1760, 1840, and 1910. Average reconstructed rainfall for the entire period from 1600 to 1830 for California was about 30 mm (1.2") lower than the mean derived from instrumental records for the last 70 years. Based on available information, it is difficult to decide if this represents a statistical anomaly or whether rainfall this century has been unusually high.

Graumlich (I 990) presents a 600-year-long comparison of foxtail pine and western juniper growing near tree-line in the eastern Sierra Nevada. Although general patterns are consistent between the two sequences, slight differences are apparent for several periods. This variation may be due to differences in the physiological responses of the two species to the same set of climatic variables, or they may just reflect small sample sizes for parts of the chronology.

Swetnam (1992) conducted a detailed study of fire scars in giant sequoia from five groves in the south- central Sierra from Mountain Home State Forest to Yosemite National Park. His composite record extends from 1238 B.C. to the present with a period between A.D. 500 and 1900 common to all groves. All five chronologies show a dramatic shift in fire frequency sometime between 200 B.C. and A.D. 500, depending on the exact length of the individual records. Prior to this shift, the average interval between fires was 10 to 20 or more years with a minimum fire interval of 5-10 years. Between A.D. 500 and 1799 the average interval was 3-5 years with a minimum interval of I year. After the middle of the 1800s, all records show decreased numbers of fires with much longer return intervals which Swetnam attributes to European settlement, grazing, and fire suppression. The vast majority of fires in all groves were latewood fires which probably occurred in September and October. Swetnam attempted to distinguish between lightning- caused fires and Native American bums, but he concluded that both types of fires would have happened at about the same season of the year. While it would be tempting to attribute the pattern of high fire frequency with short return intervals between 500 and 1799 to Native American use of fire as a resource management tool, Swetnam stressed that he could not completely eliminate climatic effects. Other long-term dendroclimatic sequences for the area (LaMarche 1974, Scuderi 1987, Fritts 1991, etc.) do not show one prevailing climatic pattern, but rather alternating periods of wet and dry or warm and cool intervals. Swetnam did find that the greatest number of very large fires, those common to four or five groves (a total distance of 112 mi., 180 km), did occur between A.D. 900 and 1300, the Medieval Warm Period.

In summary, the field of dendrochronology offers tremendous potential for reconstructing climatic fluctuations, glacial events, fire history, and many other paleoenvironmental features with a high degree of precision. Archaeologists however should keep in mind that the relationship between tree growth and climate is not a simple one. Many biological factors including insect infestation, density-dependent competition, nut-crop production, and others affect ring width measurements. Each species may respond uniquely to the same set of climatic variables. Upper treeline and lower forest border trees respond differently from each other and individuals of the same species growing in optimal habitats. The same is true for trees growing near the margins of their ecological ranges. Dendroclimatic data may be a very useful tool for understanding the past but archaeologists should use it cautiously and try to be aware of the intricacies and limitations of this type of information.

### 1.7.4 Zooarchaeology and Archaeobotany

Two other types of data, plant and animal remains, may be relevant to paleoenvironmental studies in the Sierra Nevada, providing information about past biotic communities, ancient diets, and prehistoric human modification of the landscape.

Bone preservation tends to be very poor in the acid soils of the pine and oak woodlands, and most material does not survive well unless it is burned or calcined. The most successful zooarchaeological studies have been conducted in the lower foothills zone, just west of the Sierra. Representative investigations include the Redbank and Fancher Creek sites northeast of Fresno (Langenwalter 1989), CA- TUO-2642 near Sonora (Simons 1992), CA-TUO-407 also near Sonora (Simons 1987), and sites in the New Melones Project area (Butler et al. 1983; Leonard 1984; Leonard 1986). Burned or culturally modified bone from these sites demonstrates that the prehistoric residents of the Sierra foothills exploited a diverse suite of animals other than deer. Frequently identified taxa include deer, pronghorn, cottontail, jackrabbit, quail, dove, dog/coyote, gray squirrel, ground squirrel, pond turtle, numerous small rodents, and several species of fish. The most rare environmentally sensitive taxa tend to be small animals with limited ecological ranges, but it is often difficult to be certain that these remains are culturally deposited and not just recent intrusives.

Archaeobotanical analysis has been only been rarely applied to prehistoric sites in the central Sierra Nevada, possibly due to the misconception that plant remains are only infrequently found in California sites. Nevertheless pioneering studies include coprolites from Bamert Cave (Nissen 1973), Oiyer Springs/PiPi Valley (Honeysett 1982), CA-NEV-318 (Farber and Neuenschwander 1982), the New Melones Project (Spaulding 1984), Sailor Flat (Wohlgemuth 1984), various sites in Yosemite National Park (Honeysett 1989), and CA-T'UO-2642 (Rondeau 1992). All of these analyzed data sets are dominated by nut remains (gray pine, acorn, hazelnut, and possibly walnut) and berries (manzanita, elderberry). Other charred seeds are reported which are indicated in Table 1.5-2. If these preliminary patterns are representative, it would suggest that major use of the tested sites would have been in the late summer through fall periods. An alternative interpretation is that the identified remains represent just the most durable plant macrofossils and that more intensive and careful sampling would fill in the picture for the rest of the annual subsistence cycle.

Several of these archaeobotanical reports have extensive lists of carefully identified uncharted seeds. Since very little archaeobotanical material survives for long periods of time unless it is carbonized, most of these seeds are probably intrusive and reveal more about post-abandonment site disturbance processes that prehistoric subsistence. Because fire is such an important element for Sierran plant communities, off-site control samples should always be collected to help distinguish natural from cultural remains.

The study by Spaulding (1984) for two sites from the New Melones Project is one of the few attempts to use wood charcoal as a paleoecological tool. This analysis documents changes in the local vegetation based on the relative proportion of more xeric or mesic adapted taxa.

In summary, more judicial use of zooarchaeological and archaeobotanical techniques could help answer many site-specific paleoecological questions that are difficult to address with other, more regional types of paleoenvironmental data. Both types of data could provide information regarding food procurement strategies, local landscape management, ancient diets, seasonality, occupation intensity, local fire history, site function, trade, mobility, and local environmental changes.

### 1.7.5 Clues from Biogeography

Paleobotanist Daniel Axelrod (1966, 1973, 1975, 1976, 1981, 1988; Raven and Axelrod 1978) has explored the relationships between past climates and the modern distribution of plant taxa and vegetation communities. His central thesis is that disjunct populations of certain plant species or even whole communities may be relics from late glacial or mid-Holocene times. Several specific Sierran examples include:

- disjunct patches of gray pine-blue oak woodland located well upslope in the western Sierra Nevada in localities now surrounded by coniferous forest;
- disjunct areas of mixed conifer forest on the east side of the Sierra Nevada, largely isolated from west side Sierran mixed conifer forest by fir and subalpine forests occupying higher, cooler elevations;
- relic stands of desert-border plants like sagebrush and pinyon pine, found in glaciated canyons on the west slope of the central and southern Sierra, and also in the alpine and subalpine zones.

By using data from present-day weather stations, Axelrod (1981:867-868) concluded that only a 1.8’F (I'C) increase in the mean temperature of the warmest or coldest month of the year would explain most of these differences.

The distribution of two other species, black walnut *(Juglans hindsii)* and tanbark oak *(Lithocarpus densiflora),* should be explored. These species, with very restricted ranges in the central Sierra Nevada, may have been planted by miners during the gold rush, they may have been transported by native Americans from the coast ranges in the past, or they may be late-glacial relies.

### 1.7.6 Late Quaternary Sierran Paleoenvironmental Models

To date, several paleoenvironmental models have been developed by archaeologists that attempt to relate Late Quaternary climatic and habitat conditions in the Sierra Nevada to apparent changes in the prehistoric record. These include Elston et al. (1977) for the Tahoe Reach of the Truckee River; Moratto et al. (1978) for the

Buchanan Reservoir and Lake Tahoe area; Moratto (1984:548, Figure 11.5) for the central Sierra; Markley and Henton (1985:63, Table 7) for the Tahoe-Truckee region; Kowta (1988) for Plumas and Butte counties; Moratto and Davis (1988) for the central Sierra; and Moratto (1988) for the New Melones Archaeological Project area. Many of these are restatements or revisions of previous studies. Most of these models take the form of large tabular charts that summarize local and regional paleoenvironmental data. These reconstructions are then related to local prehistoric sequences. Several of these models make very specific inferences about changes in settlement patterns, demography, trade, subsistence, and social organization that may be detected in the archaeological record at certain times in response to varying climatic conditions. An example is presented below from New Melones Archaeological Project on the western border of the forest.

In his project summary, synthesis of culture history, and conclusions regarding the New Melones Archaeological Project (NMAP), Moratto (1988) frequently refers to the paleoenvironmental model developed by Moratto and Davis (1988). Consideration of the nature of past environments becomes especially important in his discussions regarding prehistoric demography, land use and settlement patterns, models of resource utilization through time, and relationships between cultural ecology and environmental change. Many of these thoughts, viewed from a regional perspective, are summarized by Moratto (1988:558: Figure 9.1 1) in a diagrammatic model depicting the concordance of paleoclimatic and archaeological sequences in the central Sierra Nevada and environs.

In this master chart, reproduced herein as Figure 1.7-1, archaeological sequences characterizing the Sacramento/San Joaquin Delta, Lake Tahoe Basin, Mokelumne River Canyon, New Melones Project Area, Yosemite National Park, and Buchanan Reservoir are arrayed in relative/absolute time. These are compared and contrasted among themselves, and also with the composite paleoclimatic scheme developed by Moratto and Davis (1988:52, Figure 2.3). With respect to this prehistoric/paleoenvironmental design, Moratto (1988:561) makes the following observations:

A major research goal of the NMAP has been to explore relationships between environmental and cultural changes during the past 10,000 years. Success in achieving this goal has been modest, due partly to the sparse paleoenvironmental record in the study area and partly to limitations of the archaeological data upon which this local prehistory is based. Nonetheless, important correlations of the New Melones cultural and paleoenvironmental sequences are evident. Occupation was most intensive during the two periods of relatively cool/moist climate (ca. 1000 B.C.-A.D. 500 and ca. A.D. 1300-1850), whereas the intervening and preceding intervals of relatively xeric conditions witnessed significantly less human activity. Comparison of the NMAP archaeological sequence with seven others in east-central California has shown remarkable parallels, but also important differences, through time; evident too, are region-wide correlations of paleoenvironmental and cultural developments. As examples, the generally cool, moist Neoglacial period from ca. 1000 B.C. until A.D. 500 coincides with archaeological records of large populations, extensive inter- regional trade, intensive land use, and "permanent" settlement, except in the high-elevation Blue Lakes vicinity; the subsequent period (ca. A.D. 500-1300), a time of xericity and diminished carrying capacity in the foothills, witnessed reduced populations, minimal trade, and mostly temporary occupations by small groups, except in the Delta and Transition zone (e.g., Mokelumne River canyon) of the Sierra; and the return to cool, moist climatic conditions after ca. A.D. 1300 was attended by increased population size, number of settlements, east-west trade, and social complexity.

These models can be very useful guides to the primary sources of various types of paleoecological data. They are also generally very good summaries of the raw data themselves. Archaeologists attempting to use these models should always keep in mind, however, the distinction between the primary data themselves (pollen counts, ring-width measurements, etc.) and the interpretations and inferences drawn from the data (paleotemperatures, ancient vegetation communities, and so forth). It may be difficult to directly relate paleoecological reconstructions to the often sparse, and poorly dated record of prehistoric material culture. It may be even more difficult to test specific inferences about cultural adaptation in the past. Archaeologists should apply these models cautiously, keeping in mind that they are hypotheses that should be subjected to further testing and refinement. They are not yet absolute explanations for past human behavior.

Byme (1979) presents a useful critique of some of these earlier models. Several give a misleading impression of prevailing conditions in the past. Rather that the Middle Holocene being a time of intense and long-term drought, it was more a period of prevailing warmer conditions, wetter at times, drier at others, with the usual year-to-year and season-to-season weather fluctuations we all know. The magnitude of this average temperature difference was only about 3.5'F (2'C), which, as we mentioned before, is only about the difference you would experience going from Sonora, California, down to Sacramento. Full glacial cooling has been variously estimated between 7.2 and 9'F (4-5'C), less extreme than going from Sacramento up to Calaveras Big Trees State Park, an absolute average annual temperature difference of 10.6-F (6-C).

Secondly, these climatic shifts represent very long periods of time, up to hundreds of human lifetimes. Shortened, high frequency variations, such as 6-7-year droughts or El Nino events, could have had far more significant impacts on individuals and populations. These high frequency shifts would not be easily detected in any but the most sensitive and precise paleoenvironmental records (like tree-rings).

Thirdly, these environmental reconstructions should be treated as "works-in-progress." Each new pollen core or dendroclimatic sequence provides more evidence for understanding the past, especially filling in the details of an expanding regional picture. These reconstructions are not without controversy; there is no such thing as a universally accepted model for Late Quaternary climatic and vegetation changes. Paleoecologists debate their data and interpretations just as fervently as archaeologists do.

Finally, as Byme (1979:196) states:

As the authors themselves admit, non-climatic variables are often important determinants of human behavior. Furthermore, the effects of climatic change are often buffered by cultural adaptations and evidence of these may not always be visible in the archaeological record. In a broader sense, *Homo sapiens* has proven to be a remarkably adaptable species with a correspondingly cosmopolitan distribution.

# CHAPTER 2. CULTURAL CONTEXT

Contemporary archaeological studies in California are profoundly influenced by ethnological research conducted in the late 19th and early 20th centuries by Franz Boas, Edward Gifford, Alfred Kroeber, and others. Ethnographic studies of California Indian societies remain the models for archaeological interpretation. Direct correlations of material culture between prehistoric remains found by archaeologists and artifact inventories described for historic native California cultures are commonplace in archaeological reports. In many instances archaeological efforts appear to simply recreate the ethnographic descriptions provided by Barrett, Gifford, Kroeber, Lowie, Merriam, Powers, and others,

In this chapter we review the relationship between ethnological and archaeological studies in the region of the Stanislaus National Forest (Forest) and demonstrate how the two avenues of investigation are linked historically in academic research and cultural resources management studies. Literature sources for information pertaining to Me-wuk and Washoe culture are identified and brief summaries of Me-wuk and Washoe cultures are provided. [Note: Although most published ethnographic literature uses the term "Miwok," contemporary local Native Americans prefer the spelling "Me-wuk" which will be used throughout the following section.]

## 2.1 Ethnography and the Direct Historical Approach

It seems probable that the remains found in most of the archaeological sites of America were left by a people similar in culture to the present Indians. For this reason, the ethnological study of the Indians must be considered as a powerful means of elucidating the significance of the archaeological remains. It is hardly possible to understand the significance of American archaeological remains without having recourse to ethnological observations, which frequently explain the significance of prehistoric finds (Boas 1902:i).

The study of the prehistoric past in the central Sierra Nevada and in California in general began with the documentation of the Native American cultures which occupied the region. As a student of Boas, Kroeber staunchly believed the "salvage" of fast-vanishing ethnographic data should take precedence over archaeological work, and encouraged his students in this direction. He further held that the "exploration of prehistoric sites anywhere in the state rarely reveals anything of moment that is not apparent in the life of the recent natives of the same locality" (1925:925). Reflecting on his early years in California archaeology, Heizer (1974:180) states that while Kroeber recognized regional differences in material culture, he held that decisions regarding particular material form and use were made early on in any given region, and that the local culture became fixed, persisting in essentially unchanged form through time.

Kroeber considered the major contribution of archaeology to be the establishment of an historical perspective, introducing the elements of time and cultural development to the reality of the ethnographic record to reveal patterns of culture change. This led to the development of the "Direct Historical Approach" in California archaeology, the aim of which is to work back from the cultural "known" established through ethnographic studies to the prehistoric cultural "unknown" based on the demonstration of shared cultural traits elicited through detailed typological studies. This reliance upon ethnographic context continues today. Virtually every archaeological investigation report includes a summary ethnographic review, suggesting an ethnographic interpretive framework for recovered archaeological details and implying a direct historical link between prehistoric and ethnographically described Native American cultures.

It is important to recognize the limitations of the ethnographic record we have inherited. The efforts were largely descriptive, and the earliest studies were completed at a time when anthropology was a developing discipline. Much effort was devoted to the compilation of "culture element lists" used in developing age- area concepts of culture history. Such lists have proved of limited use in the description or reconstruction of structural or cultural ecological aspects of native societies (cf. Stewart 1941).

Relatively few California Indians were actually interviewed, men and women were interrogated regarding roles and activities regardless of their knowledge or likely participation in the activities of question, and set topics concerning "culture elements" directed the anthropologists' efforts. By the time most Indian consultants were interviewed their cultures had already been radically transformed by interaction with European and American colonists. Much of the "how to" of day-to-day affairs of the native Californians went undocumented, for example, the technology and procedures of gathering and hunting activities, the organization of labor, functional aspects of kinship, inter- and intra-group exchange. In short, the ethnographies upon which we have come to rely so heavily are themselves artifacts of an historical period in anthropology. Their accuracy and comprehensiveness should be tested by archaeological inquiry, not the other way around.

Ethnographic summary data presented in this overview focus on the distribution of populations, shared technological traits, social organization, and relationships between groups as observed in the context of trade and exchange, exploitation of resources, social gatherings, warfare, and intermarriage. These data all have direct implications for archaeological studies which are highlighted in the following pages.

## 2.2 Ethnographic Groups within the Stanislaus National Forest

Four ethnographic groups historically occupied the region included within the Forest: Northern Sierra Me- wuk, Central Sierra Me-wuk, Southern Sierra Me-wuk, and Washoe. (Figure 2.2-1). Northern Sierra Me- wuk occupied the foothills and mountains of the Mokelumne and Calaveras river drainages. Central Sierra Me-wuk occupied the foothill and mountain portions of the Stanislaus and Tuolumne river drainages. Southern Sierra Me-wuk occupied the upper drainages of the Merced and Chowchilla rivers. Washoe territory extended from Honey Lake in northeastern California to the West Walker River in the central Sierra, and from Nevada, east of Reno and Carson City, west to the crest of the Sierra Nevada. Me-wuk apparently acknowledged Washoe hunting and gathering rights on the upper Stanislaus nearly as far down as the Calaveras Big Trees (Kroeber 1925:570).

The Eastern Me-wuk (including Bay, Plains, Northern Sierra, Central Sierra, and Southern Sierra Me-wuk divisions) comprise one of the two major branches of the Me-wukan subgroup of the Utian language family (Levy 1978:398). The Northern, Central, and Southern Sierra Me-wuk languages are closely related; however, internal dialectal differentiation is recognized for both the Central and the Southern Sierra Me-wuk (Freeland 1951:9; Broadbent 1964:13-14). Lexicostatistic data suggest Western Me-wuk (Lake Me-wuk and Coast Me-wuk) and Eastern Me-wuk (Bay Me-wuk, Plains Me-wuk and Sierra Me- wuk) languages have been separated for approximately 2500 years. Plains Me-wuk separated from Sierra Me-wuk languages about 2,000 years ago. The internal time depth of Sierra Me-wuk is approximately 800 years. The classification of the Me-wuk languages and the lexicostatistic chronology suggest ancestors of the Me-wuk have been resident in the central California delta region for several millennia (Levy 1978:398).

The use of glotto-chronological models and recreation of historical relationships among California Indian language groups has been developed by some as an important interpretive avenue for understanding the culture history of the California region. Perhaps one of the best known models among the proponents of "linguistic prehistory" is that developed by Moratto (1984:529-574).

Washoe are the only Great Basin group to speak a non-Numic language. There can be little doubt, according to d'Azevedo (1986:466), that the Washoe people have had a long tenure in their known area of historic occupation and that their presence predates the arrival of their neighbors speaking Numic languages. Washoe are geographically a Great Basin people who share strong cultural affinities with other Great Basin and California cultures. Kroeber (1925:571) found Washoe to be the most culturally divergent group in the western Great Basin, suggesting that their most ancient ties were to California rather than with Great Basin neighbors such as the Northern Paiute, and that this might indicate that they came into contact with Numic speakers much later or that their relatively rich environment afforded them a degree of isolation and independence from neighboring peoples (d'Azevedo 1986:466).

Due to the overall cultural similarities and basic behavioral consistencies between the three Sierra Me-wuk groups and Washoe, the following descriptive data are presented within a general framework detailing social organization, settlement and subsistence patterns, and technology, with characteristics specific to any one group briefly discussed. We do not dismiss as insignificant traits specific to a particular group; rather, we choose to emphasize the cultural similarities and the contribution of ethnographic data to archaeological explanation. More detailed descriptions of each ethnic group can be found in the information sources referred to below.

## 2.3 Ethnographic Information Sources

Kroeber's (1925:441-462) chapter in the *Handbook of the Indians of California* forms the core of ethnographic data for the Sierra Me-wuk groups. A summary description of Sierra Me-wuk can be found in Volume 8 of the *Handbook of North American Indians* (Levy 1978:398-413); Washoe culture is described in Volume II of that series (d'Azevedo 1986:466-498). Other useful sources include Powers' (1877) accounts; Merriam's ethnographic notes on central California Indian tribes (1967) and his *Distribution and Classification of the Mewan Stock of California* (1907); and Aginsky's (1943) culture element lists. Gifford (1916a, 1916b, 1917, 1922, 1926a, 1926b, 1955, n.d.(a), n.d.(b)) reports on Me-wuk myths, social organization, ceremonies, cults, and shamans. Me-wuk material culture is described by Barrett and Gifford (1933). Recent studies include location and material culture data compiled for the New Melones Reservoir Project by Theodoratus et al. (1976) regarding the Central Sierra Me-wuk, and for the Stanislaus area (Theodoratus et al. 1981). WIRTH Environmental Services prepared an ethnographic overview of Me-wuk and Washoe during the initial phases of the Mokelumne River Project (1981), and later interviewed 12 Me-wuk and 12 Washoe informants for an expanded study of Native American resources for the Mokelumne River Project area (1985).

Important sources for Washoe ethnography include: Powers' (I 876) *Life and Culture of the Washo and Paiutes;* Barrett's (1917) *The Washo Indians;* Kroeber (1907, 1925); Dangberg's (1927) *Washo Texts;* Siskin's(1938) *Washo Territory; Lowie's Ethnographic Notes on the Washo(1939);* Freed (1960, 1966); and Stewart's (I 94 1) culture element lists. A number of significant studies on Washoe culture are included within *The Washo Indians of California and Nevada,* compiled and edited by d'Azevedo (1963). This last volume also includes an annotated bibliography of Washoe sources. Downs' (1966) The *Two Worlds of the Washoe* . is an important recent ethnographic treatise regarding Washoe culture. For a more comprehensive listing of literature pertaining to Washoe see Fowler (1970) and references cited in d'Azevedo (1986).

## 2.4 Summary of Sierra Me-wuk and Washoe Cultures

### 2.4.1 Ethnographic Villages of the Northern, Central, and Southern Sierra Me-wuk

In general the condition of knowledge concerning the settlements of the group--even those included in the map--is far from satisfactory. We are in total ignorance, for instance, to what extent near villages were truly independent or only outlying settlements that recognized their political and social unity with a central larger town (Kroeber 1925:444).

Three sources were consulted regarding the location of documented ethnographic villages: Kroeber (I 925); Merriam (1907); and Levy (1978). There are some differences between the three sources. For example, Merriam lists 18 villages in Northern Sierra Me-wuk territory, 18 for the Central Sierra Me-wuk, and 37 for the Southern Sierra Me-wuk, for a total of 73 known locations. Kroeber identifies 20, 51, and 22 villages, respectively, for a total of 93. Levy recognizes 23, 57, and 39 villages, respectively, for a total of 119. Levy states that settlement clusters may correspond to tribelets in both Northern and Southern Sierra Me-wuk territories. The following are lineage settlements known to have had either a chief or an assembly house in the late 19th or early 20th century (Levy 1978:400): *Upusuni, Kunusu, Apautawilu, and Hechenu* (Northern Sierra Me-wuk); *Sopenchi, Awani, and Wasema* (Southern Sierra Me-wuk).

These historic village locations are indicative of historic, and possibly prehistoric, Me-wuk settlement patterns although it is recognized that the inventory of villages is probably incomplete. The known geographical distribution of Me-wuk villages in the Sierra foothills suggests that most major villages were located in this environment rather than at higher elevations in the Sierra Nevada, a pattern comparable to that observed for the neighboring Nisenan, for example (cf. Wilson and Towne 1978:388-389).

It is difficult to extrapolate comprehensive models of historic Me-wuk settlement patterns from limited ethnographic data. Historically documented villages are certainly distributed in response to complex historic and environmental circumstances, including the alteration of pre-Contact Native American lifeways induced by the arrival of European and American settlers and miners, involving transformation of the physical landscape, and appropriation of lands to the exclusion of Native Americans. One study specifically suggest ways that Me-wuk settlement patterns changed in response to European and American colonization, Hall (1978). Some post-Contact historic Me-wuk settlements were in physiographic settings which were not preferred locations (e.g., exposed ridges, away from water sources), others were placed in proximity to EuroAmerican mining settlements to afford employment or scavenging opportunities, and some settlements were in refuges where access by Euro Americans was precluded or limited (cf. Van Bueren 1983:160-161). Nevertheless, archaeological data also suggest some ethnographically documented villages were at locations long favored for human settlement, such as the location of Skyrocket (CA-CAL- 629/630) near Copperopolis where radiometric dating indicates a discontinuous occupation history spanning some 9,000 years.

Knowledge of ethnographic village locations also affords the opportunity for ethnoarchaeological research regarding acculturation of Me-wuk society. For example, Maniery (1982, 1987) describes archaeological studies at Six Mile and Murphys rancherias, both of which are located near the western boundaries of the Forest.

There are no ethnographically described Washoe village locations on the western slope of the Sierra Nevada in the Forest. It is possible that Washoe shared Me-wuk villages in the vicinity of Big Trees and may have wintered over in these "Me-wuk" villages (Barrett 1906, 1908:347, 1917:6; d'Azevedo 1966:331).

### 2.4.2 Me-wuk Social Organization

The basic social and economic group for Sierra Me-wuk and Washoe was the family unit or household. This corporate entity would often include the nuclear family in addition to grandparents and unmarried relatives. Composition of these household groups varied most for Washoe, among whom household affiliations was also closely linked with a specific dwelling place or winter house (Downs 1966:39).

The foremost political unit of Sierra Me-wuk was the "tribelet" (of Kroeber 1932:258, 1962:29), with a population range of 100 to 300 persons (Levy 1978:410). Each tribelet was an independent socio-political group, that embraced a defined and bounded territory, and which exercised control over the natural resources contained therein. Within each tribelet were several more or less permanently inhabited settlements and a larger number of seasonally occupied campsites used at various times during the seasonal round of hunting, fishing, and gathering activities. The other unit of political significance to Me-wuk was the lineage. Lineages were localized and named for a specific geographical locality. In most cases these lineage localities were the permanently inhabited settlements of the tribelet. Each tribelet included a number of lineage settlements (Levy 1978:398).

Each tribelet incorporated several distinct settlements or hamlets, each of which was named. The tribelet as a whole went by the name of the principal settlement, the capital of the tribelet, where the chief resided. The tribelet capital contained the assembly house, regarded as the personal property of the chief, and was the site of all important religious ceremonies and other major social events. The authority of the chief extended over all the settlements within the tribelet (Levy 1978:410).

Me-wuk are the most northerly tribes to use the social scheme of moieties, a division of the people into balanced halves (in this case, land and water), which are totemic, hereditary and exogamic. Each member has a totemic relationship with his/her moiety through his/her name, given in infancy. By far the most commonly referred to animal in names of people in the land moiety is the bear, and the deer is very common for water moiety names. Me-wuk do not regard the totem animals as ancestors, nor is there any connection between a person's totem and the animal guardian spirit that may reveal itself The preferential marriage among Me-wuk is with certain relatives of the opposite moiety. The moieties compete with each other in games, and they assist each other at funerals, mourning anniversaries, adolescence observances, etc. Thus they possess social and quasi-ceremonial functions besides those concerned with marriage and descent, but no strong ritualistic ones (Kroeber 1925:453-457).

### 2.4.3 Washoe Social Organization

Washoe households were somewhat loosely combined to form villages, referred to as *bunches* by Downs (1966:44-46). The size and composition of these bunches varied considerably, responding to changing environmental and interpersonal conditions. Downs states that the winter camp or village of several households seemed to be the basis for the bunch; however, several villages located in close proximity to one another may be considered as a single bunch. Each bunch had a headman or chief, which may have been a hereditary position, passed on through either the mother or father (Downs 1966:41). If the household represented the minimal political and economic unit for Washoe, the bunch can be conceived as the minimal number of families that could cooperate to do those things that an individual household could not do for itself, for example, stage rabbit drives, form hunting parties, defend itself, and so on (Downs 1966:45).

Downs (1966:53-54) states that while the Washo "clearly differentiated between themselves and all other peoples, using various cultural criteria, it is clear that they felt no over-all obligations simply because of this relationship." He further notes that in aboriginal times there was never an over-all chief (Downs 1966:51). Clearly, due to the subsistence pattern of Washoe, which involved significant and often unpredictable movement of small economically-independent groups throughout Washoe territory, no fixed adherence to specific rules of residence were followed (Downs 1966:39). In contract to the west slope Sierran groups, natural resources were not controlled by the larger village groups or bunch, but rather by the individual family or blood group. Property rights to pinyon gathering areas, fishing traps and platforms, and the right to hunt certain animals were passed down within a family (Downs 1966:41).

There is some debate regarding the possible occurrence of a "weak moiety like system" among southern Washoe (d'Azevedo 1986:483; cf Downs 1966:49-50). D'Azevedo appears willing to lend some faith to the notions that such a social organization could have developed among southern Washoe in response to cultural influence from Me-wuk and other neighboring California cultures.

### 2.4.4 Sierra Me-wuk Religion, Ritual, and Symbolism

Sierra Me-wuk religion, mythology, and ceremonialism are described by Gifford (1917a, 1926a, 1955) and summarized in Levy (1978:412). Sierra Me-wuk recognized two categories of ceremonies: the sacred ceremonies which involved the use of highly potent ceremonial costumes of feathered headdresses and robes, and the profane dances which were primarily seen as entertainment. Kroeber (1925:449-451) discusses "the Me-wuk" participation in the Kuksu cult (the Kuksu ceremonies, shared by many northern Central Valley groups, honor the creator spirit). It is not entirely clear, however, that Sierra Me-wuk groups followed the religion. Levy (1978:412) makes no specific reference to Kuksu in his review of Eastern Me-wuk religious beliefs, and Bean and Vane (1976:665) exclude Sierra Me-wuk from the inventory of groups known to have participated in Kuksu.

A number of different shamans are described for Sierra Me-wuk. The shaman, whose office was inherited patrilineally, was instructed by an older shaman and acquired supernatural power in a variety of ways. The spirit doctor, or sucking shaman, held an important place in Me-wuk religion. Other shamans include herb doctors, deer doctors, rattlesnake shamans, weather shamans, and bear shamans. Sierra Me-wuk mythology closely resembles that of other peoples of south-central California, especially that of the Yokuts and Costanoans. The major characters are Coyote, Prairie Falcon, and Condor.

### 2.4.5 Washoe Religion, Ritual, and Symbolism

The following brief discussion is summarized from d'Azevedo (1986:489-492; see also, e.g., Dangberg 1918-1922; Downs 1961; Freed and Freed 1963; Leis 1963; Lowie 1939, Siskin 1941). Shamanism was apparently the predominant religious found among the Washoe. Not unlike the California shaman, such practitioners among the Washoe were characterized by their intimate relationship with spirits, their ability to cure (or induce) illness, rectify (or cause) misfortune, divine omens, and otherwise translate spirit power into various extraordinary capabilities not possessed by other persons. Shamans were empowered through the aid of a spirits which revealed themselves to the initiate through dreams. Shamans conducted curing ceremonies, joined in war parties, hunting drives, and other public activities where their blessings or participation would help assure the benevolent attendance of the spirits upon the given activity.

Shamans typically owned various paraphernalia which was imbued with power through the instruction of spirits and communicated via dreams. Such paraphernalia might include costume elements, mortars and pestles, feathers, and other items made or found by the practitioner.

Major ceremonies among Washoe took place in association with major gatherings, particularly those which occurred when groups aggregated to participate in seasonal hunting, gathering, and fishing activities. First- fruit and first harvest ceremonies were especially important.

### 2.4.6 Aspects of Sierra Me-wuk and Washoe Material Culture and Technology

The technology and material culture of Northern, Central, and Southern Sierra Me-wuk, and Washoe are very similar, with only minor differences often resulting from the preference for locally available raw materials. More complete description of native material culture and technology can be found in the reference literature cited above.

The typical Sierra Me-wuk hill and mountain dwelling was the conical bark house made by overlapping three or four thicknesses of bark with no interior pole or support. In the Upper Sonoran Zone grey pine bark was used, while both yellow pine and big-tree *(Sequoia)* barks were utilized (Barrett and Gifford 1933:136). At lower elevations the thatched house was constructed by arranging poles in a conical framework with an external application of brush, grass, or tule. Semi subterranean earth lodge roundhouses were used for ceremonial gatherings, assemblies, local feasts, and for housing visitors (Levy 1978:409). After the death of a chief, the semi subterranean assembly house would be burned as part of Me-wuk mourning observance. Sierra Me-wuk also constructed a circular brush assembly house, a conical, semi- subterranean sweathouse, and a small conical menstruation but. Sierra Me-wuk also made use of a small conical grinding house which was placed over grinding rocks during bad weather (Levy 1978:409).

Washoe built two basic structures: the winter house (similar to that of the western Sierra groups), made by leaning poles and slabs of cedar and other conifer bark so that they overlap to keep out rain and snow, with a short covered doorway or vestibule; and the summer brush house which varies from a mere low enclosure to a completely covered, dome-shaped house (Barrett 1917:10-11). Washoe also constructed covered fishing platforms over streams that were often described as floating houses by observers (d'Azevedo 1986:473). There is disagreement whether, prior to the historic period, Washoe constructed sweat lodges and large earth-covered dance houses such as those built by Sierra Me-wuk groups. One earth-covered dance house was built in 1893 by a Washoe who learned its construction techniques while living among Me-wuk (d'Azevedo 1986:481).

The bow and arrow were the principal tools of hunting and weapons of warfare. Sierra Me-wuk preferred bows made from incense cedar, but ash, oak, willow, pepperwood, maple, or hazel were also used. Sierra Me-wuk arrowheads were made with a concave base, at times with side notches. Laurel leaf points were used only by the Plains and Northern Sierra Me-wuk (Aginsky 1943). There is scant information concerning points and other flaked stone, probably due to the sudden influx of steel implements by 1850 (Barrett and Gifford 1933:21 1; cf. Van Bueren 1983). Tools used in the manufacture of bows and arrows include an obsidian flake and deer leg bone scraper for shaping the bow, an abrasive stone for fine finishing, and an arrow straightener (of two types: perforated stone or wood, and steatite with a transverse groove). Arrowheads and other flaked tools were made by removing flakes from the core with a hammerstone, then using various antler or bone implements to perform the rough chipping and fine finish work.

Flaked and ground stone tools were used by both Sierra Me-wuk and Washoe groups including knives, arrow and spear points, club heads, arrow straighteners, scrapers, rough cobble and shaped pestles, bedrock mortars, grinding stones (metates), pipes, and charms (Beals 1933; Barrett and Gifford 1933). Obsidian was highly valued by all four groups as a raw material for flaked stone tools. For pulverizing foods the characteristic stone implements were the bedrock mortar and the cobblestone pestle. Portable mortars of various shapes were also used. These bowl mortars, made of soapstone, sandstone, and other types of rock are more purportedly ancient and Me-wuk attribute them to a supernatural origin, usually Coyote. Because of Me-wuk subsistence pattern of seasonal transhumance, it is likely that the portable grinding bowls were abandoned in favor of the bedrock mortar. The metate may be of recent intrusion, since aged Central Me-wuk informants denied its presence and virtually no reference is made to its use in food preparation (Barrett and Gifford 1933:210,272).

Both the Me-wuk and Washoe used wooden items including bows (both simple and sinew-backed), arrow shafts and points, looped stirring stick and the flat-bladed mush paddle, pipes, and skin-dressing tools. Cordage was made from plant material including milkweed, and were used to construct fishing nets and braided and twined tumplines. Soaproot brushes were commonly used. Washoe emphasis on fishing produced a distinctive and extensive assemblage of fishing-related implements and techniques including spears, cordage lines with bone fishhooks, harpoons with detachable points, dams for stream diversion, nets of cordage and basketry, weirs, and fishtraps of many types (d'Azevedo 1986:473). All four groups made tule rafts in addition to lashed log and bark rafts. Bone tools in various forms were also made by all groups.

Sierra Me-wuk manufactured both twined and coiled basketry. The foundation of coiled baskets and the warp and weft of twined baskets were usually made from willow. Redbud served as the wrapping material in coiled baskets (Levy 1978:406; see Barrett and Gifford, 1933:229-245, for a detailed description of basketry materials and techniques). Also of interest are two pages with basketry design elements. The basket was the all-important container for Sierra Me-wuk and Washoe. Basket uses included storage, cooking, serving and processing of foods, burden baskets, traps, cradles, hats, cages, seed beaters, and winnowing trays, among others. Other textiles included tule matting and netting made of milkweed or sage fibers, or wild hemp.

Other material items included musical instruments such as the flute and musical bow, clapper sticks, whistles, bull-roarers, cocoon rattles, split-stick swishers, and the foot drum. Game items including balls and sticks of bone and wood for dice, guessing and hand games. A multitude of ceremonial items were made (many of feathers), often limited to use by shaman or other ritualists.

Clothing of the four groups was similar. Men commonly wore nothing or breechclouts of deerskin or other prepared hide, and women wore aprons or dresses made of skin. The Central Sierra Me-wuk women also wore two-piece grass or tule skirts (Barrett and Gifford 1933:220-221). Washoe folk also wore leggings made of skins and occasionally moccasins made of untanned deerhide with a lining of sage bark for winter use (d'Azevedo 1986:48 1). All four groups used snowshoes made of a circular frame of willow or redbud with sinew crosspieces and thongs. In cold weather all groups wore rabbitskin blankets or robes. Each rabbitskin robe required at least 30 to 40 rabbitskins which were cut into strips and then woven together. Other skins including bear, mountain lion, deer, and coyote were also used for robes and capes. Hair was tied back with a band of fur or skin and men would at times wear netted hair nets or caps. Tattooing was common to all four groups, as was piercing of the ear and nasal septum. Ornaments worn include stone, shell, bone, pine nut and seed beads.

Quarries reflect the extent to which certain groups utilized a local resource or were willing to travel to obtain it. The locations of the sources of various materials may be of value in helping determine the reason for numerous trails or trade routes over and along the flanks of the Sierra Nevada (Elsasser 1960:25; cf. Davis 1961). The archaeological record should reveal some trace of quarrying activities connected with obsidian, chert, chalcedony, steatite, hematite, chalk, and quartz crystals, for example. However, the gathering of salt, clay, and asphaltum, for example, would not necessarily leave any tangible evidence of removal (see Table 1.3-1 for Quarry localities within the Forest).

Steatite quarries are probably fairly common in Me-wuk territory, judging from the distribution of steatite (e.g., Eakle 1923). There is a stratum of steatite at the same level in both the south and north walls of the canyon of the north fork of the Tuolumne River, about a mile from the outskirts of the town of Tuolumne, cut by the old Duckwall road (Barrett and Gifford 1933:21 1). Steatite is known to occur elsewhere in the Sierra foothills metamorphic belt (see Table 1.3-1).

In Central Sierra Me-wuk territory, a source of white paint---chalk--came from the bottom of springs at Springfield. A mountain, called *Yololamu,* between Lake Eleanor and the Cherry River (on the east-central border of the Forest) contained hematite, used for red paint (Barrett and Gifford 1933:224). Other pigments were traded (see section below regarding trade relations).

Me-wuk trails were usually straight and direct, running up and down hills without zigzags or detours. "Past the soapstone quarry, *Lotowayaka,* on the north wall of the canyon of the north fork of the Tuolumne River, ran such a trail, connecting the hamlet of *Pulayuto,* in the meadows east of the fork, with the hamlet of *Hanitwuye,* near Soulsbyville (Table 2.2-1). This trail ran straight down one canyon wall and up the other, not zigzagging on the steep slope" (Barrett and Gifford 1933:256).

### 2.4.7 Me-wuk and Washoe Settlement, Subsistence and Resource Procurement

The universal practice of all Sierran ethnographic groups of moving with the seasons, usually east and west, but in a specific territory, must indicate an optimum method of survival in the given environment, and one of long standing (Elsasser 1960:8).

Sierra Me-wuk were basically oriented to procurement of subsistence resources in a Sierra foothill environment. Based on Beals and Hester's (1974) ecological typology, the subsistence staples in descending order of importance for the Foothill ecological type are acorns, game, and fish. Using Beals and Hester's terminology (see Table 1.5-1 for concordance with other floral community terminologies), primary subsistence came from the Upper Sonoran and Lower Transition life zones: woodland, woodland- grassland, grassland, and chaparral. Me-wuk groups lived in permanent or semi-permanent villages located on warm, open sites above and close to water sources. Valley villages were often located on raised mounds to avoid flooding from the nearby stream or river. Permanent villages in the foothills and mountains were usually located on a knoll, bench, or ridge between streams or rivers and near springs. In the steep, deep canyons, such as the Tuolumne and Stanislaus rivers, it was possible for the inhabitants of a permanent village at the edge of the Transition Zone to climb down the canyon walls and reach the Upper Sonoran flora and fauna at the canyon bottom within an hour (Barrett and Gifford 1933:135). The west-slope Sierran people generally occupied these permanent villages throughout the year, except when smaller groups would travel and set up temporary camps in search of various foods. In the foothill region there was an uneven distribution of plants and therefore of animals, but in general there was an abundance of food resources in the lower elevations (see Table 1.5-2).

Sierra Me-wuk moved between higher or lower elevations during various seasons of the year to obtain foods not otherwise found in the vicinity of their permanent settlements. People living in the Sierran Yellow Pine forests followed the deer to higher Sierran elevations during the summer. Abundance of seed- bearing annuals and ample forage for deer, antelope, and tule elk were promoted by annual August burning of grasslands. Gathering of wild plant foods varied with the season and the locality (see Table 1.5-2). Greens were usually gathered in the spring, seeds from May through August. For example, the Tuolumne people visited Leland Meadows, in the high Sierra, to gather sunflower and other seeds and greens (Merriam 1967:351). After the annual burning in August, digger pine and sugar pine nuts were collected. Late fall and early winter was the season for collecting acorns.

Two very important subsistence plant species were black oak *(Quercus kelloggii),* typical of the Yellow Pine Forest between 1,500-6,500 feet elevation, and pinon pine *(Pinus monophylla),* found mostly on the east side of the Sierra in the Upper Montane-Subalpine forest zone between 6,000-8,000 feet. Acorn varieties were graded by desirable traits such as flavor or undesirable traits such as difficulty in hulling. Besides black oak, valley or white oak *(Q. lobata),* interior live oak *(Q. wislizenii),* and blue or post oak *(Q. douglasii)* were important foods. Two other pines sought for edible nuts were gray pine *(Pinus sabiniana)* and sugar pine *(P. lambertiana).* A mainstay of Me-wuk diet were wild seeds of many kinds, including grasses and buckeye. Another important aspect of plant collecting is for medicine. Barrett and Gifford (1933:166-176) list 67 identified and 15 unidentified plants used medicinally by Me-wuk.

Wild tobacco *(Nicotiana attenuate and N. bigelovi)* was gathered and cultivated by Sierra Me-wuk, the leaves of which were harvested and dried in the summer or fall (Merriam 1967:319). The Yosemite Indians learned about tobacco from the Mono Lake Paiutes (Merriam 1967:356). Tobacco plots were often located at some distance from the village in order to guard against their discovery (Littlejohn 1928:30). Other wild plants were also tended and cared for to produce better growth for various uses, such as straight willow and redbud branches or long sedge rhizomes for basketry materials. Fire, discussed below, also served to regulate growth and production.

The abundance of foods at different times allowed for storage. Acorns were stored in special granaries, while other foods such as seeds, greens, grasshoppers, quail, dried meat and fish were stored in large twined storage baskets.

Mule deer *(Odocoileus hemionus),* a very important animal resource, was hunted both individually and collectively in the higher elevations, as were antelope *(Antilocapra americans)* and tule, or dwarf, elk *(Cervusnannodes)* in the plains. Central Sierra Me-wuk journeyed to the plains country in Yokuts territory to hunt antelope (Barrett and Gifford 1933:178). The major communal hunting occurred when the deer migrated along well-known trails from higher to lower elevations in September and October, and again in April and May. Jackrabbits *(Lepus californicus)* and the cottontails *(Sylvilagus auduboni, S. nuttallii, S. bachmani),* and gray squirrels *(Sciurus griseus)* in the higher elevations, hunted communally, were second only to deer in quantity of meat supplied. Bear were hunted in winter when their hides were in the best condition. Fishing, with dip or seine nets and harpoons and hook and line or spears, was important, especially to the peoples living along the larger rivers in the foothills. Various species of salmon were caught in the spring and fall. Trapping and snaring were used to take small game and a variety of birds. Grasshoppers were a favorite food and were collected in communal drives usually in June.

Downs describes the Washoe subsistence calendar as divided into three "years": the fishing year, the gathering year, and the hunting year (1966:12). As soon as the snows began to leave the lower foothills, young men and boys, often accompanied by young women would leave the winter villages located in the basin valleys and travel to Lake Tahoe. Here they would live in caves and other natural shelters and fish for whitefish. The beginning of the fishing year followed a period of winter hunger, and sometimes the young members of the group would travel back to the winter villages with fish so that the other group members might have enough food to make the trip to the lake. As the weather improved, more people would move up into the lake area, and by early June most Washoe were found encamped along the shores of Lake Tahoe. By this time other fish species including trout and large sucker fish would move out from the deeper portions of the lake in large numbers into the stream to spawn. This abundance of fish was sometimes celebrated with first fish ceremonies, more commonly among the western and northern Washoe groups (Downs 1966:14). As the snows melted in the higher valleys, family groups would move away from the lake, with subsistence activities focusing on both fishing in smaller lakes and on gathering of Sierran plants, as well as the taking of game. As the summer progressed, Washoe began their trek back to lowlands where the many grasses of the valleys were ripening and the seed harvest was at hand (Downs 1966:16). Fishing continued, albeit on a much more limited scale, throughout the year and even into the winter when ice on pools would be broken open and fish taken with hook and line.

The gathering year focused on the many varieties of plant foods available in the several environmental zones inhabited by Washoe. Whereas the fishing year served to gather Washoe into one place, gathering activities meant the constant movement of small family units in order to take advantage of the many plants available in smaller quantities and during limited periods.

The usefulness of plant foods depended on the ability of a family to take advantage of opportunities as they occurred. While some species of plants were widely distributed in the lowlands, they seldom were ripe at the same time. Grass seeds might be ready for harvest in one place while they were still green only a few miles away. Thus, to take advantage of the many plants, the Washo had to be almost continually on the move [Downs 1966:19].

While most people headed back east from Lake Tahoe, many would continue onto the west slope of the Sierra and the lower Sierra foothills where they would gather chokecherries and wild grass seeds and hunt for deer while they waited for the acorn harvest. Although most would return east before the deep snows of winter, a few families would remain on the west side either living alone or with west side groups (Downs 1966:19). For the groups who returned east, fall brought with it the culmination of the gathering year-the pinon harvest. Although family units would converge during the pinyon harvest, the social gathering was nowhere as large as during the spring and early summer fishing at Lake Tahoe because pinyon groves were more widely dispersed. Nevertheless, pinyon harvest time was a period of abundance when food was plentiful and people were well fed and healthy. Big times were held near pinon harvest spots, sometimes lasting for as long as two weeks (Downs 1966:24). After a summer of intense movement the Washo were anxious for a period of social interaction. Pinon provided a staple food for all the Washo, and if the harvest was good, winter starvation could be avoided (Downs 1966:21).

Hunting began as soon as animals appeared in the spring, however, the main focus of hunting occurred in the late summer and lasted until the first snows of winter. Hunting was the exclusive domain of men, and successful hunting required years of training and skill, as well as thorough knowledge of associated ritual and magic in order to achieve continued success (Downs 1966:26). Rabbits and deer were taken primarily in the fall, with groups of six to eight men traveling into California to hunt intensively for deer. Occasionally larger groups of Washoe would gather in the early fall and drive deer into the open by firing the brush. Antelope were also taken with the surround or corralling method, although less frequently due to their limited numbers within Washoe territory. Mountain sheep were taken even less frequently, and bear might be taken for food in times of extreme emergency, although bear hunting was more a ritual then an economic pursuit (Downs 1966:33). Many species of birds were also taken including water fowl, quail, sage hens, prairie chickens, and doves. Bird hunting was more of an opportunistic rather than a planned activity. If large quantities of birds were locally available, Washoe would take advantage of their presence. Rarely, however, would bird hunts be scheduled or involve special trips (Downs 1966:34).

Frequent mention is made in the ethnographic literature for all Me-wuk and Washoe groups of the use of fire for environmental modification and as an aid in hunting. These annual fire destroyed seedlings but did not harm established trees such as valley and interior live oaks, and their scattered method of growth is attributed to this repeated annual burning. Sierra Me-wuk promoted an abundance of seed-bearing annuals and ample forage for deer, antelope, and tule elk through annual (August) burning (Levy 1978:402). In order to gather insects Washoe would light the brush and grass on fire, and drive the insects into a ditch where they would be more easily gathered (Downs 1966:35). Deer would also be herded in this way (d'Azevedo 1986:478). Washoe appear to have used fire only for herding or driving game. For Sierra Me-wuk, though, regular burning was useful for many purposes. "Travel was better, view farther, ambuscades more difficult, certain kinds of hunting more remunerative, and a crop of grasses and herbs was of more food value than most brush" (Kroeber 1925:396). Burning of chaparral areas also improved deer forage, potentially altering migratory patterns of deer populations (Matson 1972). The effect of anthropomorphic fire prior to EuroAmerican settlement of the Sierra Nevada is an important study focus for silviculturalists and other researchers who are attempting to understand prehistoric vegetation distribution within the region and the role of fire (Roper Wickstrom 1987).

### 2.4.8 Travel Routes, Exchange Patterns, and Items of Exchange

There were several types of economic exchange in California: a simple exchange of equal value; a purchase, using media of exchange (e.g., shell beads); free, reciprocal use of one another's resources or areas; purchase of a favorable locale in another territory; payment to a chief for a single trip; clandestine invasion and/or warfare (Davis 1961:8). Most often the exchange of goods occurred between tribes having a border in common, as well as between neighboring villages.

According to Davis (1961), there were two major trade routes within Sierra Me-wuk territory. Both followed an east/west orientation: a northern route along the Consumnes River, over the Sierra crest, and south of Lake Tahoe into the Great Basin; and a southerly trail along the. Merced River, over the crest, passing just south of Mono Lake and into the Great Basin. Another important trade route was along the Mokelumne River, where there are salt springs.

According to Davis (1961), Northern Sierra Me-wuk traded with Plains Me-wuk and Washoe, Central Sierra Me-wuk traded with Eastern Mono (Northern Paiute), Washoe, Northern Valley Yokuts, and Costanoan [Ohlone]. Southern Sierra Me-wuk traded with Eastern Mono. Northern Sierra Me-wuk supplied Plains Me-wuk with finished arrowheads, digger pine nuts, salt and obsidian; they received grass seeds and fish. Northern Sierra Me-wuk supplied Washoe with acorns, shell beads, sea shells, and baskets; they received salt and baskets. Central Sierra Me-wuk supplied Eastern Mono with shell beads, glass beads, acorns, squaw berries, elderberries, manzanita berries, a fungus used in paint, baskets, sea shells, and arrows; they received pine nuts, pandora moth caterpillars, fly pupae, baskets, red and white paint, salt, pumice stone, pinon nuts, buffalo robes, and rabbit skin blankets. Central Sierra Me-wuk supplied Washoe with acorns, and fibers of the soaproot bulb coat for brushes. Washoe supplied Sierra Me-wuk with salt, pinon nuts, buffalo skin robes, and rabbit skin blankets. Central Sierra Me-wuk supplied Northern Valley Yokuts with baskets, bows, and arrows; they received dogs. Southern Sierra Me-wuk supplied the Eastern Mono with clam disc beads; they received rabbit skin blankets, and basketry materials. Eastern Mono also supplied Central and Southern Sierra Me-wuk with mineral paint, salt, obsidian, tobacco, baskets, buckskin, pottery vessels, and clay pipes. Costanoan supplied Sierra Me-wuk with olive shell *(Olivella biplicata)* and abalone shell *(Haliotis* sp.). Historically, Me-wuk were allowed to travel to Monterey Bay to procure these shells (Barrett and Gifford 1933:25 1). Olive shell disc beads came from the south, though sometimes the Central Sierra Me-wuk made them, and clam shell *(Saxidomus nuttallii)* beads came from the north or northwest (Barrett and Gifford 1933:253).

Price (1962) and d'Azevedo (1986:471) point out the "little trade" which apparently took place between Washoe and neighboring groups, emphasizing the self-reliant nature of the Washoe in providing the majority of raw materials and finished goods for their own use. There is legendary evidence for Washoe treks to the California coast.

### 2.4.9 Relations between Groups

Northern, Central, and Southern Sierra Me-wuk, and Washoe peoples not infrequently came together for purposes of trade, ceremonial gatherings, and at times, as a result of hostilities usually due to perceived territorial encroachment. Most interactions, however, appear to have been civil if not friendly. Mention is made, however, of hostilities between Me-wuk and Amador County Nisenan (Beals 1933:367).

It is not clear to what extent Sierra Me-wuk may have regularly traveled outside of their territory, although frequent mention is made of friendly interaction between Washoe and Me-wuk. It appears, though, it is Washoe who traveled to Me-wuk territory, often spending the winter on the west side of the Sierra crest, sometimes sharing a village with resident Me-wuk (d'Azevedo 1986:472). It is not surprising, considering the extreme mobility of Washoe during their seasonal subsistence round, to learn that Washoe traveled extensively both within and outside of their territorial range. Mention is made of long trading trips made by Washoe, at times as far as the Pacific Coast and to San Diego to obtain shellfish and particularly fine obsidian knives (Downs 1966:37). Marriage and kinship also served to strengthen intergroup relations. Frequent intermarriage between Nisenan and Me-wuk, and between Me-wuk and Washoe is reported in the literature, particularly between groups who most closely shared territorial boundaries.

## 2.5 Historic Period Cultural Transformation

European contacts with Eastern Me-wuk were first documented by Spanish exploring expeditions to the Sacramento-San Joaquin Valley in the second part of the eighteenth century. The Bay Me-wuk were the first to undergo missionization with the first records coming from Mission San Francisco in 1794. Plains Me-wuk converts began appearing in the records of Mission San Jose in 181 1. Most of the Bay and Plains Me-wuk tribelets disappeared through the combined effects of removal to the missions and epidemics, which killed many thousands of people in the central valley in the first half of the nineteenth century. Sierra Me-wuk seem to have been peripheral to the missionization process. The Stanislaus and Tuolumne natives were particularly noted for their rebelliousness against this process, however what are probably Southern Sierra Me-wuk are noted in the neophyte registers at Mission San Juan Bautista late in the Mission Period (Milliken, personal communication). A closer look at the Central Sierra Me-wuk reveals the beginning of the irreversible destruction of their traditional life ways.

No permanent EuroAmerican settlements were established in Central Sierra Me-wuk territory before 1848. However, the presence of Spanish and Mexican settlements and institutions in the region did not leave the Me-wuk undisturbed (Hall 1978:12). Indirectly they were very much affected by the Hispanic occupation via the changes taking place to the Yokuts in the San Joaquin Valley (Hall 1978:38-39). Between 1830 and 1833 a severe epidemic, possibly of malaria, swept through the Sacramento and San Joaquin valleys, killing an estimated 50% of the population (Cook 1955, 1978:92). A smallpox epidemic, which began in the area of Stockton in 1844, depleted Me-wuk populations as well as other groups. During the Hispanic period there was a great deal of mobility and population displacement. Gold Rush documents often mention the presence of "Mission Indians" living among Me-wuk in the mountains as well as the foothills. The inhabitants of Yosemite Valley, as described by Bunnell (1911), were a mixed group of Southern and Central Sierra Me-wuk, Mono and Yokuts for several years before the whites entered Yosemite.

One effect of population movements, according to Gifford, was the creation of "true village life" and "new territorial ties" (1926b:391). True village life takes place when "a number of unrelated lineages, often of different moieties, came to form a new political body, the village community" (Gifford 1926b:393). The entry of some Yokuts into territory that was traditionally Me-wuk and their incorporation into Me-wuk villages would have changed village life in ways that are not clearly understood (Hall 1978:47).

The arrival of substantial numbers of Americans, Europeans and other people from around the world in California during the 1840s, due to the discovery of gold in the Sierra foothills, had a major effect on Sierra Me-wuk peoples. New diseases took their toll on the native inhabitants, and relations soon became hostile between Sierra Me-wuk and the fur trappers, gold miners, and settlers. Cook (1943) found records to indicate killings of at least 200 Me-wuk by the miners during the period 1847-1860. A number of Southern Sierra Me-wuk and Yokuts tribelets supplied labor for J. D. Savage's gold mining operations in the Big Oak Flat district, but as the number of miners increased large mining operations were shut down and Indian participation lessened.

The campaign against Me-wuk was more subtle than the attempt to run the 'foreigners' out of the state. The underlying cause of violence against Me-wuk was starvation. Because of the real possibility of death at the hands of the miners, many Me-wuk moved into the mountains in 1849. The food resources at the higher elevations were not sufficient to support all these refugees, especially during the winter months. In addition, by silting up the rivers, cutting trees, introducing domestic livestock and hunting wild game, the miners destroyed more and more traditional food sources (Hall 1978:74).

Along with the massive exodus of Central Me-wuk from the gold regions, there is much evidence for population displacement on a smaller scale. The guerrilla warfare against the Whites necessitated a more mobile lifestyle; and the numerous instances of the burning of Me-wuk villages forced many people to move. Also, by forcing the natives out of the foothills and into areas which were not traditionally occupied year-round, the whites created a situation that demanded more mobility in the search for food (Hall 1978:82).

Following treaty negotiations with the federal government in 1850, Me-wuk people were forced to give up rights to their homeland and were placed under the protection of the government. None of the negotiated treaties, however, were ever ratified by the government (Heizer 1972). A few groups of Sierra Me-wuk were removed to the Fresno area, but most of the Me-wuk population remained in rancherias scattered throughout the Sierra foothills. During the latter part of the nineteenth century and the early part of the twentieth, Me-wuks living on the rancherias subsisted partly by hunting and gathering and partly through seasonal wage labor on farms and ranches in the foothill area. Reliance on cash income increased in this period and dependence on hunting and gathering diminished (Levy 1978:400-401).

During the Gold Rush years [1848-1852], Me-wuk suffered from the continued depletion of their populations, mainly due to disease and murder at the hands of the whites. Population loss and displacement, which began in the Hispanic period and continued long after the Gold Rush was over, plus many other factors related to the permanent white occupation of Me-wuk lands and the whites' discrimination against the Me-wuk, acted to change the traditional social, political, economic, and religious organization in many ways (Hall 1978:87).

Me-wuk population in 1900 was roughly ten percent of the estimated pre-Contact population. Many factors increased mortality rates, such as disease, violence, alcoholism, and starvation. Throughout the period after the Gold Rush, the Whites' attitude that the extinction of the Indian was inevitable was a major reason for the near annihilation of the Me-wuk (Hall 1978:90).

The process of acculturation discussed by Barnett et al. [1972] which most closely fits the Me- wuk situation up to 1900 is cultural disintegration. The Me-wuk had essentially lost their political and cultural autonomy. As their economic self-sufficiency was taken away, many of their traditional rituals and many social roles no longer had meaning. The unwillingness of the younger generation to try to maintain traditional practices and beliefs contributed to the disintegration (Hall 1978:176-177).

Trappers and explorers crossing through the Great Basin into the Sierra Nevada were the first to come into contact with Washoe people, although Washoe oral tradition suggests that Spanish contact occurred prior to this (Downs 1966:73). Washoe people reportedly observed members of the Donner Party during their tragic encampment near Truckee in 1846 (Downs 1966:73).

Prior to the Gold Rush, however, the pattern of Washoe life was little affected by the intermittent presence of non-native peoples. The year gold was discovered on the American River coincided with the signing of the Treaty of Guadalupe Hidalgo, ending the Mexican War and bringing California under the American flag. Swarms of miners set up temporary camps at Lake Tahoe during their crossing through Washoe country on their way to the gold fields in the west, but more damaging was the construction of a wagon road over the Carson Pass by the Mormon Battalion. Within the year parties of Mormon settlers were moving into the Carson Valley (Downs 1966:74). Paiute expansion into Washoe territory also put strain on Washoe in the region.

By the mid-1850s, the temporary camps on the shores of Lake Tahoe had become permanent trading posts. Although only about 1,000 foreigners were living within Washoe country, they occupied the best and most productive areas of land. Still, little violence was reported between the settlers and Washoe, who isolated themselves from the foreign settlers and still moved about in small units. The discovery of silver and the opening of the Comstock Lode in the late 1850s brought additional pressure to bear upon Washoe. Traditional hunting, gathering, and fishing were severely curtailed. Still, Washoe never organized against the EuroAmerican settlers, and perhaps as a result were never pursued with concerted hostility by the non-native settlers. The reservation system was never instituted for Washoe, and they remained "squatters" on the land until 1887 when they were assigned scattered allotment lands (Downs 1966:95). Washoe bands still continued to move throughout the region, and Washoe subsistence patterns remained largely unchanged.

Through the second half of the 1800s and up to World War I, Washoe learned to adjust their activities to correspond to the economic opportunities presented by the EuroAmerican settlement of their land, and managed to make the adjustment to their changed position. The switch to cattle ranching from agricultural which took place following World War I again brought about changes for Washoe, requiring fewer workers and involving jobs such as sheep herding that were largely filled by Basque immigrants. Downs (1966:97) notes that Washoe never fully adopted the horse, and thus did little work as cowboys on the new ranches. Road improvements also served to lessen the importance of local centers, and populations (and jobs) were reduced. In the 1920s the last mobile, identifiable Washoe band dispersed and settled down (Downs 1966:98).

## 2.6 Me-wuk and Washoe Today

Today there are four Washoe communities near Lake Tahoe (Dressierville, Woodford, Carson, and Stewart) with a total population of approximately 1051 individuals. Another 475 Washoe live off reservation lands (Roper-Wickstrom, Unit 11, Section 2.2.6).

It is rather difficult to estimate the extant population of Sierra Me-wuk descendants. In the early decades of this century the federal government established four rancherias for surviving Sierra Native American groups in the Stanislaus area: Jackson, Sheep Ranch, Chicken Ranch, and Tuolumne. The 1990 Census (U.S. Department of Commerce 1992) reports 13 Native Americans at Jackson Rancheria (today mostly Maidu descendants), none at Sheep Ranch, 10 at Chicken Ranch, and 107 at Tuolumne Rancheria. The Tuolumne Rural Indian Health Project serves 130 individuals in the Tuolumne area (including the Rancheria itself) and an additional 285 people in the communities of Railroad Flat, Murphys, and West Point (an estimated total population for the Tuolumne Band of 415). Federal and state programs in place for the Tuolumne Rancheria include the above mentioned health project; Head Start; a drug and alcohol program; a youth program; and the California Indian Manpower Consortium. Members of the Tuolumne group have asserted their cultural identity by becoming involved in local cultural resources concerns and repatriation issues. The Me-Wuk Committee for Heritage Sites was formed during the New Melones Project. In February 1991, the Tuolumne group formed The Central Sierra Me-wuk Cultural and Historic Preservation Committee which monitors cultural resources issues throughout the north-central Sierra.

Other less formally organized Me-wuk bands, each with a recognized tribal chairperson exist in Amador and Calaveras counties. A fourth group of Me-wuk descendants live around Mariposa where the 1990 Census (U.S. Department of Commerce 1992) reports 70 Native American individuals (mostly Western Mono and Sierra Me-wuk). The combined Mono and Me-wuk group, The American Indian Council of Mariposa County, is actively seeking "federally recognized tribe" status.

Me-wuk and Washoe groups today are actively working to reassert their cultural traditions and participate fully in the national economic and political systems of which they have become an integral part. Instruction in native languages and cultural traditions are part of many education programs for both Washoe and Me-wuk. Me-wuk and Washoe continue to press for remedy of land and property issues resulting from the loss of native lands and the failure of the United States government to ratify treaties created with Native American leaders in the late nineteenth century.