An Archeological Research Design For Yosemite National Park, California

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U.S. Department of the Interior

AN ARCHEOLOGICAL RESEARCH DESIGN FOR YOSEMITE NATIONAL PARK

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ABSTRACT

The National Park Service has developed plans to alter Yosemite National Park operations and facilities during the 1980s and '90s. Some of the proposed changes would affect archeological and historic resources. As one element of planning, the present document advances a comprehensive program for future archeological investigations in the park. The aim of this study is to provide a research design to ensure that future work, whether prompted by management and salvage needs or by "pure research" interests, will be professionally sound and advance archeological knowledge.

The research program includes a definition of goals and assumptions and an overview of Yosemite's cultural and natural history. A theoretical foundation is provided through exploring the nature of research strategies and designs in anthropology, with emphasis on Yosemite in a regional context. Central to the study is a discussion of archeological research domains in the central Sierra Nevada, followed by a status report of current archeological knowledge of the park. Methods of data recovery and analysis are recommended to mitigate impacts of planned developments, to preserve information that might be lost in the course of normal park operations, and to optimize the long term study and preservation of archeological values in Yosemite.

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1: INTRODUCTION

1.1 Goals

As described in its General Management Plan, the National Park Service intends to make a number of significant changes in Yosemite National Park during the next 10 to 15 years. Implementation of the General Management Plan would remove automobile traffic from Yosemite Valley and Mariposa Grove, relocate many facilities to the park periphery and beyond, alter the management classification of certain lands, and develop additional interpretive and recreational opportunities for visitors (National Park Service 1980b:1-3). Among the hundreds of specific actions proposed by the General Management Plan are many, such as new construction and the removal of extant buildings, that potentially could affect archeological remains. The probable effects of these planned undertakings are assessed in the Draft Environmental Statement (National Park Service 1978a), and procedures to mitigate adverse impacts on cultural resources are recommended in the General Management Plan, Cultural Resources Management Plan (National Park Service 1978b). In addition to the undertakings identified in the General Management Plan, the operation and maintenance of existing park facilities may result in impacts on archeological resources; such impacts must be assessed and avoided or mitigated.

Against this background, the present document sets forth a comprehensive research design to guide archeological investigations in Yosemite during the 1980s. The ultimate goal is to design research so as to ensure that future archeological work, whether prompted by management and salvage needs or by "pure research" interests, will be professionally sound and cost-effective, and will advance archeological knowledge. A more immediate aim is to formulate archeological testing that will determine the scope of necessary salvage work. Accordingly, this work designs archeological survey, surface collection, testing, and excavation to evaluate cultural properties and mitigate the impacts of actions proposed by the General Management Plan.

1.2 Scope

As required by the Scope of Work for Yosemite National Park Archeological Research Design (Western Archeological and Conservation Center 1980), the research will be framed in a regional context and will be designed to incorporate current social, economic, climatic, settlement, and subsistence models applicable to the Yosemite area (see Chapter 4). The research further:

> should be designed to produce the highest yield of information with the least impact on cultural resources . . . [and] the design should make use of appropriate cultural and environmental variables and statistic[al] approaches in designing sampling procedures for all levels of data collection (survey, surface collection, testing, excavation) (Western Archeological and Conservation Center 1980:2).

During the course of park operations, maintenance, and "clearance" inspections, archeological data accumulate continuously. To be useful, those data must be systematically recorded, evaluated, and incorporated in a larger research framework. The present design is keyed to a planning and information system that is intended to maximize useful archeological data while minimizing impacts on the resources. This approach is dictated by historic preservation law, National Park Service policy, and commitments made in the Yosemite General Management Plan and in the Section 106 case report for it.

One of the more critical needs in Yosemite archeology is to identify cultural resources and define their parameters accurately, so as to plan effectively for their preservation as well as for data recovery. Such resource definition may be derived from varied sources: extant records, surface observations, surface collections, incidental exposures of subsurface soil deposits, remote sensing, and a variety of direct testing techniques. Each step in evaluation should build upon the preceding step, making full use of extant data, to plan further evaluation or data recovery. Hence a key purpose of the present design is to show how investigations of all kinds can be used effectively to advance archeological knowledge in the park. Another aim is to relate the archeology of Yosemite to that of surrounding regions, so that information gained in the park will contribute to understanding broader patterns of history and prehistory.

Toward these ends, six chapters develop a series of topics ranging from the definition of assumptions and goals to the explication of methods to be used in future archeological work in Yosemite. Chapter 2 summarizes the natural and archeological background of Yosemite as an introduction to the research design. Chapter 3 provides a theoretical foundation for this study by exploring the general nature of research strategies and designs. Presented in Chapter 4 is a comprehensive discussion of prehistoric archeological research domains and objectives in the central Sierra Nevada, with special reference to archeological problems that could be investigated in Yosemite; this chapter forms the substantive core of this work. Current archeological knowledge of the park is summarized in Chapter 5, along with an analysis of covariation between site types and environmental variables. Also discussed in Chapter 5 are the known contents and information potentials of sampled sites in Yosemite. Several topics are addressed in Chapter 6: the identification of data classes needed to achieve particular research objectives; the analysis of Yosemite's archeological data potentials as related to those objectives; and a discussion of methods for data recovery. Lastly, Chapter 7 outlines specific procedures to be followed in Yosemite in order to optimize the preservation and recovery of archeological data.

2: RESEARCH BACKGROUND

2.0: Introduction

The background data for this study consist mainly of archeological site records, National Register of Historic Places nomination forms, and L. K. Napton's (1978) Archaeological Overview of Yosemite National Park, California. Dr. Napton's Overview... is particularly useful because it examines in detail the natural history, ethnography, and prehistory of Yosemite, as well as the nature of cultural resources and history of archeological investigations in the park. As the best available synopsis of archeological work in the central Sierra, the Overview... contains information essential to understanding the present research design.

In keeping with the Scope of Work for Yosemite National Park Archeological Research Design (Western Archeological and Conservation Center 1980:2), additional background data beyond those presented in Napton's Overview... will not be given here. Rather, the purpose of this chapter is to define briefly the natural and cultural context of Yosemite as an introduction to the research design. It is emphasized, however, that the Overview... forms the basis of the present study and is the most substantive introduction to it.

2.1: Natural and Cultural Setting

The focus of study is Yosemite National Park, an area of about 3,120 km^2 in the central Sierra Nevada (Figures 2.1, 2.2). With elevations ranging from approximately 550 m near El Portal to approximately 3,950 m along the mountain crest, Yosemite forms a transect across the western slope of the Sierra between the San Joaquin Valley and the Great Basin. Moist Mediterranean climates prevail throughout most of the park, whereas more xeric Continental conditions occur in the crestal zone and east of the divide. Among the abundant water resources of Yosemite are alpine lakes, springs, and myriad tributaries of the Merced and Tuolumne Rivers. With respect to biota, Yosemite is remarkably diverse: represented in the park are five life zones--arrayed from Upper Sonoran to Arctic Alpine, with the Transition zone being most exten-

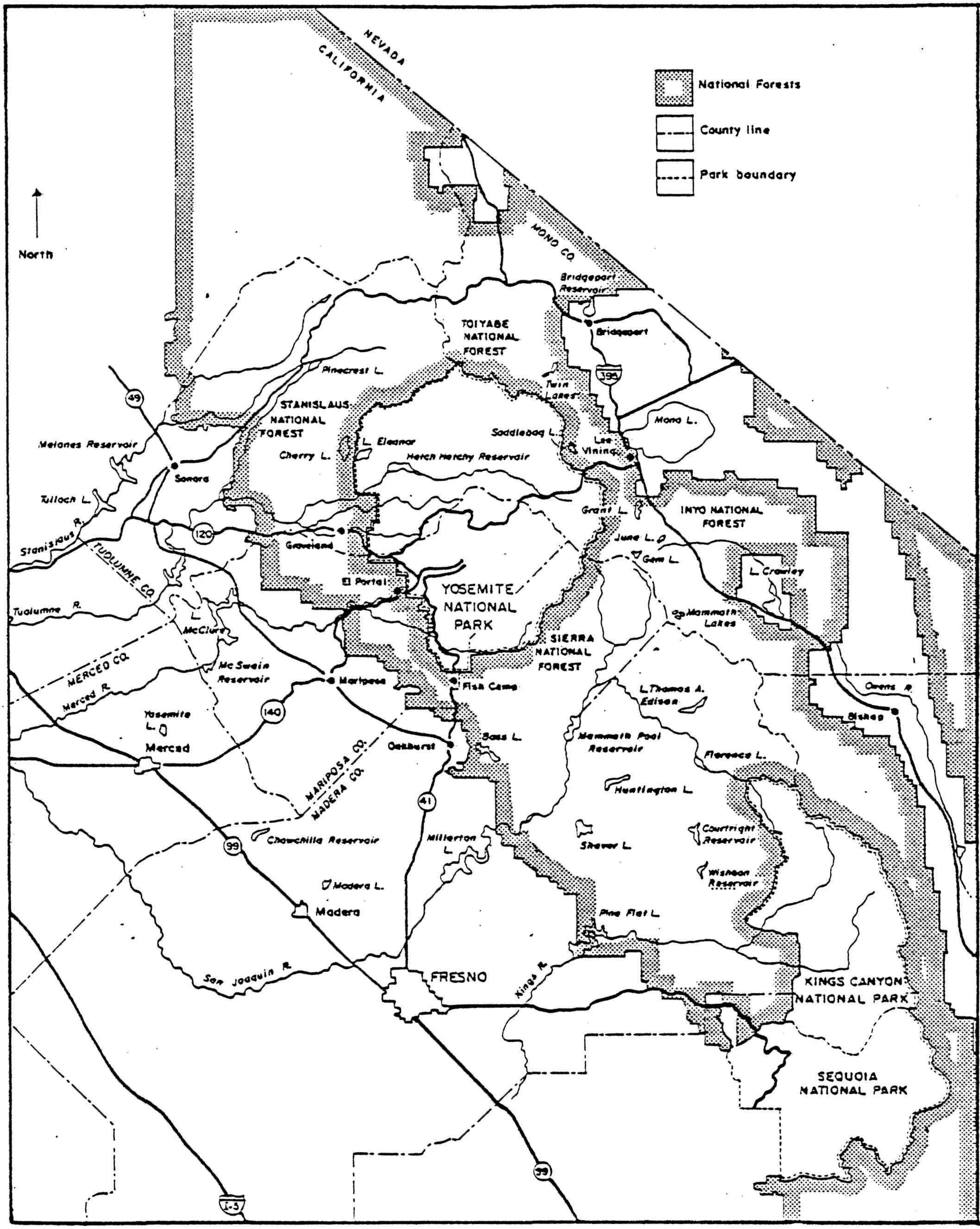

Fig. 2.1 South Central California Showing the Location of Yosemite National Park

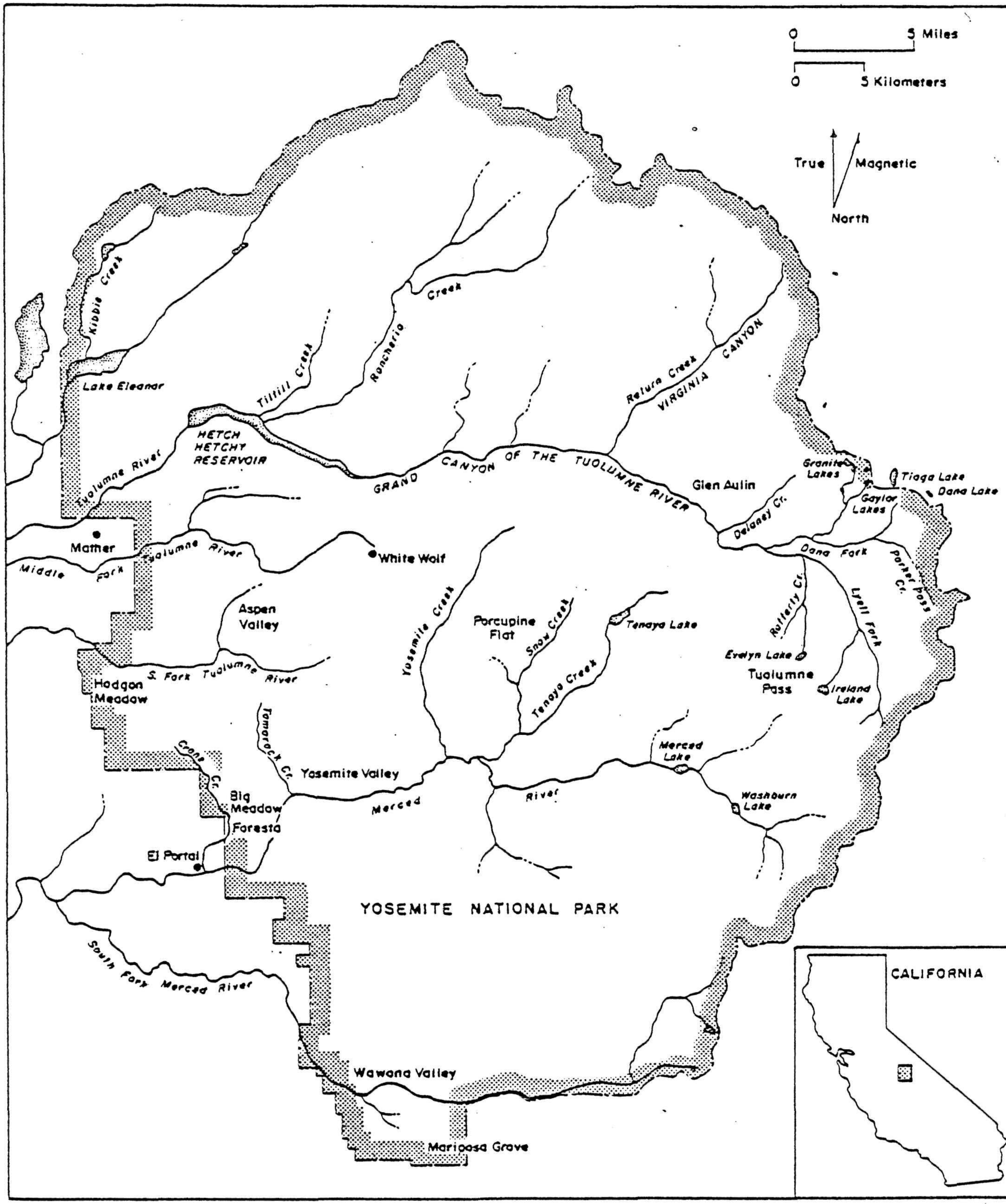

Fig. 2.2 Yosemite National Park Showing Principal Rivers.

sive--and a great variety of vegetation types (Barbour and Major 1977; Storer and Usinger 1970).

Culturally, Yosemite stands between the major ethnographic areas of central California and the Great Basin (Kroeber 1939). In late prehistoric and early historic times, Yosemite was held chiefly by the Central and Southern Sierra Miwok--typically "Californian" groups--but Great Basin Indians such as the Washo and Paiute also occupied parts of Yosemite (at least seasonally), intermarried with the Miwok, conducted a lively trade with westslope peoples, and otherwise brought considerable Great Basin influence into the central Sierra. Hence, Yosemite may be viewed as a boundary zone and contact area between two major geomorphic and cultural provinces.

While a review of central Sierran ethnography is beyond the scope of this paper, it may be useful to identify some of the published works dealing with the topic. For the Miwok, important general studies are those by Aginsky (1943), Barrett (1908), Barrett and Gifford (1933), Kroeber (1925), Levy (1978), Merriam (1917, 1955, 1967), and Powers (1877). Washo ethnography has been summarized by Downs (1966), D'Azevedo (1963), and Steward (1938), and the Paiute have been described by Kroeber (1925), Steward (1933, 1938), and Stewart (1939). The ethnohistory of Yosemite and adjacent parts of the central Sierra also has been documented by several scholars, among them Bates (1975), Castillo (1978), Hall (1978), Muñoz (1975a, 1975b), and Theodoratus (1976). Lastly, Napton (1978:59-140) has provided synopses of both ethnographic and ethnohistoric data with particular reference to the area of Yosemite National Park.

2.2: Archeology

Past archeological work in Yosemite has involved both survey and excavation (see Napton 1978:141-209, 310-453). Briefly, University of California archeologists documented 401 sites in the course of "intuitive" surveys during the summers of 1952 to 1954 (Bennyhoff 1953, 1956; Grosscup 1954). Systematic, intensive surveys by teams from California State College, Stanislaus, during the 1970s brought the total of recorded sites to over 560 and greatly improved the quality of documenta-

tion for more than half of that number (Napton 1974a, 1974b; Napton, Albee, and Greathouse 1974a, 1974b; Napton and Greathouse 1976). To date, an estimated 5 percent of the park, mostly in areas of heavy use, has been surveyed by professional archeologists (Napton 1978). This work has led to the discovery and recording of many types of sites or features, among them middens, lithic scatters, rockshelters, bedrock milling stations, cemeteries, isolated burials, pictographs, and circular arrangements of stone (see Chapter 6).

Scientific excavations in Yosemite have included minimal testing (1-10 units, 5 ft. x 5 ft. each) at seven sites, more extensive "salvage" excavations (16-43 units) at four sites, and the removal of several isolated interments (see Chapter 6).

Based upon chipped and ground stone artifacts recovered from test excavations at four sites and from widespread surface collecting, Bennyhoff (1956) defined a local cultural sequence of three complexes: Crane Flat, Tamarack, and Mariposa, from oldest to youngest. The Crane Flat Complex is marked by heavy (greater than 3.5 g) projectile points, inferred use of the atlatl and dart, and the mano/metate system for milling seeds, whereas the Mariposa Complex is distinguished by light (less than 1 g) projectile points, inferred use of the bow and arrow, bedrock mortar and cobble pestle (Bennyhoff 1956).

Representing the protohistoric period, the Mariposa Complex can be identified with the ancestral Sierra Miwok. Bennyhoff's (1956:53-54) suggested dates of ca AD 1200-1800 are derived mainly from resemblances between Mariposa Complex point types and those from dated components in the Central Valley and Great Basin. The Tamarack Complex (AD 500-1200?) is tentatively defined and not linked clearly to the predecessors of any historic group. The Crane Flat Complex (? BC-AD 500?) shares manos, slab metates, and several types of large points with the Martis Complex near Lake Tahoe, but the emphasis on obsidian in Yosemite contrasts with the relatively greater use of basalt and other non-glassy lithics in the northern Sierra. In sum, while the status of the Tamarack Complex is unclear, Bennyhoff showed that: (1) Yosemite has been occupied for 2,000 years or more; (2) significant cultural changes (and perhaps population replacement as well) occurred during this interval; and (3) that the prehistoric cultures of the Yosemite locality were influenced by and

were related to those of the Great Basin, Central Valley, and other parts of the Sierra Nevada.

Excavations at El Portal (4-Mrp-181), Crane Flat (4-Mrp-105), and Hodgdon Ranch (4-Tuo-236) during the early 1960s, led R. Fitzwater to replace Bennyhoff's sequence with a two-phase cultural succession (lacking the Tamarack Complex). The Crane Flat Phase, little changed in content from Bennyhoff's complex of the same name, was first evidenced in the Yosemite locality about AD 1. It was replaced ca AD 1000 by the Mariposa Phase, which in turn persisted until the mid-19th century. The earlier part of Fitzwater's chronology is supported by three ^{14}C dates from Crane Flat: 950 ± 70 BP from the 46-61 cm level; 1580 ± 80 BP from 91-107 cm; and 2040 ± 100 BP from 122-137 cm (Fitzwater 1964, 1968a, b).

As Napton (1978) has observed, the development of an archeological sequence for Yosemite in the 1950s and 1960s was perhaps premature, or at least based upon a very small sample of data. To the extent that the prehistory of Yosemite may parallel that of certain nearby Sierran localities, such as the Chowchilla River drainage where intensive excavations and nearly 30 ^{14}C dates have been reported (King 1976; Moratto 1972a), Bennyhoff's original chronology would appear to be essentially valid. On the other hand, the sequence does not take into account cultural variation due to functional differences among sites, nor does it distinguish among separate but coeval manifestations such as those representing Great Basin and western Sierran cultures. In any event, the Crane Flat to Mariposa occupations surely reflect only the more recent phases of a long prehistory in the central Sierra (see Section 4.2). Thus, future archeological work may not only enhance our knowledge of late prehistory but also yield information about poorly known early cultures. One may suspect that, in the final analysis, several long and distinctive archeological sequences may be worked out for the various localities of Yosemite National Park.

2.3: Yosemite: Archeological Opportunities

As a scientific resource, the archeological remains in Yosemite National Park are of special value. Yosemite is large enough, and its cultural resources are sufficiently numerous and diverse, to provide a

good sample of data for addressing a variety of research problems:

1. The park is environmentally varied, including a wide array of landforms, hydrologic features, and vegetation types. At the same time, archeological features occur widely and in almost all of Yosemite's microenvironments. This affords an excellent opportunity to study cultural-environmental relationships (cultural ecology) and to reconstruct past land-use configurations.

2. As a transect across the central Sierra from elevations of approximately 550 to 3,500 m, Yosemite is an ideal place to study seasonal occupation, transhumance, and montane adaptation at high altitudes.

3. Yosemite was spatially intermediate between the Great Basin and Californian cultural and environmental provinces. Because trade and other forms of interaction between these two areas occurred in Yosemite, the archeological resources of the park may yield information about California-Great Basin exchange systems, acculturation, and processes of cultural boundary maintenance.

4. Yosemite National Park contains much evidence of Holocene environmental changes, particularly meadow sediments, fossil pollen, moraines, tephra in stratified contexts, and tree-ring records of precipitation and fire. Such data often are rare or lacking in lower elevation regions of California. Hence, Yosemite would be an especially good place to investigate relationships between paleoenvironmental and cultural changes.

5. At least some of Yosemite's midden sites are deep, stratified, and relatively old (2,000 years or more). Through research at such sites it may be possible to reconstruct local cultural sequences and to establish the nature and timing of social replacement in Yosemite prehistory.

6. Included within Yosemite National Park are portions of the ethnographic territories of the Mono Lake Paiute, Monachi, Central Sierra Miwok, and Southern Sierra Miwok. Therefore, the archeological resources of Yosemite may record past activities of these groups, including their arrival in the area, adaptations to local conditions, and interactions.

7. The cultural resources of the central Sierra have suffered tremendous impacts, especially as a result of the Gold Rush and, more

recently, the construction of New Melones, New Don Pedro, and McClure Reservoirs. In this context, the archeological remains in Yosemite, excepting those inundated by the Hetch Hetchy Reservoir, have survived relatively undamaged and with their integrity of setting largely intact. Accordingly, the overall cultural record may be more complete--and thus hold greater research potential--in Yosemite than in most other parts of the central Sierra Nevada.

8. The Yosemite region has experienced a rich history, beginning with the arrival of the Moraga expedition from the mission zone in 1806, and virtually exploding with activity during the mid-19th century. The tapestry of Yosemite's history is woven from the deeds of explorers, traders, homesteaders, miners, ranchers, and loggers, as well as the activities of those engaged in developing water resources, transportation systems, recreation facilities, and other land uses (Farquhar 1966b; Russell 1968). The complex history of Yosemite is reflected in its cultural resources, among them many structures and places--such as Camp Curry, the Old Coulterville Road, the Golden Crown Mine, and Galen Clark's Homestead--which have been nominated to the National Register of Historic Places (Chappell 1968; Chappell and Cox 1977; Hart 1975, 1976a-b, 1977; Hart and Wilson 1976a-e, 1979; Schenk 1976). The preservation and study of these resources will enhance public appreciation and understanding of local, regional, and national historic themes.

3: RESEARCH DESIGN

3.0: Introduction

3.0.1: Scope

The major goals of this chapter are to present a research strategy and to introduce the concept of research design. In keeping with this direction, the present chapter does not recommend that any particular archeological site be excavated or otherwise studied. Rather, the intent here is to provide a basis for developing site-specific research plans in the larger contexts of anthropological theory and regional archeology.

3.0.2: General Issues

To understand central Sierran culture history, one must address such broad questions as: (1) when and by whom was the region initially and subsequently occupied?; (2) how has the effective environment of the central Sierra changed through time?; (3) in what ways have cultures responded and adapted to environmental shifts?; (4) did technology, subsistence practices, and settlement patterns change diachronically and, if so, why?; (5) how did native groups of the central Sierra relate to one another and to peoples of other regions in terms of social, religious, military, and economic interaction?; and (6) what major trends and patterns have characterized historic cultural developments in the region? It is clear that answering such questions will require information about natural and cultural changes over a long span of time. The necessary data may be obtained through scientific studies in and near Yosemite National Park, provided that the research be designed to integrate the findings of archeology with those of geology, palynology, climatology, and other fields.

The integrating device for such multi-disciplinary research is anthropological theory. A fundamental premise of anthropology is that culture is a uniquely human system of learned behavior by which members of a society interact with one another and with their effective environment. Studies of the mechanisms of interaction can lead to an understanding of the processes by which societies organize and adapt, and

help explain why some cultures are more successful than others in defined contexts. This concern about the nature of cultural dynamics is translated here into a set of working assumptions which, in turn, comprise a strategy or theoretical basis for the research design.

3.1: Research Strategy

3.1.1: Definition

A research strategy is a means of relating a theoretical stance to a particular research design. A strategy gives order and direction to research. By providing a logical structure for generating hypotheses, a research strategy permits the investigation of cultural processes and causality. Hence, a formal strategy brings explanatory potential to research.

3.1.2: Assumptions

The strategy for the present research program embodies the following series of operating assumptions:

1. Culture is the primary means of human adaptation--the device by which societies relate to their habitats (Cohen 1968; White 1959).

2. Cultures operate as systems comprised of economic, social (including demographic), and ideological subsystems. Cultural traits may be classed as technomic, sociotechnic, or ideotechnic, according to the subsystem within which they function (Binford 1962).

3. Cultures exist within environments formed of both natural (climatic, geophysical, biotic) and sociocultural elements. Environments and cultures interact as parts of larger systems; the broad regularities of this interaction conform to the principles of General System Theory (cf. von Bertalanffy 1962).

4. The environment is dynamic. Its changes may be large or small, gradual or abrupt, and of minor or great moment to the cultures affected.

5. Cultures respond to shifts in their effective environment. Consistent with models of "punctuated equilibria" (Gould and Eldridge 1977), rapid and pervasive cultural changes occur intermittently against a background of constant, lower intensity adjustments.

6. Cultural adaptation is largely the process of economic adjustments to significant environmental changes. Social, political, and ideological behaviors are determined or limited by the conditions of material production (Harris 1979).

7. Each culture represents a unique, long-term experiment in cultural ecology and human organization. It is of scientific value to understand past (and present) cultures because (a) they evince the potentials and limits of human behavior in the context of specific external and internal conditions, and (b) they reflect the processes by which cultures may be maintained or changed over time (Brose _et al._ 1979).

8. Cultural behavior is systematic and patterned. Because the material products of such behavior reflect its patterning, archeological remains may be studied to "discover" past cultural regularities (cf. Deetz 1965). Indeed, archeology provides the only access to the immense reservoir of human behavioral data undocumented by history (Watson 1973).

9. A major objective of archeology is to describe and explain past cultural systems (Binford 1962; Kushner 1970). A more encompassing goal is to formulate valid laws or principles to explain general (cross-cultural) patterning of human behavior (Renfrew 1973; Watson _et al._ 1971).

10. Explanation in archeology occurs when observed or inferred behavior can be subsumed under laws or principles. Such laws and principles may account for such phenomena as cultural uses of energy and materials, costs and benefits of alternative economic strategies, and the relative advantages of different forms of social organization (Harris 1979; L. Johnson 1972).

11. Archeological research designs are indispensible for the study of past cultural systems (Schiffer and Gumerman 1977).

3.2: Research Designs

3.2.1: Basic Concepts

A research design is a formal device to articulate theory, method, and data. By linking explicit objectives with a plan for the systematic

recovery and analysis of data to meet those objectives, a research design permits hypothesis testing (Binford 1964, 1967; Martin 1972). Hypothesis vertification, in turn, may bring the archeologist to the explanation of cultural behaior (Binford 1962; Brim and Spain 1974; Watson et al. 1971).

Ideally, a research design should: (1) define the universe of study; (2) provide a rationale for the intended work; (3) identify the topics and problems to be investigated; (4) describe the data recovery and analytic methods to be used; (5) show how the methods relate to stated aims; and (6) set forth realistic expectations (probable outcomes) of the research. To be useful, a research design must be current as well as explicit. It should be updated often enough to reflect advances in theory, method, and knowledge. As the sine qua non of archeological research, a design "should cover the whole planning and investigation sequence from the initial statement of problem, through general assumptions, to operational statements" (Vivian 1977:72).

As contrasted with intuitive or implicit approaches, research designs lead to efficient, cost-effective work because they maximize the yield of relevant (useful) information (Moratto 1976, 1979). They also permit the evaluation of findings and work in progress in terms of explicit criteria (Goodyear 1976; Schiffer and Gumerman 1977). Moreover, research designs afford a basis for determining the scientific value or "significance" of archeological remains (Glassow 1977b; House and Schiffer 1975; Moratto and Kelly 1978). In sum, research designs comprise the only means to optimize the use of unique, finite, and diminishing cultural resources.

3.2.2: Regional Research Designs

The scope and quality of research are enhanced when regional perspectives are applied. Individual sites and localities often cannot reflect the full range of cultural patterning (e.g., settlement or exchange systems) related to the archeological population being studied; that is, local samples are seldom fully representative samples. Hence, the methods most appropriate for investigating many kinds of cultural variability and change are those which are "regional in scope and executed with the aid of research designs based on the principle of probability sampling" (Binford 1964:425).

A regional research design does not preclude the study of locally-specific topics. Indeed, the balancing of local and regional interests is likely to yield the best possible research effort in a particular locality. Among the advantages of regional research designs are that they: (1) identify problems for investigation not evident locally; (2) permit evaluation of data potentials in a regional context; (3) lead to an understanding of the local archeological record with respect to larger cultural trends and patterns; (4) provide a basis for determining representative samples; and (5) tend to minimize investigator bias (McMillan et al. 1977; Schiffer and Gumerman 1977).

In California, regional research designs have appeared only recently and only for some regions. For example, Kowta (1975) has prepared a thoughtful strategy, hypotheses, and test implications to guide research in northeastern California. Bickel and King (1980) have done much the same for the northwestern part of the state. One of the more comprehensive projects along this line is the archeological overview and research program for California's central coast being developed by Breschini and Haversat (n.d.). This work builds upon several older and more limited research plans within the region (e.g., those by Fritz and Smith 1978; C. King and L. King 1973; T. King and Hickman 1973). Valuable discussions of research problems, though not regional designs as such, appear in archeological overviews of Marin County (T. King 1970), the Mojave Desert (Coombs 1979a, 1979b), Joshua Tree National Monument (T. King 1975), the northern Channel Islands (Glassow 1977a), Redwood National Park (Moratto 1973), and the central North Coast Ranges (Jackson 1976).

Although various archeologists have written about research prospects in the central Sierra Nevada, there is as yet no true research design for this region as a whole. A great deal of archeological design work has focused on the middle Stanislaus River locality northwest of Yosemite (Baker et al. 1980; Brose et al. 1979; Fitting et al. 1979; Moratto 1974, 1976, 1977; Riddell et al. 1969; Stickel 1978). Due to a long history of curious political events, none of these plans has been implemented. In areas bordering Yosemite, archeological plans have been devised for specific projects (e.g., Jackson 1979; Varner 1976), and research/management plans are being developed for the Inyo, Sierra,

Toiyabe, and Stanislaus National Forests (K. Moffitt 1980: personal communication; W. Woolfenden 1980: personal communication).

Within Yosemite National Park itself, most archeological work has followed largely implicit plans. Napton (1978:166-174) has summarized the goals, methods, and findings of the major studies conducted during the 120-year history of archeological activities in Yosemite. The rationale for projects--e.g., the need to salvage jeopardized remains--usually was explicated (cf. Fitzwater 1962; Rasson 1966), but specific objectives were seldom linked to data recovery plans in a formal way. Exceptional were the recent field surveys in Yosemite directed by L. Napton, who devised an explicit methodology (the Terrain-Ecology Response Mode) to achieve stated objectives (Napton and Albee 1974; Napton _et al_. 1974a; Napton and Greathouse 1976).

Notable progress toward a research design for Yosemite is evinced by Napton's (1978) Overview.... Building upon research problems sketched by Moratto (1976, 1977), Napton (1978:329-356) has explored how archeological investigations in Yosemite might elucidate such topics as the park's initial occupation, demography, settlement patterns, transhumance, trade and exchange systems, aboriginal use of Sierran environments, and the evolution of certain forms of sociopolitical organization. Napton has shown that the archeological resources of Yosemite hold great potential to improve knowledge about local prehistory as well as matters of wider scientific and public interest. Realizing that potential will call for a research design sensitive to both local and regional needs and opportunities.

4: PROBLEM DOMAINS

4.0: Introduction

This chapter identifies general problem domains and specific objectives to guide archeological research in Yosemite National Park. As used here, a "problem domain" is a group of related topics or a field of inquiry (e.g., settlement patterns) to be investigated (cf. Canouts 1977; Goodyear 1977; Raab 1977). Discussed below are problem domains ranging from paleoenvironments to social organization. Each will be examined in terms of particular research objectives and the importance of the domain to understanding culture history in the central Sierra Nevada.

4.1: Paleoenvironment

4.1.1: Rationale and Scope

An essential first step toward understanding past cultures is to reconstruct the environments within which they functioned. As J. D. Clark (1960:308) has pointed out:

> . . . the environment and ecology setting of cultures . . . [must] be established as accurately as possible, for, without this knowledge, we can hardly begin to interpret the cultural evidence. It is necessary to know the nature of faunas, of vegetation and climate, of kinds and forms of raw materials, available to man and so on. Here, to a very great degree, the archeologist must rely on workers in other disciplines--geologist, paleontologist, ecologist, paleobotanist, soil chemist, and geographer, to mention a few. It is now fully apparent that unless there is teamwork with other disciplines, we cannot hope to extract more than a fraction of the evidence that in many instances our sites could yield.

These observations, coupled with the realization that the central Sierra has experienced marked natural changes during a long span of human occupation, provide the rationale for focusing upon paleoenvironments as a problem domain. Among the topics included in this category are glaciation, vulcanism, climates, flora, fauna, and how their changes may have influenced cultural developments in and near Yosemite.

4.1.2: Regional Background

L. K. Napton (1978:17-58) has described the principal biotic and geologic features comprising the effective human environment of Yosemite. The main points of Napton's environmental overview may be summarized as follows:

1. Yosemite National Park lies near the center of the Sierra Nevada, an elevated granitic batholith. Low, rolling foothills separate the mountains from the Central Valley on the west, while the steep eastern scarp of the Sierra forms the western rim of the Great Basin.

2. The Sierra greatly influences climate, so that precipitation (including winter snowfall) is moderate to heavy on the western slope and sparse in the rainshadow east of the crestal zone. Elevations above snowline (approximately 1,000 m) were generally unsuited for human occupation during the snow season.

3. While the Sierra Nevada is an imposing range, it was not an obstacle to east-west travel in earlier times. Through numerous passes Sierran Indians regularly and easily crossed the mountains, including the higher central and southern parts of the range, during snow-free months.

4. The gentle western slope of the Sierra afforded land surfaces ideal for Indian habitation. Also, the many streams of the western Sierra provided abundant water so that the pattern of settlement was not determined by the location of water resources alone, but rather by locations that offered combinations of several resources.

5. Because the lithology of Yosemite is chiefly granitic, certain rocks and minerals of value to the Indians (e.g., chert, obsidian, and basalt) were not available locally and had to be imported. On the other hand, granite outcrops and stream cobbles were employed as mills (mortars and pestles, millingstones and manos), and rock overhangs were used as shelters.

6. The numerous high elevation lakes of Yosemite were a focus of aboriginal settlement, at least seasonally.

7. Yosemite National Park forms a geologic, climatic, and biotic transect across the central Sierra from elevations of less than 400 m to more than 3,950 m. As a result, microenvironments in Yosemite are both numerous and diverse. The topography is arrayed from nearly flat mea-

dows to vertical cliffs; water comes from two large rivers and hundreds of smaller streams, springs, and lakes; and a complex mosaic of vegetation types (e.g., Sierran chaparral, blue oak/digger pine woodland, Alpine fell field, etc.) is distributed in five of the six Californian life zones: Upper Sonoran, Transition, Canadian, Hudsonian, and Arctic-Alpine.

9. Transmontane exchange of food products and lithic materials was stimulated by major differences in resource availability between the granitic, mesic, forested western slope of the Sierra and the volcanic, xeric, brushy eastern side of the range (Napton 1978).

Napton has provided an excellent synopsis of Yosemite's extant and historic environments as they relate to cultural activity. It is known, however, that regional climates, glaciers, hydrology, and biota have changed significantly during the span of human occupation in the central Sierra. Some of the paleoenvironmental changes that would have affected Yosemite and its residents are discussed in the following section, adapted from Moratto et al. (1978).

4.1.3: Paleoenvironmental Overview

Climate and Biota: The Holocene epoch (ca 11,000 B.P.-present) was characterized by climates which, although generally warmer than those of the late Pleistocene, changed through time in complex yet broadly synchronous ways. Changes in temperature, humidity, and precipitation significantly affected the distribution of water, floras, faunas, and the human societies dependent on these resources. Pollen analyses, glaciology, and timberline and tree-ring studies indicate at least six relatively cool/moist episodes and five warm/dry periods during the Holocene in California (Moratto et al. 1978).

The most precise, climatically sensitive records available are two bristlecone pine (*Pinus lingaeva* Bailey) growth ring chronologies from the White Mountains, about 75 km east of Yosemite. The longevity of bristlecone pine and its well preserved dead wood provide good time depth. A 5,400-year ring width record from the upper treeline mainly reflects the positive influence of high summer temperatures, while a complementary 6,000-year series from the lower forest border records the effects of high precipitation and low evapotranspiration. Dated remains

of bristlecone pine up to 150 m above the present treeline indicate relatively high summer temperatures from before 5400 BP until about 4000-3400 BP, when summers evidently began to cool. Drier conditions then forced an extensive treeline retreat between ca 900 and 500 BP (Fig. 4.1) (La Marche 1973, 1974, 1978; LaMarche and Mooney 1967; La Marche et al. 1974).

Five pollen diagrams from the Lake Tahoe and Yosemite localities, viewed mainly as temperature and water depth indicators, provide a comparable climatic record. The pollen spectra show a vegetation shift during the transition from cool/dry climate to cool/moist Pleistocene conditions about 10,000 years ago. After ca 9000 BP, a general temperature increase is evident until ca 2900 BP, except for a cool/ moist reversal between ca 7000 and 5000 BP. The past 2,900 years witnessed several warm, moist, and dry intervals within a prevailing cool/moist period (Fig. 4.1) (Adam 1967; Šercelj and Adam 1975). Byrne et al. (1979b) have reported a comparable sequence as reconstructed from a 7 m core taken from Tule Lake in Mono County, just north of Yosemite.

The pollen record corresponds to meadow stratification in the central and southern high Sierra. Wood's (1975) study of meadow strata, ^{14}C dates, and tephrachronology indicates that: (1) the upper montane belt was forested between ca 10,200 and 8700 BP; (2) one or more intervals of good soil drainage and dry valley bottom conditions occurred between 8700 and 1200 BP; and (3) forest soils changed abruptly to wet meadow deposits around 2500 BP at some sites and 1200 BP at others.

In sum, although the diverse paleoenvironmental studies vary in precision, all are remarkably consistent with respect to the nature and timing of late Quaternary events in California (as well as in other western regions; cf. Mehringer 1977). Of all evidence, the dendroclimatic data are especially valuable, not only as a record of temperature and moisture variation, but also as a proxy history of glaciation from ca. 6000 to 2700 BP, prior to the oldest recognized mid-Holocene moraines (LaMarche 1974).

Glaciation: Early Pleistocene glaciers as much as 1,200 m thick pushed down the Tuolumne and Merced Canyons to elevations as low as 600 m. In Yosemite Valley ancient glaciers removed some 950 m of granitic bedrock before later glaciers and periglacial lakes deposited

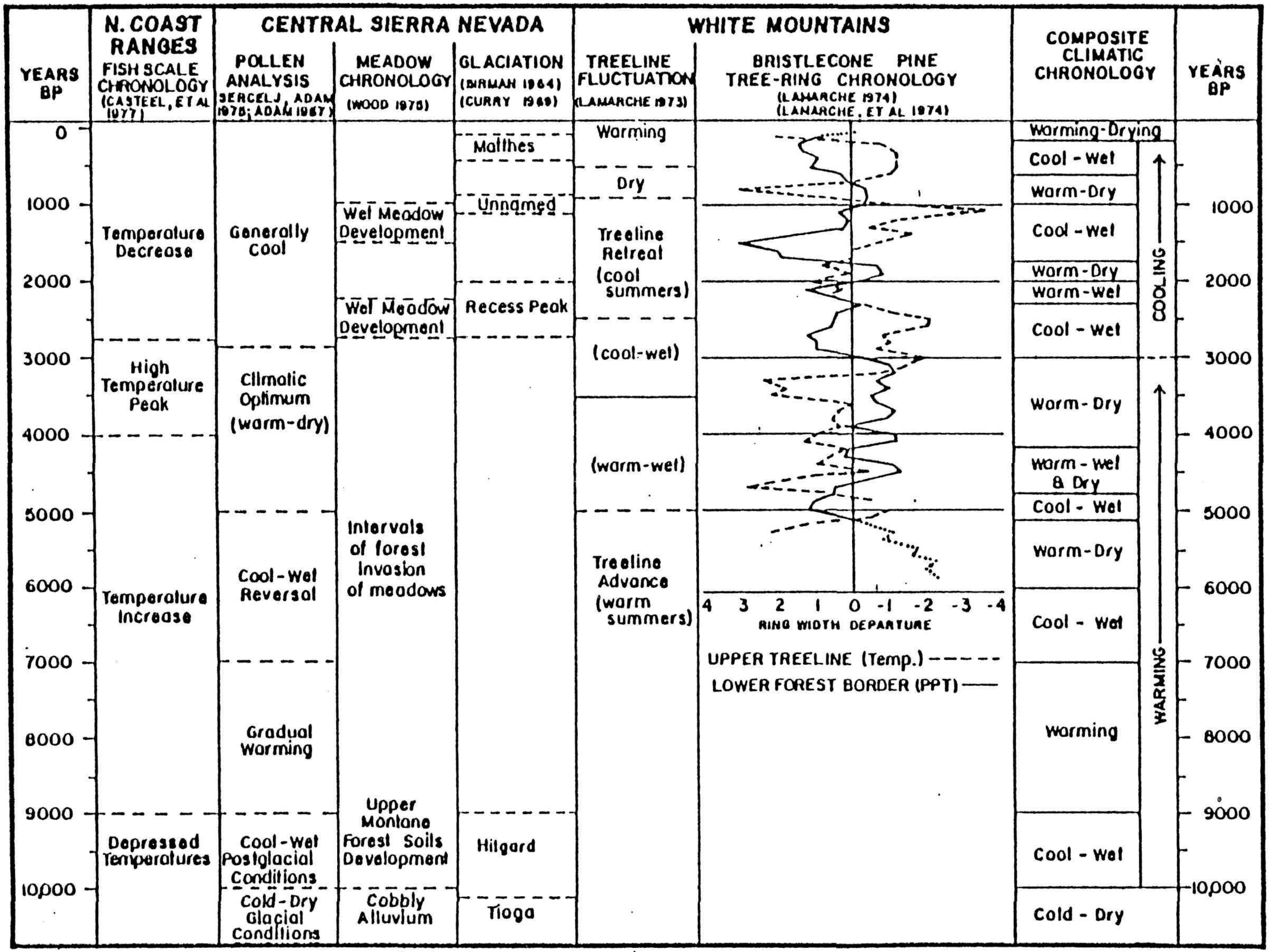

Fig. 4.1 Reconstruction of California's Holocene Climates
(Moratto et al. 1978:Fig. 1).

about 600 m of sediments (Oakeshott 1971; Schaffer 1977). There were three Wisconsin glacial episodes in the Sierra Nevada, known as the Tahoe (85,000-60,000 BP), Tenaya (50,000-40,000 BP), and Tioga (30,000-10,000 BP) stages (Hill 1975; Schaffer 1977:243).

The retreat of the Tahoe stage ice left a basin in Yosemite Valley which filled with a lake about 12 km long. The Tenaya stage glacier also invaded the valley, and the most recent Lake Yosemite was formed when it retreated. Sedimentation of Lake Yosemite and some post-lake deposition occurred during the Tioga stage, but Tioga glaciers apparently were limited to the Tenaya and Little Yosemite Canyons and did not enter the valley proper. In the Merced Canyon, Washburn and Merced Lakes were formed about 10,000 years ago. Rockfall on the floor of Yosemite Valley has accumulated since the retreat of the Tenaya stage glacier and thus is less than 40,000 years old (Schaffer 1977).

Of particular interest here is Holocene glaciation. Periods of montaine or cirque glaciation (cf. Matthes 1950:64) during the past 11,000 years coincide with intervals of cool/moist climate as determined by tree-ring and pollen studies (Fig. 4.1). A Holocene glacial chronology for the Sierra Nevada was first compiled by Birman (1964) and later expanded by Curry (1969, 1971). Although Birkeland _et al_. (1976) questioned the proposed ages of some deposits, the basic glacial sequence is generally accepted. This includes four post-Tioga advances: (1) Hilgard, an early Holocene glacier (ca 10,500-9000 BP), and (2-4) three "Neoglacial" episodes--Recess Peak (ca 2600-2000 BP), an unnamed glaciation (ca 1100-900 BP), and Matthes (ca 600-100 BP) (Curry 1971; Sharp 1972).

Related Holocene changes in Yosemite include the gradual sedimentation of lake basins, emergence of mountain meadows, alluviation and rock fall in Yosemite Valley, and fluctuations of biotic communities as a result of climatic oscillations (Matthes 1950; Wood 1975).

Vulcanism: The Mono-Inyo Crater chain is a series of late Quaternary domes, flows, craters, and tephra deposits along a 40 km arc at the eastern base of the Sierra, some 15-20 km east of Yosemite (Bateman and Wahrhaftig 1966; Wood 1975:130). Two recent eruptions are known from stratified and ^{14}C dated volcanic ash (tephra). Tephra 2, distributed from northern Yosemite to the south side of Kings Canyon, is derived

from an eruption of one of the northern Mono Craters ca 1,200 years ago. Tephra 1, related to an eruption of South Deadman Creek obsidian dome ca 720 years ago, is distributed from Inyo Craters southward to the valley of the Little Kern River; this tephra extends northwestward only as far as the southeastern border of Yosemite National Park. As least two other Holocene eruptions of the Mono-Inyo Volcanoes, including one ^{14}C dated at ca 3365 BP, are known but not as well documented as the later events (Wood 1975:139-150). Hence, there is evidence of not less than four, and perhaps many more, eruptions of the Mono-Inyo Craters during Holocene times. This volcanic activity certainly affected the environs and probably the cultural ecology of Yosemite. It would be of interest to know the degree to which local vulcanism may have affected earlier peoples in the Yosemite Region.

4.1.4: Sierran Paleoenvironments and Cultures

Moratto *et al*. (1978) have reported a striking correlation of environmental and cultural changes in the Chowchilla River drainage of the Sierran foothills about 50 km southwest of Yosemite:

1. Settlement began only after the amelioration of very warm/dry conditions around 2900 BP, and was sporadic until very cool/moist climates prevailed around 1700 BP. Between ca 2800 and 1700 BP, the area was sparsely inhabited by small, presumably mobile groups.

2. During the cool/wet period after 1700 BP, the population became fairly sedentary and highly organized; settlements were large, and extensive trade was carried out with both coastal and trans-Sierran peoples.

3. After 1400 BP, there was a period of social disruption coeval with rapid warming and drying of the climate; nucleated villages broke up, the population dispersed, political organization deteriorated, and violence increased. During this arid interval, persisting until ca 600 BP, the southern Sierra foothills were occupied by relatively small groups with little hint of complex political organization or status differentiation. If population centers existed, they apparently were at higher altitudes where environmental conditions previously typical of the lower foothills were replicated. The bow and arrow were introduced,

and acorn processing apparently increased. Contact was maintained across the Sierra, but trade with the coast virtually ceased.

With the return of cool/moist conditions around 600 BP, the population increased substantially, settlements proliferated, and social organization became more complex. Status differentiation was marked, and trade across the Central Valley resumed (King 1976; Moratto 1972b; Moratto et al. 1978).

Archeological data from the Chowchilla River sites indicate that human populations were greatly affected by climate-based environmental changes. The cultural sequences identified at Hidden Reservoir (Fenenga 1973; Kelly 1974) and in Yosemite National Park (Bennyhoff 1956; Fitzwater 1962, 1964, 1968a, b) also seem to show a correspondence of archeological phases and known climatic periods. Likewise, Elston et al. (1977) have reported a long sequence of covariant environmental and cultural changes in the Tahoe Reach along the Truckee River on the northeastern side of Lake Tahoe. The overall correspondence between the Tahoe and central Sierran sequences is excellent, showing that broad environmental changes occurred simultaneously at least throughout the Sierra Nevada, and that cultures hundreds of kilometers apart were similarly affected by these shifts (Moratto et al. 1978). In light of these findings, Yosemite would be an especially good place to study cultural responses to natural changes because of numerous archeological sites in diverse environmental settings at elevations of approximately 400 m to 3,000 m.

4.1.5: Research Objectives

Thus far, I have shown that certain volcanic, glacial, and climatic changes affected the central Sierra during Holocene times. The next step is to relate these paleoenvironmental variables to specific archeological research objectives that may be pursued in Yosemite National Park. The objectives set forth below are designed to advance knowledge about Holocene events, conditions, and changes, and how they may have influenced cultural developments. The kinds of data needed to address these objectives will be discussed in Chapter 6.

For the Holocene epoch (post-9000 BC):

1. Identify significant geomorphic changes that may have affected human activities in the central Sierra Nevada.

2. Ascertain the number, age, and extent of tephras in Yosemite National Park, and determine both the source and magnitude of each represented volcanic event in order to assess the effects of vulcanism on prehistoric cultures.

3. Reconstruct the sequence of paleoclimatic episodes in the central Sierra with reference to the age, rate, direction, and amplitude of temperature and precipitation shifts, as well as any detectable seasonal shifts of climatic variables.

4. Determine the glacial, hydrologic, erosional, and depositional effects of each identifiable climatic regime.

5. Reconstruct the succession of floral conditions in the central Sierra, with emphasis on the former distributions of vegetation types (communities), treeline fluctuations, and the nature and timing of perceived shifts.

6. Determine the nature and distribution of past faunal assemblages in the central Sierra, including both Rancholabrean and modern species, and indicate when and how the faunas changed through time.

7. Identify the location and kinds of abiotic and biotic resources that would have been available in Yosemite throughout the Holocene epoch, regardless of other environmental conditions.

8. Synthesizing and comparing data from above (4.1.5(1-7)), define the sequence of effective environmental changes in Yosemite and determine the age, resource potentials, and constraints (vis-à-vis human populations) of each interval.

4.2: Cultural Chronology

4.2.1: Rationale and Scope

The problem domain is concerned with cultural successions in the central Sierra Nevada. It deals with the sequence of population movements and cultural replacement in and near Yosemite National Park. The inherent focus on chronology provides the rationale for investigating this domain: temporal control is necessary to order past events and to solve problems about origins, influences, diffusion of traits, migra-

tions of people, rates of cultural change, and sizes of populations in settlements (Hole and Heizer 1973:245). By indicating the contemporaneity of diverse sites, dating also permits the reconstruction of settlement systems and land-use patterns during specific time periods. Finally, chronologies allow the archeologist to relate particular cultural developments to paleoenvironmental conditions and changes.

4.2.2: Early Occupation

It will be of interest to learn when and by whom the central Sierra was first occupied. Not long ago, I observed that the known archeological record in the Sierra Nevada did not seem to extend much beyond ca 3500 BP--a remarkably late time as compared with the oldest dated cultural remains in the Central Valley and Great Basin (Moratto 1972b). Subsequently, I proposed several reasons why Sierran occupation might have been retarded, but cautioned that "the basic assumption as to the date of the first western Sierran habitation needs to be examined with every effort . . . to discover possible archeological settlements more than 3,500 years old" (Moratto 1977:402-403).

It is now apparent that the Sierra was indeed occupied more than 3,500 years ago. For example, Wren (1976: personal communication) reports a ^{14}C age of 5,220 ± 105 years for a Pinto-Humboldt component at 4-Fre-534 (elevation 2,165 m) on the North Fork of the Kings River, about 24 km west of the Sierran divide. Likewise, McGuire and Garfinkle (1979) have found evidence of sporadic hunting and gathering as early as ca 6000 BP, with intensive settlement after ca 3200 BP, near the crest of the southern Sierra between Lamont Meadow and Rockhouse Basin (elevation 1,980-2,430 m). Finally, Moratto and Riley's (1980) excavation of site 4-Fre-811 at Balsam Meadow in eastern Fresno County yielded a carbon sample dated at 7,300 ± 260 (UCR-1245).

Farther north, a Clovisoid fluted point from Ebbetts Pass (Davis and Shutler 1969) suggests that hunters may have ventured into the Sierra south of Lake Tahoe more than 10,000 years ago. Along the Truckee River northwest of Lake Tahoe (1,897 m), Elston and others have defined seven cultural phases spanning an estimated 8,000 years (Fig. 4.2). The earliest phase (Tahoe Reach), represented by Parman points and other artifacts evincing Great Basin connections, has been ^{14}C dated to 8130 ±

Years B.P.	Chowchilla River Foothills	Tuolumne River Foothills	Stanislaus River Foothills	Yosemite National Park	Lake Tahoe Uplands	Western Great Basin
0	Madera Phase	Don Pedro Phase	Melones Phase	Mariposa Phase	Late Kings Beach Phase	Marana Period
1000	Raymond Phase	Rogers Creek Phase	?	Tamarack Phase	Early Kings Beach Phase	Halwee Period
2000	Chowchilla Phase	Tuolumne Phase	Stanislaus Phase	Crane Flat Phase	Late Martis Phase	Newberry Period
3000					Middle Martis Phase	
4000	Pinto Phase	Pinto Phase		Pinto Phase	Early Martis Phase	Little Lake Period
5000	?	?	?	?	Spooner Phase	
6000						
7000						
8000			Parman Phase		Tahoe Reach Phase	Lake Mojave Period

Fig. 4.2 Archeological Sequences in East Central California.

130 BP (Elston et al. 1977). In 1979, Parman points were also found deeply buried at Cal-S-347 in the foothills of the Stanislaus River Canyon (L. Riley 1979: personal communication). Although the age of the Stanislaus River specimens has not been established, Parman points in the type locality (in northwestern Nevada) have been assigned to the 9000-8000 BP period (Layton 1979).

In Yosemite National Park, the oldest identified cultural phase (Crane Flat) has been ^{14}C dated to 2040 ± 100 BP (Fitzwater 1964, 1968a). However, some of the artifacts described by Bennyhoff (1956) may reflect pre-Crane Flat activities in Yosemite. For example, Bennyhoff's projectile point types C-3, C-10, C-11b, and C12 are equivalent to the Humboldt, Gypsum, Pinto, and Windmiller-Stemmed types for which time spans of 6000-3000, 4000-2000, 5500-2500, and 4500-2500 BP, respectively, have been established by radiocarbon dating (cf. Heizer and Hester 1978; Ragir 1972). In this regard, the Eared Concave-Base points from Yosemite, variously guessed to be from 1,000 to 7,000 years old (cf. McLellan 1952), would now seem to be ca 3,000-1,500 years old on the basis of ^{14}C dating in a locality near the park (cf. King 1976; Moratto 1972a).

Finally, numerous hammerstones, choppers, and heavy flake tools have been found eroding from gravel and cobble terraces along small streams in the Farmington Reservoir locality on the western edge of the Sierra Nevada approximately 35 km east of Stockton (Treganza 1952). While initial geologic work indicated an age of ca 7,000-9,000 years for the Farmington Complex (Antevs 1953; Treganza and Heizer 1953), ^{14}C dates of 1660 ± 220 and 1170 ± 70 BP on charcoal from 4-Sta-44 (the type site) were taken to mean that the Farmington Complex was not ancient (Heizer 1964:130; Napton 1978:147). However, excavations in 1973 by Ritter and others showed that the charcoal in the 4-Sta-44 gravels could be traced to riparian woodland fires long after the Farmington materials were emplaced. Moreover, the artifact-bearing Modesto Formation is related geomorphologically to the Tioga glaciation. Hence, the Farmington gravels and artifacts were most likely deposited during late Pleistocene or early Holocene times, roughly 12,000 to 7000 BP (Ritter et al. 1976).

In summer, there is increasing evidence of cultural activity in the Sierra Nevada over a span of perhaps 10,000 years. The earliest use of

the Sierra may have involved scattered, seasonal incursions rather than permanent settlement. Intensive occupation apparently began ca 3,000 years ago. Based upon findings elsewhere in the Sierra, one may infer that Yosemite was visited at least intermittently, between ca 10,000 and 2000 BP, but the archeological traces of such occupation remain to be discovered and interpreted.

4.2.3: Linguistic Prehistory

In AD 1850, the Yosemite area was held mainly by the Central and Southern Sierra Miwok. Three other ethnic groups--the Western Mono (Monachi), Northern Paiute (Paviotso), and Washo--also occupied or regularly visited parts of Yosemite (cf. Napton 1978:70-112). Thus, an obvious research topic would be to investigate when and whence each of these groups arrived in the Park vicinity; another concern would be the spread and diversification of languages in Sierran prehistory.

Moratto (n.d.:Chapter 11) has adduced linguistic and archeological data to support an hypothetical model of California linguistic prehistory, the most relevant aspects of which may be summarized as follows:

1. Between ca 12,000 and 8000 BP, California was occupied chiefly by speakers of Hokan languages. The Western Pluvial Lakes Tradition and related manifestations (such as the Parman components in the Sierra) represent the ancient Hokan populations.

2. Hokans ancestral to the Pomoan and Yanan peoples diverged from the Proto-Yuman-Cochimí ca 7,500 years ago and moved northward into the Central Valley. Proto-Yanan groups may have visited the western Sierra sporadically after 7000 BP.

3. Between ca 4500 and 3000 BP, ancestral Yokutsan groups spread outward from the Delta into the mid-Central Valley and adjacent Sierran piedmont. The Windmiller Pattern represents this Yokutsan expansion.

4. By ca 3000 BP, the predecessors of the Maidvans (seen archeologically as the Martis Phase) entered the northern and central Sierra Nevada from the Great Basin.

5. As part of a larger Utian radiation, western and eastern Miwokan branches diverged ca 2,500 years ago. The advent of the eastern division (pre-Plains/Sierra Miwok) in the Cosumnes District is recorded as the Lobensels facies.

6. By ca 2000 BP, Yokutsan enclaves were present in Yosemite (Crane Flat Phase) and in the Sierran foothills at least as far south as the Chowchilla River (Chowchilla Phase) (Fig. 4.2).

7. The predecessors of the Sierra Miwok diverged from the Plains Miwok about 2,000 years ago and settled in the foothills and mountains between the American and Calaveras Rivers. Seasonal transhumance to higher elevations by ancient Plains Miwok may have led to the first Miwok occupation of the Sierra.

8. Western Numic (Mono/Paviotso) groups spread northward from the Owens Valley locality along the eastern side of the Sierra about 950 years ago. By ca 500 BP, the Monachi had diverged from their Numic congeners and crossed the Sierra, acquiring from the Washo (and Yokuts?) lands on the western side of the range.

9. After ca 700 BP, the Miwok rapidly expanded southward in the Sierra Nevada. Displacing Yokuts as they advanced, the Sierra Miwok progressed as far south as the Fresno River by ca 450 BP. In Yosemite, the Mariposa Phase marks the arrival of the Miwok (Moratto n.d.:Chapter 11).

The foregoing reconstruction is both general and spectulative. It is especially incomplete with regard to events in Yosemite before ca 2500 BP and between ca 1500 and 600 BP. However imprecise, the model serves to place Yosemite's linguistic prehistory in a larger areal context and to point up deficiencies in knowledge to be addressed in future research.

4.2.4: Research Objectives

Achieving the research objectives listed below will lead to the development of cultural chronologies for Yosemite and the central Sierra Nevada.

1. Establish when people first entered the central Sierra as well as the nature of their activities there.

2. Determine the origins, affiliations, and cultural features of the earliest population in the region.

3. Identify the factors that may have caused each known population movement into the central Sierra.

4. Ascertain the number of cultural phases represented by components in Yosemite National Park. Test the validity of the Crane Flat, Tamarack, and Mariposa Phases as archeological constructs.

5. Characterize each phase in terms of its particular social, economic, technical, and stylistic traits. To the extent possible, identify and distinguish among time markers, culture markers, and ethnic markers.

6. Define the temporal and spatial limits of each phase.

7. Reconstruct the timing and origin of major technical and economic innovations (e.g., acorn processing, the bow and arrow, pottery, milling devices, etc.) in Yosemite, and evaluate the effects of the innovations on local cultural developments.

8. Ascertain whether the identified phases represent in situ cultural change, diffusion, socio-cultural replacement, or other processes. Determine how each of the Yosemite phases relates to others in the region as well as to its local antecedents and sucessors.

9. Reconstruct the linguistic prehistory of Yosemite, indicating the origin and date of arrival of each linguistic group. To the extent possible, explore the nature of contacts among different ethnic/linguistic groups.

10. Determine whether coastal or Central Valley Indians took refuge in Yosemite during the Spanish and Mexican periods, and, if so, how they interacted with the established residents.

11. Summarize the cultural history of the central Sierra, with particular emphasis on the area of Yosemite, in terms of the origins, linguistic affiliations, and cultural patterns of the groups associated with each phase.

4.3: Economic Patterns

4.3.1: Rationale and Scope

Bohannan (1963:211) defines economy as "the way in which resources, technology, and work combine to satisfy the material requirements of human beings and of social groups." Accordingly, this problem domain covers such topics as the production of goods and services, concepts of property, exchange systems, and the distribution and consumption of

goods and services (Gabel 1967). A knowledge of economic patterns is essential for understanding settlement systems, population size, social organization, and cultural evolution.

4.3.2: Subsistence

It is in the realm of subsistence or food procurement that a culture articulates most directly with its environment. The subsistence practices of central Sierran cultures are well documented (see Napton 1978:70-112), and can be grouped into two "ecologic types." Foothill, represented by the Monachi and Miwok, and Desert Hunters and Gatherers, including the Washo and Northern Paiute (Beals and Hester 1960). Briefly, peoples of the Foothill type lived in hill or mountain country with a variety of resources, of which the acorn was most important.

> Their primary subsistence came from those parts of the Upper Sonoran and lower Transition life zones occupied by a combination of woodland, woodland-grass, or chaparral vegetation types. Fish and/or game quantitatively were a minor part of the diet. . . . Known settlements tended to be concentrated in areas of woodland and woodland-grass vegetation cover in which occur the great majority of oaks. . . . Some groups penetrated even into the Boreal zone of the high Sierra in summer, although this was often a food deficit area requiring carrying in supplies (Beals and Hester 1960:416-417).

The Great Basin rim on the eastern side of Yosemite was the home of Desert Hunters and Gatherers. Subsisting on small game and vegetal products,

> these were the only people in California for whom the pinyon nut was the single most important item of food. . . . In most areas use of the meager resources was further limited by the absence of water, and life centered as much about permanent or seasonal springs and the occasional spring as it did about supplies of food. This type is characterized by extremely low population densities [and] use of a wide variety of vegetable foods (Beals and Hester 1960:417).

These generalizations, of course, apply only to ethnographic cultures and historic environments. Almost nothing is known about older (e.g., pre-Miwok) subsistence patterns in Yosemite. If the central Sierra did indeed experience a succession of Native cultures (cf. Item 4.2) and environmental adjustments (cf. Item 4.1) during Holocene times,

then subsistence patterns in the Yosemite country surely also changed in prehistory. It remains for archeology to document and explain those changes.

Subsistence activities tend to be well represented archeologically. For example, the prehistoric use of plants can be investigated by analyses of pollen, phytoliths, carbonized seeds, and chemical residues (Bombin 1980; Ford 1979; Watson 1976). Likewise, studies of bones, fish scales, teeth, antlers, and other faunal remains from archeological sites can yield information about hunting and fishing practices, butchering techniques, season of procurement, preferred species, and amount of meat acquired (Grayson 1979; Heizer 1960; Jochim 1976; White 1955). Subsistence behavior is thus amenable to archeological reconstruction.

4.3.3: Environmental Manipulation

Although the basic subsistence activities of ethnographic Sierran peoples included gathering, collecting, hunting, and fishing, various groups also sowed wild plant seeds; planted and/or tended native root crops, greens, and tobacco; planted "vineyards" of wild grapes; irrigated wild plants; and used "quasi-agricultural" techniques to harvest acorns, grass seeds, and pine nuts (Bean and Lawton 1973).

The Indians further managed their environment through the controlled burning of vegetation. Fire was used extensively to increase the yield of edible seeds, encourage the growth of desirable plants, flush and drive game, provide forage for deer and elk, clear the ground below oaks and pines to facilitate nut harvests, and for other reasons (Lewis 1973:41-44). Systematic burning was the single most important environmental modification by the California Indians, allowing them to control plant successions and, locally, to maintain entire vegetation communities such as grasslands and oak savannas.

In Yosemite Valley, aboriginal burning limited the extent of conifer forest:

> [In 1855] there was no undergrowth of young trees to obscure clear, open views in any part of the valley from one side of the Merced River across to the base of the opposite wall. The area of clear open meadow ground, with abundance of luxuriant native grasses and flowering plants, was at least four times as large as at the present time [1894] (G. Clark 1894, quoted in Gibbens and Heady 1964:7).

Periodic burning by the Indians helped to maintain local concentrations of valued plant resources and resulted in an intricate mosaic of age classes and vegetation types, which in turn assured that subsequent fires would not burn large areas with intensity (Burcham 1974; Kilgore and Taylor 1979). Finally, because conifers may overtop and shade out oaks, fires set by the Indians in Yosemite would have killed most of the conifer regeneration and favored black oak growth in the past (Reynolds 1959).

As Napton (1978:48-52) has indicated, there is an extensive literature dealing with early 19th century burning in Yosemite. However, very little is known about the prehistory of burning or its long-term effects on vegetation in the Sierra. Through a study of fire scars on stumps in the upper Kings River drainage, Kilgore and Taylor (1979) determined that the frequency and intensity of fires between ca AD 1400 and 1870 in a sequoia-mixed conifer forest were best explained as a result of burning by Indians. Further studies, both archeological and paleobotanical, will be needed to determine the time depth of Native burning and its effects on Sierran biota.

As a related matter, early accounts of western California describe not only Indian burning practices but also certain edible seeds that may no longer exist. The historic cessation of burning, along with the spread of domestic grazing animals and exotic plants, may have brought to extinction some of the food plants once important to the Indians. Grass seeds likely were more significant than has been supposed, and may have rivaled the acorn as a staple in the aboriginal diet. (Bean and Lawton 1973). This, too, is a topic that could be investigated archeologically in Yosemite.

4.3.4: Seasonal Movements

One economic strategy followed by Sierran peoples was a seasonal (summer) movement to higher elevation, allowing the Indians to escape from the heat and aridity of the lowlands, exploit montane resources, and trade with people from the opposite side of the range while the passes were free of snow. With regard to Yosemite, Napton (1978:336) has suggested that:

> The Miwok might have occupied sites near El Portal and at other low areas on the extreme western periphery of the park, and as the snow melted, gradually worked their way into the high country in autumn, returning again in the fall to the winter villages at lower elevations.

Beyond the inference that this sort of annual round would have resulted in a settlement pattern of seasonally occupied camps and villages (discussed in Section 4.4), the details of seasonal movements remain poorly understood. It is not known, for example, when or by whom the seasonal shifts were introduced in Yosemite or exactly what kinds of economic activities took place in each elevation band. Archeological inquiry may provide such information.

4.3.5: Exchange Systems

Cultural mechanisms for distributing goods include reciprocity (such as mutual aid, gift giving, or exchange, often among kin), redistribution (the reallocation of goods and services by a central authority), and trade between social groups (Gabel 1967). The latter is the easiest to detect archeologically.

Trade within and across the Sierra Nevada has considerable time depth. The most ancient trade item known is a string of about 50 *Olivella biplicata* shell beads ca 8,550 years old found at Leonard Rockshelter, Nevada, about 400 km east of its coastal source. Implied by the presence of these beads in Nevada are intervening peoples, among them residents of the Sierra, who were engaged in intergroup trade. Ancient trans-Sierran trade is likewise indicated by the discovery in Windmiller sites (in the Central Valley) of artifacts ca 4,000 years old made of obsidian from Mount Hicks, Bodie Hills, and Casa Diablo in Mono County (Heizer 1978:691).

Much has been written about aboriginal trade in California (Davis 1961; Earle and Ericson 1977; Heizer 1978; Jackson 1974; Sample 1950). With regard to the central Sierra, it is known that the Miwok obtained a wide range of commoditities through trade. From the Paiute they received baskets, obsidian and finished projectile points, loaves of salt, rabbitskin blankets, pinyon nuts, sinew-backed bows, red and white pigments, buffalo robes, and fly pupae in exchange for which the Paiute were given baskets, *Saxidomus* clam shell disc beads, arrows, and manza-

nita berries (Barrett and Gifford 1933; Clark 1904; Curtis 1924). With the Monachi the Miwok traded *Saxidomus* shell discs for rabbitskin blankets and basketry materials (Davis 1961). Occasional brownware pots found in protohistoric Miwok sites probably originated also with the Monachi (Gayton 1929; King 1968). The Washo provided the Miwok with pinyon nuts, rabbitskin blankets, dried fish from Lake Tahoe, and buffalo skins in return for acorns, *Saxidomus* shell discs, soaproot fibers, redbud bark, and manzanita berries (Barrett 1917; Barrett and Gifford 1933; Curtis 1924; Downs 1966). Finished baskets and bows and arrows were supplied to the Yokuts as payment for *Olivella* shell beads, asphaltum, and dog pups (Barrett and Gifford 1933; Latta 1977). Finally, among themselves, the Miwok exchanged baskets, steatite vessels, hematite, chert, chrysotile, quartz crystals, pine nuts, dried fish, acorns, grass seeds, and berries, depending on local availablity and needs (Barrett and Gifford 1933; Heizer and Treganza 1944; Powers 1976).

The foregoing shows that aboriginal trade in and across the central Sierra Nevada was both ancient and, by protohistoric times, intensive. Still, apart from some preliminary findings about obsidian distribution, little is known of prehistoric trade. A systematic investigation of trade in prehistory could reveal not only the items being exchanged, but also economic aspects of the exchange system and something about past intergroup relationships. Here again are topics for archeological research.

4.3.6: Research Objectives

1. Determine the extent of hunting, fishing, gathering, and collecting in each phase.
2. Identify the plant and animal species taken and their relative importance through time.
3. Ascertain whether types or frequencies of hunted species changed with the advent of the bow and arrow.
4. Trace the development of acorn exploitation in Yosemite prehistory.
5. Reconstruct the location, scheduling, nature, and methods of subsistence activities in each phase.

6. Indicate the food-processing techniques (harvesting, butchering, storage, milling, preparation, cooking, etc.) used during each phase.

7. Explicate seasonal population shifts as an economic tactic. Define their time depth, scheduling, social elements, relationship to trade patterns, and effect on the carrying capacity of the Yosemite area.

8. Investigate which high elevation (greater than 1,500 m) resources were exploited prehistorically, and how they were used.

9. Examine the evidence for prehistoric environmental manipulation, and evaluate the importance of such behavior in the subsistence strategy. In particular, determine when and by whom periodic burning was introduced to Yosemite as well as its long-term effects on vegetation patterns and carrying capacity.

10. Discover whether seeds of grasses or products of other plants now extinct figured in prehistoric economies and, if so, how.

11. In large compass, specify how subsistence activities changed through time, and propose testable hypotheses to account for the observed changes.

12. Identify the types of abiotic resources (e.g., rhyolite, porphyry, diorite, timber, clay, basketry material, etc.) exploited in Yosemite during each phase, where the materials were acquired, and the steps in their processing.

13. Analyze the material industries of each phase and describe them in terms of skills, methods, modes, and technical traditions. If possible, relate the identified technologies to specific ethnic groups.

14. Describe any evidence of craft specialization, and determine the economic role and importance of such specialization.

15. Describe prehistoric exchange activities with respect to the nature of the social matrix, scheduling, the specific items offered and obtained, and the mechanisms and economics (costs/benefits) of the exchange process.

16. Determine the location of prehistoric trade trails.

17. Review the diachronic shifts in exchange patterns, and investigate whether these covary with other cultural or environmental

changes. In this vein, test the hypothesis by Moratto *et al.* (1978) that prehistoric trade may have been disrupted by "adverse" paleoclimatic episodes.

18. Examine the archeological record for evidence of redistribution systems in prehistory, and explicate the nature and economic role of any such systems identified.

4.4: Settlement Patterns

4.4.1: Rationale and Scope

The domain of settlement patterns is concerned with the function and spatial arrangement of sites. Studies of "settlement archeology" may investigate such topics as: (1) site function (e.g., residential, military, religious, etc.); (2) community patterning (i.e., size, structure, social composition, and degree of nucleation or dispersion; (3) territoriality; (4) demography (to be discussed under Section 4.5), and (5) the degree of sedentism or mobility, including seasonal movement, of the community (Chang 1968; Meggers 1956; Trigger 1965).

Settlement patterning may be analyzed in terms of: (1) relationships among contemporary activity areas within a site; (2) relationships among sites within a defined area; or (3) relationships among sites, economic behavior, and environmental variables (Trigger 1968). Borrowing a model from statistical geography, archeologists may employ locational analysis to study such spatial relationships with regard to direction, distance, and "connectivity" (functional association) (cf. Nystuen 1968). The purpose of this sort of analysis is to ascertain the determinants of settlement location. Among the variables known to influence settlement patterning are the natural environment (food, water, climatic extremes, etc.), technology, trade, warfare, political factors, religious beliefs, secular values, and demographic factors. Settlement locations usually represent a compromise among such variables.

The rationale for investigating the settlement domain is basic; a knowledge of settlement patterning in archeology is essential for understanding land-use, exploitative economics, carrying capacity, demography, and social organization. This is so because settlement systems are

"a more direct reflection of the economic and social systems than other surviving evidence" (Green 1973:311).

4.4.2: Miwok Settlement Patterns

The Sierra Miwok lived in semi-permanent villages, most of which were below the snowline, and in special-use camps at elevations ranging from the lower foothills to the high Sierra. With regard to settlement locations, Barrett and Gifford (1933:135) report that:

> The villages in the mountains were habitually on the ridges, not in the canyons. A spring or small stream, not the river, was the source of water supply for such a village. In the Lower Sonoran foothill country, villages were often near the river, as the canyons of the great rivers were there much shallower.

In Yosemite, the principal Miwok settlements appear to have been in the valleys (e.g., Wawona, Yosemite, and Hetch Hetchy) at elevations of approximately 1,000-1,400 m (Table 6.2). Napton (1978:87-91) has summarized the names and locations of 19th century Indian village sites in Yosemite--as recorded by Kroeber (1921), Powers (1976), Bunnell (1911), Merriam (1917), and Hutchings (1886)--and developed a concordance of archeological sites with the named villages. As Napton (1978:104-107) has observed, the ethnographic names may relate to locales rather than precise spots; consequently, two or more archeological sites may represent a single named village. One aim of archeological research, therefore, would be to define the exact areas of early 19th century occupation--not simply to assign historic names to specific places, but to better understand protohistoric Miwok settlement patterns.

4.4.3: Seasonality

It is not known to what extent "permanent" Miwok villages were located within Yosemite National Park, as the historic accounts are conflicting on this matter. For example, Merriam (1967:345) describes an elderly Yosemite woman who "did not remain in the valley winters, but went down the river to Hites Cove for the cold season." In this regard, the villages near El Portal "were permanent, but they were far larger in winter than in summer, receiving material additions from Yosemite when the cold weather set in" (Merriam 1917:208). Kroeber (1921:62) agrees that the Yosemite villages:

> were preeminently summer encampments. Now and then a few families with an unusually favorable stock of supplies hoarded up, might remain in the valley from autumn to spring, but the majority of inhabitants annually retreated to the canyon of the Merced River below El Portal in order to avoid the heavy snows of the 4,000 foot altitude of Yosemite.

However, there are also good indications that the winter shift to low elevation was far from absolute. Powers (1877:365-366) relates that:

> The Indians now living [1871-1872] say that it [Yosemite Valley] was occupied every winter . . . . The assertion of the Indians is borne out by the location of the villages themselves . . . . With the exception of the two on the south bank, they were all built as close to the north wall as the avalanches of snow and ice would permit, in order to get the benefit of the sunshine . . . . If they had been intended only for summer occupation they would have been placed, according to Indian custom, close to the river.

Given the availability of resources, it seems probable that Wawona, Hetch-Hetchy, Yosemite, and other valleys in the Lower Transition zone were occupied throughout the year. Such year-round settlement may account for the preponderance of middens and bedrock mortars at elevations below 5,000 feet (1,524 m) (Appendix 2). It is also possible that some groups may have wintered in the uplands. For example, certain of the Washo near Donner Lake occupied their village,

> . . . even in deep snows when just the roofs of the <u>gales dangl</u> (conical houses) were showing. This was possible because they had plenty of wood there, and also they could gather an abundance of food for the winter (d'Azevedo 1956:54, as quoted in Elston <u>et al</u>. 1977:15).

Archeological investigations in Yosemite may shed light on the problem of settlement seasonality and resolve the uncertainty about winter occupation both in the Transition zone and at higher elevations.

4.4.4: Environmental Variables

Appendix 2 shows that not less than six kinds of occupation remains (lithic scatters, middens, pictographs, bedrock mills, stone circles, and rockshelters) occur alone or in various combinations in Yosemite. These are found in diverse natural settings at elevations ranging from about 500 m to 3,280 m. Toward the goal of understanding the determi-

nants of settlement in the central Sierra, it would be useful to study correlations between each kind of site and such environmental variables as elevation, landform, aspect, slope, vegetation type, and proximity to water.

In this regard, W. Woolfenden (1980: personal communication) has called attention to a relationship between the location of archeological sites and migratory routes of deer in the central Sierra. Woolfenden observed that the game routes have been in use for long periods, are fairly permanent, and are seldom changed even by the construction of roads or reservoirs. A similar study in Yosemite might help explain settlement patterning, especially the distribution of campsites and lithic scatters in the back country.

In another central Sierran archeological study, T. Jackson (1979) describes a "near perfect correlation" between mid-slope site locations and the contact between two major lithologic units, the granitic basement complex of rocks and overlying volcanics. Jackson observed that sites not located on major stream drainages, but found in a geologic setting in which softer rocks overlay harder basement rocks tend to be situated along or very near the contact between the geologic units. The contact zone provides a terrace landform, slopes of less than 10 percent, springs and seeps, abudant food resources, and varied lithics, including granite for milling stones (Jackson 1979:2-5). Archeological research in Yosemite may reveal similar correlations of settlement features and environmental variables.

One aspect of such research would be the investigation of "site catchment"--the area from which residents of a settlement derived their resources (Roper 1979). Site catchment analysis is "the study of the relationships between technology and the natural resources lying within economic range of individual sites" (Vita-Finzi and Higgs 1970:5). Catchment analysis assumes that:

> . . . in general, the farther one moves from an inhabited locus, the greater the amount of energy that must be expended for the procurement of resources. Therefore, as one moves away from that locus, it is assumed that the intensity of exploitation of the surrounding territory decreases, eventually reaching a point beyond which exploitation is unprofitable (Roper 1979:120-121).

One would thus expect that a settlement location will represent the place of best economic advantage for its residents. As a study of the interface of economic and settlement systems, catchment analysis may indicate the kinds of resources being exploited, their relative importance, and how the distribution may have influenced the location of habitation sites. The methods of catchment analysis are nicely summarized by Roper (1979).

4.4.5: Research Objectives

1. Determine the number, distribution, and types of sites representing each cultural phase.

2. Taking into account the paleoenvironment (Sec. 4.1) and economic factors (Section 4.3), isolate the variables that likely determined selection of each site location. Specifically, examine the relationships between settlement locations and such variables as geologic features, landform, slope, aspect, hydrology, vegetation type, and proximity to game resources.

3. Evaluate the function of each site. Analyze intra-site formal patterns to deduce the activities, population size and composition, and season of use represented. Examine both diachronic change in site function and synchronic variability (indicative of special activity loci or variable intensity of use).

4. To the extent possible, using both paleoenvironmental data and economic remains, reconstruct the catchment of each site and describe how the site location relates to catchment exploitation.

5. Indicate how permanent settlements differ from seasonal camps in terms of location, size, social composition, and activities.

6. Ascertain which of the Yosemite sites were occupied year-round, and what combination of resources made such permanent settlement possible. Test the proposition that Hetch-Hetchy, Big Meadow, Yosemite, Wawona, and other lower Transition zone valleys were "permanent" population centers from which small groups moved seasonally to higher country.

7. Determine the nature of high altitude settlement and land-use systems in Yosemite. Test and expand upon Bennyhoff's (1953) model of high altitude adaptation.

8. Determine whether the uplands of Yosemite were used differently during relatively warm/dry paleoclimatic periods than during cool/moist intervals.

9. Describe any "ethnic markers" that may serve to identify cultural groups affiliated with particular sites. Based upon such identification, characterize the settlement pattern of each group.

10. Integrating data from Items 1-9 (supra), summarize the changes in Yosemite's land-use and settlement patterns through time. Explain major diachronic shifts in land-use/settlement strategies.

4.5: Demography

4.5.1 Rationale and Scope

Paleo-demography, or demographic archeology, embraces all aspects of archeological population studies. This research domain is concerned with the size, density, and growth rate of past populations as well as such populational characteristics as sex ratios, life expectancy, and birth and death rates. The goal of demographic archeology is to learn as much as possible about the nature and diachronic trends of extinct populations. Acquiring demographic knowledge is the most direct approach to understanding societies and how they functioned in the ahistoric past.

4.5.2 Approaches to Demographic Archeology

Hassan (1978:51) has identified six major categories of data that may be used in demographic archeology: (1) settlement variables; (2) artifacts; (3) food remains; (4) human skeletal remains; (5) ecological potentials of the human habitat; and (6) historical and ethnohistoric records. The potentials of each of these categories will be discussed briefly here:

1. Settlement data may include the floor space of dwellings, number of rooms per residence, area of habitation sites, or the combined area of coeval occupation sites within a defined geographic area. These data may be used in various ways to reconstruct the population size of residential groups, communities, or regions. For example, Cook and Heizer (1968) found that 119.5 ft^2 (11.1 m^2) was the mean floor area of

houses in 18 "regions" of California where the average number of residents per house was about six persons. To the extent that this ratio also may be valid in Yosemite, it could be used to estimate the population of sites where the floor areas of all contemporary dwellings are known.

A related but more complex approach to population estimates is based upon settlement site area. In a pioneering study, Naroll (1962) demonstrated a logarithmic relationship between site area and population. In another study, however, Cook and Heizer (1965) showed that in California sites ranging in size from 370 to 9,200 m^2 may all have been occupied by the same average number of 30 persons. The variables and limitations of this approach are considered at length by Cook (1972b), Cook and Heizer (1965, 1968), Hassan (1978), and Plog (1975). It is sufficient to say here that the estimating of populations based upon settlement data holds good potential for application in Yosemite, provided that the interpretations do not exceed the limitations of the method.

(2) Artifacts, especially commonplace technomic implements, also can be used to estimate population size. Cook (1972a), for example, calculated the populations of several Southwestern archeological sites on the basis of pot sherds. In Yosemite, bedrock mortars would seem ideally suited for the same purpose. One would need to know the number of mortars per site, average number of persons dependent on the food processed in a mortar, and the durability ("turnover rate") of the average mortar. Given these data, one could calculate the average population of a site--assuming year-round occupation and sustained dependence on food processed in mortars--as follows.

$$\bar{P}s = \bar{P}f\left(\frac{M\bar{D}}{T}\right)$$

where: $\bar{P}s$ is the average population of the site; $\bar{P}f$ is the average population of the family unit dependent on the food processed in a mortar; M is the total number of mortars at the site; $\bar{D}$ is the durability or "life expectancy" of the average mortar in years; and T is the time span of the site's occupation expressed in years corrected, if necessary, for any periods of abandonment. The analysis of other types of artifacts (e.g., projectile points) as an approach to population estimates for

Yosemite also should be investigated, although at present bedrock mortars would seem to hold the greatest promise.

(3) Dietary remains can be used to reconstruct population if food consumption rates can be determined and if food remains are preserved (Hassan 1978). In one early study, N. C. Nelson (1910:346) estimated that an average population of about 95 persons, each consuming 50 shellfish per day, would have been required to produce the 1.26 million ft^3 (35,694 m^3) volume of the Ellis Landing shellmound (4-CCo-295) within a span of ca 3,500 years. Ascher (1959) used a more refined approach, based upon the estimated amount of protein represented by mussels in a site, divided by estimated protein intake requirements per person during the span of the site's occupancy. These and other techniques which quantify faunal remains as a basis for estimating human populations are discussed by Cook (1972b:7-11). The potentials of such techniques for archeological demography in Yosemite National Park remain to be explored.

(4) Of all archeological remains, human skeletons represent past populations best and most directly. At the level of the individual, skeletal analyses may indicate age and sex, stature, physical features, anomalous and pathological conditions, and apparent cause of death (Brothwell 1963; Brothwell and Sandison 1967; Krogman 1962). From these kinds of primary data, the paleo-demographer can reconstruct sex ratios, fertility rates, survivorship curves, morbidity and mortality patterns, and physical characteristics of the population as a whole (Howells 1960; Swedlund and Armelagos 1976; Weiss 1973). Some excellent examples of demographic analyses based upon archeological skeletal data are the studies by Bennett 1973, 1975), LaJeunesse (1972), and Ubelaker (1974). No research of this kind has yet been undertaken in Yosemite National Park, skeletal analyses having been limited to the description of two isolated burials (Birkby 1973; LaJeunesse 1979)*. The 23 human skeletons recovered from 4-Mrp-181 in 1959-1960 (Fitzwater 1962) apparently have not been analyzed.

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*Any future studies of skeletal remains--whether discovered accidentally or by intentional digging--in the park should be done with the full knowledge and involvement of the American Indian Council of Mariposa County.

Quantitative studies of human skeletons may also lead to estimates of total population size. For this, it must be assumed that the mortuary population represents all persons who lived within the study area (e.g., a village site); further, the demographer must know the total number of skeletons (either by complete excavation or by calculation from an adequate sample), the mean age at death ("life expectancy") of the population, and the span of the site's occupation. Given these data, the mean site population ($\bar{P}s$) may be estimated as follows,

$$\bar{P}s = G\left(\frac{N}{T}\right)$$

where: N is the total number of skeletons present, T is the time span of the site's occupation in years, and G is the number of generations represented (i.e., G = N/mean age at death in years).

(5) The concept of "carrying capacity" is fundamental to studies of population-environment relationships. Carrying capacity--or "homeostatic equilibrium point" (Zubrow 1971)--may be defined as the maximum number of people who can be maintained indefinitely in a given environment at a certain level of cultural development (Cook 1972b; Glassow 1978; Hardesty 1977). As an approach to demographic reconstruction, carrying capacity models take into account the productivity of the environment, types of resources exploited, food procurement efficiency, storage, consumption habits, and communal management of food resources (Hassan 1978:73-74).

Both the limits and applications of carrying capacity models have been discussed at length (Cook 1972b:16-32; Glassow 1978:36-40; Hassan 1978:73-77). It is sufficient to say here that the use of the carrying capacity concept in demography has enjoyed a reasonable measure of success. In California, the population estimates developed in Baumhoff's (1963) classic study of "ecological determinants" generally have been confirmed by thorough documentary research (cf. Cook 1976). This suggests that fine-grained studies of carrying capacity in Yosemite might prove fruitful as a means of estimating past populations.

(6) Historical records have been used extensively in demographic research, especially for estimating New World aboriginal populations (Cook 1976; Dobyns 1966). The application of historical data to the problem of reconstructing populations in the area of Yosemite National Park is taken up later in this chapter.

4.5.3: Grizzly Bears and Demography

Studies of demography in Yosemite must take into account the impact of grizzly bears on human populations. Before ca AD 1850, humans and grizzly bears competed intensively for the same food resources throughout cismontane California.

> The grizzly . . . was usually avoided by the Indians, and because of its size, prowess, and temperment it could preempt any available food before other large mammals and was paralleled by few. It was a big, resourceful beast. The energy needs of this active mammal weighing up to a thousand pounds or more were obviously great. Its numbers multiplied by its average daily metabolic requirements must have made the grizzly an outstanding factor in the total food consumption by mammals (Storer and Tevis 1955:17).

The overlap of the human and grizzly diets is remarkable. The bears regularly hunted ground squirrels, hares, and rabbits, and occasionally killed larger animals such as deer and elk; they fished for salmon, dug roots and bulbs, and consumed great quantities of greens, berries, seeds, and nuts. In all of these respects, they probably were in direct competition with the Indians for food resources. This was especially true of acorns. "When acorns are ripe the grizzly grows fat and heavy--his belly drags along the ground" (Anonymous 1857:820). Acorns were a staple in the grizzly's diet whenever available, and the bears migrated to local oak groves when the crop was ready (Storer and Tevis 1955).

Significant numbers of grizzly bears once operated in the area of Yosemite National Park (see Grinnell and Storer 1924; Storer and Tevis 1955). There are records of at least three mid-19th century grizzly bear hunters active in the central Sierra near the Merced River. One of these, Jim Duncan, is said to have killed 49 bears in nine years in the Wawona vicinity, keeping a record by notches on a timber of his cabin at Cresent Lake (Muir 1898:619-620).

The principal effects of the grizzly bears on human populations presumably were that: (a) the bears consumed the same food as humans, thus lowering the potential carrying capacity of the environment; (b) the bears disrupted the pattern of resource scheduling and at times may have jeopardized Indian survival by robbing acorn granaries; and (c) the grizzlies attacked and killed people. It is suggested that there was,

in effect, an ongoing feud between people and bears in which the latter functioned as a population control mechanism. This complex equilibrium between human and bear populations should be investigated in future paleo-demographic research in Yosemite.

4.5.4: Central Sierran Populations

Demographic archeology may be employed to augment and critically assess the estimates of ethnographic populations in the central Sierra. Kroeber (1925:445) set the number of Sierra (three divisions) and Plains Miwok at about 9,000, of which roughly 2,250 people were assigned to each of the four language groups. Kroeber's figures should be viewed as educated, but conservative, estimates.

S. F. Cook, who has undertaken the most exhaustive studies of California demography, concluded that the true population levels (ca AD 1770) were nearly twice as large as those advanced by Kroeber. Based upon village lists, historic accounts, and other documentary evidence, Cook (1955) calculated that about 83,800 people had occupied 33,400 mi^2 (86,506 km^2) of the San Joaquin Valley (including its Sierran watershed), giving a density of 2.51/mi^2 (0.97/km^2). Using Cook's values, one may calculate that 15,000-20,000 Miwok occupied interior California in AD 1770. This range agrees with the estimates of Levy (1978:402), who gives the total population of Eastern Miwok (encompassing the Bay, Plains, and three Sierran branches) as about 19,500, of which 2,100 and 2,700, respectively, are allowed for the Central and Southern Sierra Miwok, 2,000 for the Northern Sierra Miwok, 11,000 for the Plains Miwok, and 1,700 for the Bay group.

Baumhoff (1963) used the availability of food resources (acorns, deer, salmon, etc.) to determine carrying capacities and populations for defined areas of California (Table 4.1). Based upon his analysis of resource potentials, Baumhoff (1963:209-210) estimated the Central and Southern Sierra Miwok populations to have been 2,130 and 2,725, or 0.78 persons/ mi^2 (0.30 persons/km^2) and 1.43 persons/mi^2 (0.55 persons/km^2), respectively. Values of 0-2 persons/mi^2 (0-0.77 persons/km^2) in the high Sierra and 5 to 7 persons/ mi^2 (1.93-2.70 persons/km^2) in the foothills were also computed, with considerable local variability related to resource availability.

Table 4.1.

SUMMARY OF RESOURCE AREAS IN THE CENTRAL SIERRA NEVADA
(after Baumhoff 1963:209-210)

RESOURCE AREAS	CENTRAL SIERRA MIWOK	SOUTHERN SIERRA MIWOK
Total Area	2,870.3 mi^2	1,905.1 mi^2
Fishery (fish-miles)*	88 mi	60 mi
Pine-Fir Forest	1,733.6 mi^2	682.9 mi^2
Oak Woodland	728.3 mi^2	757.7 mi^2
Chaparral	75.6 mi^2	221.8 mi^2
Grassland	95.7 mi^2	287.3 mi^2
Barren Lands	236.9 mi^2	55.4 mi^2

*A mile of river from which fish can be taken in significant amounts.

4.5.5: Yosemite Populations

The aboriginal population of Yosemite National Park has never been determined within reasonable limits, even though discussions on the matter are in good supply. In the 19th century, Bunnell relied upon the testimony of two Indian informants to report that the Yosemite "tribe" had numbered more than 200 persons (Bunnell 1911). More liberal was Hutchings' (1886:421) statement that the precontact Yosemite Indian population was "nearly five hundred." Kroeber (1921:62) conservatively suggested that the Indian population of Yosemite Valley was about 150 persons, whereas Powers in 1877 had estimated that the valley residents numbered about 450 (Powers 1877).

Bennyhoff (1956:9) recalled the figure given to Bunnell, and opined that "the 200 estimate of the Pohonichi chief is perhaps closest for the disrupted period just prior to white contact, while the prehistoric population was probably somewhat larger." One problem in estimating the "ethnographic" population of Yosemite is that disease may have reduced the number of Indians early in the 19th century. "If the valley was swept by an epidemic, as claimed by Tenaya, it is doubtful whether the Indian population . . . would have restored itself by 1851" (Bennyhoff

1956:9). In this regard, Reynolds (1959) observed stands of conifers in Yosemite ca 150 years old, the date of origin being AD 1800 ± 10 years. Reynolds speculated that the trees may have become established during an interval when the Indians were not present to carry out controlled burning, and that the temporary abandonment of the valley due to disease (cf. Bunnell 1911) may be represented by the even-aged stand of conifers (Gibbens and Heady 1964:8). Archeological research may shed light on this reported epidemic and its impact on Native populations.

One approach to estimating the precontact Miwok population of Yosemite would be to use the density values derived from Baumhoff's (1963) resource analysis. Assuming that the Central Miwok density was about 0.78 persons/mi^2 (0.30 persons/km^2), and that their holdings in Yosemite amounted to ca 679 mi^2 (1759 km^2), the Central Miwok population of the Park (essentially the Tuolumne River drainage) would have been about 530. The same calculations for the Southern Sierra Miwok, but with a density of 1.43 persons/mi^2 (0.55 persons/km^2) and an area of 509 mi^2 (1318 km^2) in the Merced drainage, yield 729 persons. This gives 1,258 as the total population of Yosemite National Park, with a mean density of 1.06 persons/mi^2 (0.41 persons/km^2)--considerably more in the valleys and less in the high country.

The population values given above should be viewed as rough estimates to be tested by additional data. It is worth noting, too, that the foregoing estimates relate only to protohistoric and early historic populations and are likely not to reflect earlier prehistoric conditions. Archeological research will be needed both to confirm the estimates of ethnographic populations and to determine the numbers of people in Yosemite at earlier times.

One approach to reconstructing archeological populations would be through the study of bedrock mortars. There are 4,532 recorded bedrock mortars within the 5 percent of the park surveyed to date. Given that past archeological surveys have emphasized the lower elevations, it may not be too wide of the mark to guess that perhaps 10-15 percent of the mortars have been found, and that roughly 35,000-40,000 mortars may exist in Yosemite. This is a large enough number for meaningful statistical treatment. Once the actual data have been obtained in the field, population estimates can be developed using the methods discussed (*supra*).

Other demograhic investigations in Yosemite might focus upon numbers and areas of contemporary settlements, volumes of midden representing each phase, dated human skeletal remains, and refined studies of carrying capacity. Population estimates derived from any one method should be tested against others. What is significant about the archeological resources of Yosemite is that they are sufficiently numerous and diverse to permit such investigations.

4.5.6: Research Objectives

Populations

(1) Where adequate samples of structural remains exist, estimate the population size of residential units and sites.

(2) Derive site and park-wide population estimates from analyses of bedrock mortars.

(3) As data permit, reconstruct site and local populations using food residues, midden volumes, human skeletal remains, and other forms of direct evidence.

(4) Calculate the carrying capacity of the Yosemite National Park area at selected points in time (e.g., during the mid-Altithermal, early Medithermal, and late prehistoric periods), considering the paleoenvironments and inferred cultural adaptations of each time transect.

(5) Taking into account all relevant data (resulting from Items 1-5, *supra*) and methods, reconstruct the total population size, as well as densities in the various environmental strata, in Yosemite National Park during each identified cultural phase.

Biocultural Issues

(6) For skeletal remains of individuals: (a) determine the age, sex, stature, anomalies, pathologic conditions, and apparent cause of death, and (b) record basic osteometric and odontometric measurements as well as any non-metric traits.

(7) Characterize each population in terms of sex ratios, fertility rates, survivorship curves, and other relevant actuarial statistics; determine the survivorship rates for each age and sex group.

(8) Analyze the morbidity of each population. Identify the etiology and frequency of diseases, congenital abnormalities, odontopathy,

dietary stress, and natural trauma. Also, investigate any evidence of historic epidemics and their demographic consequences.

(9) Investigate evidence of violence in each cultural phase (evaluate traumas, mass interments, male mortality rates, etc.) Reconstruct the social dimensions of inferred hostility (e.g., intra-group feuding, warfare, etc.).

(10) Assess the evidence for the "Male Supremacist Complex" Divale and Harris 1976) as a population control mechanism. If such evidence--asymmetric male-dominated adult sex ratios, indications of hostility, female infanticide--does exist, trace the evolution of the Male Supremacist Complex through time and relate it to demographic pressures and trends as well as to social patterns.

(11) Characterize the physical features of each discrete population in terms of stature, osteology, odontology, and non-metric traits. Compare features with other populations and, where possible, infer biorelationships.

Summary

(12) Synthesizing data from all of these objectives, reconstruct the demographic prehistory of the Yosemite National Park area with particular attention to diachronic shifts in population size and density, biologic population replacement, and changes in biocultural patterns. Advance explanations for observed changes.

4.6 Social Organization

4.6.1: Rationale and Scope

Following King (1976:5), "social organization" refers to the "total organization of a society, including interpersonal, intracommunity, and intercommunity relations insofar as these occur in some relationship to rules." Broadly, the present research domain is concerned with the organization of past societies in the area of Yosemite National Park. Beyond reconstructing the social prehistory of Yosemite, there are several reasons why this topic should be investigated. One of these is that distinctive social patterns may permit the identification of specific ethnic groups in the archeological record. However, the chief

rationale for research in this domain is that social behavior is pervasive; it relates to almost all other aspects of culture--e.g., economic, demographic, settlement, and even religious activities--to such a degree that they cannot be understood fully without reference to social organization.

4.6.2 Miwok Society

Throughout the central Sierra Nevada, Miwok social organization was characterized by a system of patrilineal, exogamous and totemic moieties. Each of these balanced societal halves was mystically conjoined with water or land elements of the Miwok cosmology, and each was related to a series of land or water animal totems. Moieties functioned chiefly with respect to exogamy, a man's preferential marriage partner being his matrilateral cross-cousin. Otherwise, moieties competed in games and assisted one another in funerals and mourning ceremonies, but seemed to play no role in the Kuksu cult or sacred ceremonials (Gifford 1916a, 1916b, 1917; Kroeber 1925).

Apart from moieties, the Miwok were organized according to patrilineal joint families or lineages. These lineages (nena) were the corporate land-holding elements of the society. Each nena claimed a small tract of land near its hamlet in the ancestral homeland. Most of the country, however, was unclaimed by the nena and was regarded as "everyman's land" (Gifford 1951:327). This pattern was disrupted during the historic period, when:

> Caucasian pressure brought about true village life among the Miwok, in which a number of unrelated lineages, often of different moieties, came to form a new political body, the village community (Gifford 1951: 328).

Politically, the Miwok were rather loosely organized. They did not employ the concept of tribe or nation, but instead referred to each other by an endless succession of "northerners" and similar directional names (Koreber 1925:444). The most encompassing polity seems to have been the village complex, consisting of a major settlement with its cluster of satellite hamlets. Merriam (1967:340) observed that there were two classes of Miwok settlements:

> (1) those in which the "Royal Families" or families of the chiefs reside; and (2) those inhabited solely by the

> common people. Several or many of the latter are tributary to each of the former. . . . The head chief or chiefs . . . are men of high standing, power and influence in the tribe, and are recognized as chiefs by the tributary villages.

Authority was vested in the chief by virture of birth and wealth. Miwok chiefs owned numerous dance costumes; they controlled the use of the large community house (dance house); and they usually had more shell money than anyone else in the village. Chiefs might further enhance their economic stature by providing shelter to young men in exchange for their service as "official" hunters and fishermen.

In general, Miwok society was stratified with individuals being classed as elite, commoners, poor, or drifters. There were also "bureaucrats" (chief's aids, speakers, managers, etc.) and religious functionaries who merited a notch above the commoners. Prestige came as well to such craft specialists such as traders, basketmakers, and flint knappers. But social preeminence was reserved for chiefs. Supported by their communities, chiefs lived in relative luxury with large houses, extravagant clothing, food stores, and money. Chiefs might also marry several women in order to strengthen alliances with the elite of other groups (Bean 1976; Kroeber 1925; Merriam 1967; Gifford 1955).

To sum up, the Miwok were socially non-egalitarian, with status being defined in terms of wealth, prestige, skill, political power, and/or control over religious activities. While Miwok social organization is surely not typical of all past societies in the central Sierra Nevada, the observations made here do provide a basis for discussing potentials for research into the social archeology of the Yosemite region.

4.6.3: Social Archeology

The problems and methods of reconstructing extinct social organizations from archeological evidence have been discussed extensively (Binford and Binford 1968; Dumond 1977; Redman 1978). These problems and methods will not be reviewed here in any detail; rather the kinds of social behavior that might be inferred from analyses of archeological remains in and near Yosemite will be emphasized.

It seems likely that the archeological record in Yosemite may contribute information about status differentiation, including distinctions between achieved and ascribed status. Assuming that mortuary practices reflect social variability (Binford 1971), archeologists have used variability in funerary patterns along with types and relative abundance of grave goods to reconstruct status differentiation (Fredrickson 1974; L. King 1969; Saxe 1970; Tainter 1978). Analysis of data from prehistoric cemeteries not far from Yosemite led to these conclusions about social organization:

> About 1,500 years ago . . . the organization of society was characterized by a considerable degree of political differentiation. Authority was vested in a class of individuals with little definition by age or sex; these people were entitled at death to a good deal of community energy expenditure in mortuary activities. . . . They controlled the bulk of the community's wealth (T. King 1976:199).

Comparable research--though not necessarily leading to the same conclusions--would be possible if mortuary remains in Yosemite were analyzed (see note page 47). Studies of funerary items according to the sex of the deceased might also yield information about the division of labor in prehistory. Similarly, the analysis of artifact types associated with particular activity areas may lead to inferences about the social-composition of various activity groups.

Archeological research in Yosemite further may advance knowledge about the centralization of authority in the past. By analyzing the distribution of such traits as community houses, wealth items, and sociotechnic artifacts related to political and ceremonial functions, it may be possible to distinguish between "royal" and "common" villages and trace their origins. Thus it may be possible to determine not only the time depth of the village complex pattern, but also whether it developed in situ or first appeared when the ancestral Miwok entered the central Sierra. Studies of older, perhaps more subtle and poorly known sociotechnic traits may shed light on the social organization of pre-Miwok groups in the Yosemite area.

Many archeologists (e.g., Deetz 1965; Hill 1970; Longacre 1970) have attempted to reconstruct postmarital residence patterns using archeological data. A case in point is Deetz' (1965) study of ceramics

from an Arikara village site in South Dakota. Assuming that pottery was made only by women and taught by mothers to daughters, Deetz interpreted increased ceramic variability through time to mean that matrilocality was being replaced by other forms of postmarital residence. While alternative interpretations are possible in this and similar studies (see the critiques by Dumond 1977 and Johnson 1972), the premise that residence patterns may be inferred from archeological data (in the context of properly designed research) seems well established. Nonetheless, it appears doubtful that residence patterns can be inferred from the kinds of archeological materials presently known in the central Sierra. Pottery is rare, and those kinds of artifacts that are both numerous and variable (e.g., projectile points) tend not to be concentrated in residences. While the possibility of determining ancient residence patterns must be kept open, the prospects for such work in Yosemite do not seem good at the moment.

4.6.4: Research Objectives

(1) Based upon analyses of sociotechnic artifacts along with demographic, settlement, and mortuary data, reconstruct the features of social organization in each cultural phase.

(2) Determine the nature of the social units--in terms of age, sex, role, status, and size--responsible for each type of archeological site or component and for identifiable activity areas within them.

(3) Trace the appearance and diachronic changes in role specialization, status differentiation, and the emergence of nonegalitarian societies in the central Sierra. Ascertain the functional relationships between such developments and changes in demographic and settlement patterns.

(4) Determine whether particular social-settlement patterns can be related to specific ethnic groups and how such patterns might have advantaged certain groups at the expense of others. In particular, establish the archeological characteristics of Miwok social organization and when it first appeared in the central Sierra.

(5) Synthesizing data from these research efforts (Items 1-4, supra), reconstruct the social prehistory of the Yosemite National Park area and explain its major diachronic changes.

5: ARCHEOLOGICAL INVENTORY

5.0: Introduction

This chapter briefly reviews the nature and condition of known archeological resources in Yosemite National Park--topics examined in detail by Napton (1978). Also discussed are relationships among cultural and natural features in the park. The purpose here is to identify the strengths and limitations of available data as a basis for evaluating their research potentials.

5.1: Archeological Surveys

5.1.1: Overview

Since 1930, not less than eight archeological surveys of variable scope and intensity have been completed in Yosemite National Park (Table 5.1). These include the recording of sites by avocationals (Knierimen 1967; McIntyre n.d.; Presnall 1930), "intuitive" surveys by University of California archeologists (Bennyhoff 1956; Grosscup 1954), and systematic, intensive surveys (including the reexamination of some areas inspected previously) by archeologists from California State College, Stanislaus (Napton 1978; Napton and Albee 1974; Napton and Greathouse 1976; Napton et al. 1974a, 1974b).

Among the areas inspected are river valleys, lake and streamsides, passes, meadows, and back-country trails at elevations ranging from about 500 to 3,300 m (Appendix 2). Unfortunately, it is not possible to determine precisely the extent of archeologically surveyed lands in the park, either in terms of total acres or in terms of the areas of each landform type, because accurate records and maps of survey coverage were not made before about 1974. Napton (1978:283) estimates that "less than 5 percent of the park has been subject to any type of formal survey or reconnaissance by professional archeologists." Given that much of the earlier work was "intuitive" and incomplete, it follows that considerably less than 5 percent of Yosemite has been surveyed intensively and systematically. Large areas of the park have never been inspected by archeologists.

Table 5.1
ARCHEOLOGICAL SURVEYS, YOSEMITE NATIONAL PARK

YEAR	INVESTIGATOR(S)	AREAS SURVEYED	NO. OF SITES	REFERENCES
1930	C. C. Presnall C. A. Harwell	Big Meadow vicinity.	7	Presnall (1930)
1940-1950	R. McIntyre	Yosemite Valley, Tuolumne Meadows, Mather, Wawona, many other places.	100	McIntyre (n.d.)
1952	J. Bennyhoff R. Brooks L. Fisher	Yosemite Valley, Tuolumne Meadows, Lyell Fork, Dana Meadow, Wawona, Mather; Yosemite, Rafferty, Delaney, Parker Pass, and Cottonwood Creeks; Harden, Elizabeth, Evelyn, and Fletcher Lakes; Big Meadow; Tamarack, Crane, and Porcupine Flats; Little Yosemite Valley.	291	Bennyhoff (1953, 1956); Hartesveldt (1953)
1954	G. Grosscup E. Prince R. Anderson	Yosemite Valley, Turtle Dome, Mariposa Grove, Big Creek, Wawona; Chilnaulna, Bridalveil, and Illilouette Creeks; Ostrander Lake; Mono Meadow.	41	Bennyhoff (1956); Grosscup (1954)
1966	I. Knierimen	An area north of the Tuolumne River between Tuolumne Meadows and Hetch-Hetchy.	18	Knierimen (1967)
1974	L. Napton A. Albee	Glacier Point, Badger Pass, Bavarian Village, Wawona, Yosemite Valley, Yosemite Sewer, Badger Pass Sewer	59	Napton and Albee (1974); Napton *et al*. (1974a, 1974b)

Table 5.1--Continued

YEAR	INVESTIGATOR(S)	AREAS SURVEYED	NO. OF SITES	REFERENCES
1975	L. Napton E. Greathouse	El Portal, Cascade Campground, Foresta/ Big Meadow, Tuolumne Meadows, White Wolf, Snow Creek/Mt. Watkins, Yosemite Creek, Eagle Peak, Ribbon Meadow, Lake Eleanor, Hetch-Hetchy, Aspen Valley, Hodgdon Meadow, Crane Flat, Wawona, Mariposa Grove	97	Napton and Greathouse (1976); Napton (1978)
1976-1977	L. Napton	146 miles of back country trail corridors. Trails Nos. 58, 59, 61, 69, 77, 81, 83, 85, 89, 90, 92, 94, 96-101, 105, 107, 156, 160, 161, 165, 179, 210, 234, 244, 261, 264.	49	Napton (1978)

5.1.2: Survey Data

In May, 1980, the Yosemite National Park files contained records of 610 archeological site designations. Five of the records pertain to sites on Forest Service land, four relate to isolated artifacts, and 32 contain essentially no locational or archeological data apart from the site number (Appendix 1). This leaves 569 designated sites in Yosemite for which documentation is available. The number of records is surely larger than the number of sites, however, because distinct cultural features (such as bedrock mortars and midden deposits) in a given place are often designated separately. The same is true of many discontinuous but nearly contiguous midden deposits. As an example, the designations 4-Mrp-56, 61, 196, 296-298, and 300 seem to represent one habitation area occupied by the Miwok community of Ahwahnee. Hence, there are probably far less than 569 discrete archeological sites within the surveyed areas.

The extant survey records are of variable quality and reliability. Those prepared by Napton and his colleagues are uniformly detailed and complete, while the older records often lack site dimensions, locational data, descriptions of cultural features, or information about the relationship of the site to environmental variables (cf. Napton 1978:176-178). Nonetheless, the available data permit certain generalizations about the nature and distribution of archeological remains in Yosemite.

(1) The site records document eight types of cultural features which occur alone or together: middens, lithic scatters (some of which may relate to subsurface deposits), rockshelters, bedrock mortars, pictographs, stone "ceremonial circles," and isolated artifacts. To these one may add the small stone walls, caches of artifacts, graves, cremations, cemeteries, and isolated house remains reported elsewhere (Beatty 1933b; Bennyhoff 1956; Birkby 1973; Caywood 1954; Fitzwater 1962).

(2) The greater than 4,532 bedrock mortars distributed on nearly 700 outcrops at 275 sites comprise the most common type of archeological feature, followed by lithic scatters (334), middens (151), rockshelters (41), pictograph panels (7), and stone circles (two sites).

(3) Valley sites (in Yosemite, Wawona, Big Meadow, etc.) in the lower Transition zone tend to be larger and more complex (i.e., include a greater variety of features) than high elevation sites (Appendix 2;

Table 5.2). This is consistent with Bennyhoff's (1956:18) observation that 83.3% of the "large villages," 58.3% of the "small villages," and 64.3% of the "house sites" occurred in the Transition zone (i.e., below approximately 1,980 m):

(4) Lithic scatters occur in all elevation bands to an altitude of 3,280 m or more, but they are proportionally more abundant in the high country. Lithic scatters were recorded at only 21 percent of the sites in the 914-1,218 m band, but at 72 percent of the known sites between 2,438 and 2,742 m; for elevations above 2,742 m their frequency is 93 percent (Table 5.2).

(5) Although bedrock mortars have been found as high as 3,233 m, most occur at low elevations. Both the number of sites with bedrock mortars and the number of mortars per site correlate inversely with altitude (Table 5.3). Seventy-five percent of all recorded sites with bedrock mills are below 1,523 m, and only 4 percent occur above 2,437 m (Table 5.2). Significantly, more than 90 percent of the approximately 4,533 recorded mortars are found below 1,500 m--a distribution largely coincident with that of the black oak.

(6) As would be expected, most archeological rockshelters (86 percent) occur in the rockfall zone of Yosemite Valley and thus are at elevations of 1,150-1,300 m. All of the known pictographs are in the same elevation band (although not all are in Yosemite Valley), and all but one co-occur with rockshelters (Appendix 2). This may imply a true cultural association, or it may be that more rockshelters than pictographs have been preserved.

(7) Several kinds of archeological remains appear to correlate with vegetation types (Table 5.4a, 5.4b; Fig. 5.1). For example, 48 percent of the lithic scatters (as compared with only 17 percent of the middens) occur in lodgepole pine or lodgepole pine/Alpine meadow settings--probably a reflection of less intensive, seasonal occupation of higher elevation sites. By comparision, 42 percent of the middens and 64 percent of the sites with bedrock mortars are associated with ponderosa pine/cedar/oak forest or oak woodlands, whereas only 23 percent of the lithic scatters are so associated. Other <u>apparent</u> correlations are given in Table 5.4a. However, that table should be interpreted cautiously because of the varied accuracy and completeness of the

Table 5.2
ATTRIBUTES OF ARCHEOLOGICAL SITES BY ELEVATION*

ELEVATION	LITHIC SCATTER	MIDDEN	BEDROCK MORTARS	ROCK-SHELTER	PICTOGRAPH
1,100-2,000 ft. (305-609 m)	8 3%	8 5%	19 7%	0	0
2,000-3,000 ft. (610-913 m)	0	1 1%	2 1%	2 5%	0
3,000-4,000 ft. (914-1,218 m)	30 9%	21 14%	73 27%	15 37%	3 43%
4,000-5,000 ft. (1,219-1,523 m)	60 18%	44 29%	110 40%	20 49%	4 57%
5,000-6,000 ft. (1,524-1,828 m)	13 4%	9 6%	15 5%	1 2%	0
6,000-7,000 ft. (1,829-2,133 m)	14 4%	30 20%	23 8%	0	0
7,000-8,000 ft. (2,134-2,437 m)	46 14%	12 8%	22 8%	2 5%	0
8,000-9,000 ft. (2,438-2,742 m)	84 25%	22 15%	9 3%	1 2%	0
9,000-10,000 ft. (2,743-3,047 m)	58 17%	2 1%	1 0.5%	0	0
10,000-11,000 ft. (3,048-3,354 m)	21 6%	2 1%	1 0.5%	0	0
TOTALS	334 100%	151 100%	275 100%	41 100%	7 100%

*There are 563 recorded "sites," with a total of 808 documented attributes. In all, there are 610 site records, but 32 of these give neither type nor elevation; 11 record site types but not elevation, and four are isolated artifacts rather than "sites" in the conventional sense of the term.

Table 5.3
DISTRIBUTION OF BEDROCK MORTARS (BRMs) IN SELECTED LOCALITIES

LOCALITY	AVERAGE ELEVATION	NO. OF SITES w/BRMs	TOTAL NO. OF BRMs	RANGE PER SITE	$\tilde{x}$ NO. OF BRMs
El Portal	565 m	19	644	1-179	33.89
Yosemite Valley	1,204 m	93	1,076	1- 56	11.57
Wawona Valley	1,215 m	35	648	1- 68	18.51
Foresta/Big Meadow	1,320 m	20	759	1-433	37.95
Hodgdon Meadow	1,395 m	7	216	3-178	30.86
Mather	1,400 m	9	91	1- 25	10.11
Crane Flat	1,880 m	5	46	1- 31	9.20
Tamarack Flat	1,890 m	3	41	12- 16	13.67
Aspen Valley	1,890 m	4	61	2- 44	15.25
Tuolumne Meadows	2,621 m	5	25	2- 10	5.00

Table 5.4a
ATTRIBUTES OF ARCHEOLOGICAL SITES BY VEGETATION TYPE

VEGETATION TYPE*	LITHIC SCATTER	MIDDEN	BEDROCK MORTARS	ROCKSHELTER	PICTOGRAPH
Ponderosa pine forest with cedar and black oak	73 / 22 %	53 / 35 %	148 / 56 %	28 / 70 %	5 / 83 %
Ponderosa pine forest with cedar and black oak; grass	7 / 2 %	2 / 1 %	8 / 3 %	0	0
Jeffrey pine forest with cedar and red fir	5 / 1.5%	10 / 7 %	11 / 4 %	0	0
Lodgepole pine forest with red fir	71 / 22 %	13 / 9 %	20 / 8 %	2 / 5 %	0
Lodgepole pine forest with red fir; Alpine meadow	84 / 26 %	12 / 8 %	7 / 3 %	1 / 2.5%	0
Conifer forest, species unknown	1 / 0.3%	1 / 1 %	2 / 1 %	1 / 2.5%	0
Red fir forest with silver pine, sugar pine, jeffrey pine, lodgepole pine, and mountain hemlock	9 / 3 %	4 / 3 %	8 / 3 %	0	0
Chaparral	1 / 0.3%	1 / 1 %	2 / 1 %	1 / 2.5%	0
Oak woodland (mixed species)	4 / 1 %	6 / 4 %	18 / 7 %	5 / 12.5%	0
Digger pine/blue oak woodland	3 / 0.9%	2 / 1 %	6 / 2 %	0	0

Table 5.4a--Continued

VEGETATION TYPE*	LITHIC SCATTER	MIDDEN	BEDROCK MORTARS	ROCKSHELTER	PICTOGRAPH
Whitebark pine forest	2 / 0.6%	0	1 / 0.3%	0	0
Black oak woodland	1 / 0.3%	3 / 2 %	3 / 1 %	1 / 2.5%	0
White fir forest with sugar pine, red fir, jeffrey pine, and Douglas fir	10 / 3 %	9 / 6 %	16 / 6 %	1 / 2.5%	1 / 17 %
Chaparral; ponderosa pine forest with cedar and black oak	1 / 0.3%	0	1 / 0.3%	0	0
Alpine meadow	8 / 2 %	2 / 1 %	0	0	0
Conifer forest, species unknown; Alpine meadow	5 / 1.5%	1 / 1 %	0	0	0
Jeffrey pine forest with cedar and red fir; Alpine meadow	1 / 0.3%	0	1 / 0.3%	0	0
Riparian type	1 / 0.3%	0	1 / 0.3%	0	0
TOTALS**	329 / 100 %	150 / 100 %	265 / 100 %	40 / 100 %	6 / 100 %

* After Hanes (1977), Griffin (1977), Rundel _et al_. (1977), Storer and Usinger (1963).

** Plus 65 sites for which no data regarding vegetation were recorded.

Table 5.4b
VEGETATION TYPES AND MARKER SPECIES

Grassland mostly below 1,220 m (4,000 ft.)

species not listed

Oak Woodland 245-1,220 m (800-4,000 ft.)

Dominant		
Blue Oak	Interior Live Oak	Digger Pine
Frequent		
Buckeye	Toyon	
Golden Oak	Holly-leafed Cherry	
Laurel		

Oak Woodland-Grass (Savanna) 245-1,220 m (800-4,000 ft.)

Dominant	
Valley Oak	Black Oak
Blue Oak	Digger Pine
Interior Live Oak	grasses
Fremont Cottonwood	

Chaparral 245 m (above 800 ft.)

Dominant		
Chamise	Ceanothus	Manzanita
Frequent		
Scrub Oak	Mt. Mahogany	Poison Oak
Toyon	Flowering Ash	Holly-leafed Redberry
Chinquapin	Quinine Bush	Ribes
Huckleberry Oak	Chaparral Honeysuckle	Elderberry
Redbud		

Ponderosa Pine Forest 730-1,950 m (2,400-6,400 ft.)

Dominant		
Ponderosa Pine	Incense Cedar	Black Oak
Frequent		
White Fir	Sugar Pine	Golden Oak
Understory		
Manzanita	Kit-kit-dizze	

White Fir-Mixed Conifer Forest 1,220-1,525 m (4,000-5,000 ft.)

Dominant	
White Fir	
Frequent	
Sugar Pine	Incense Cedar

Table 5.4b--Cont.

Occasional

Lower Elevations:	Higher Elevations:	Variable:
Ponderosa Pine	Red Fir	Sequoia
Black Oak	Jeffrey Pine	Douglas Fir

Understory

Broad-leafed Maple	Manzanita	Ceanothus
Kit-kit-dizze	Golden Oak	

Jeffrey Pine Forest 1,830-2,600 m (6,000-8,500 ft.)

(Jeffrey Pine usually occurs in mixed stands in the Western Sierra.)

Frequent

Incense Cedar	Black Oak	Lodgepole Pine
White Fir	Black Cottonwood	Red Fir
Ponderosa Pine	Sugar Pine	

Understory

Manzanita	Kit-kit-dizze

Red Fir Forest 1,830-2,750 m (6,000-9,000 ft.)

Dominant

Red Fir (nearly pure stands)

Frequent

Silver Pine

Occasional

Sugar Pine	Incense Cedar	Lodgepole Pine
Jeffrey Pine	Whitebark Pine	White Fir
Mountain Hemlock		

Understory

Ceanothus	Snowberry	Willow
Manzanita	Gooseberry	Huckleberry Oak
Currant	Bitter or Red Cherry	

Lodgepole Pine Forest 1,830-3,050 m (6,000-10,000 ft.)

Dominant

Lodgepole Pine (extensive even-age stands)

Occasional

Red Fir

Understory

Manzanita	Gooseberry	Red Mountain Heather

Table 5.4b--Continued

Subalpine Coniferous Forest   2,440 m (over 8,000 ft.)

Dominant		
Mountain Hemlock	Whitebark Pine	Foxtail Pine
Frequent		
Silver Pine	Limber Pine	Sierra Juniper
Shrubs		
Sagebrush	Currant	Creamberry

(Note: This type may be represented by Mountain Hemlock Forest, White-bark Pine Forest, Foxtail Pine Forest, or Limber Pine Forest.)

Meadow   1,220 m (mostly above 4,000 ft.)

species not listed

Riparian Type

Frequent		
Willow*	Aspen	Red Dogwood
Alder*	California Wild Grape	Currant
Cottonwood*	Western Azalea	Thimbleberry
Broad-leafed Maple	Elderberry	Hazelnut

*(species vary according to local environmental conditions)

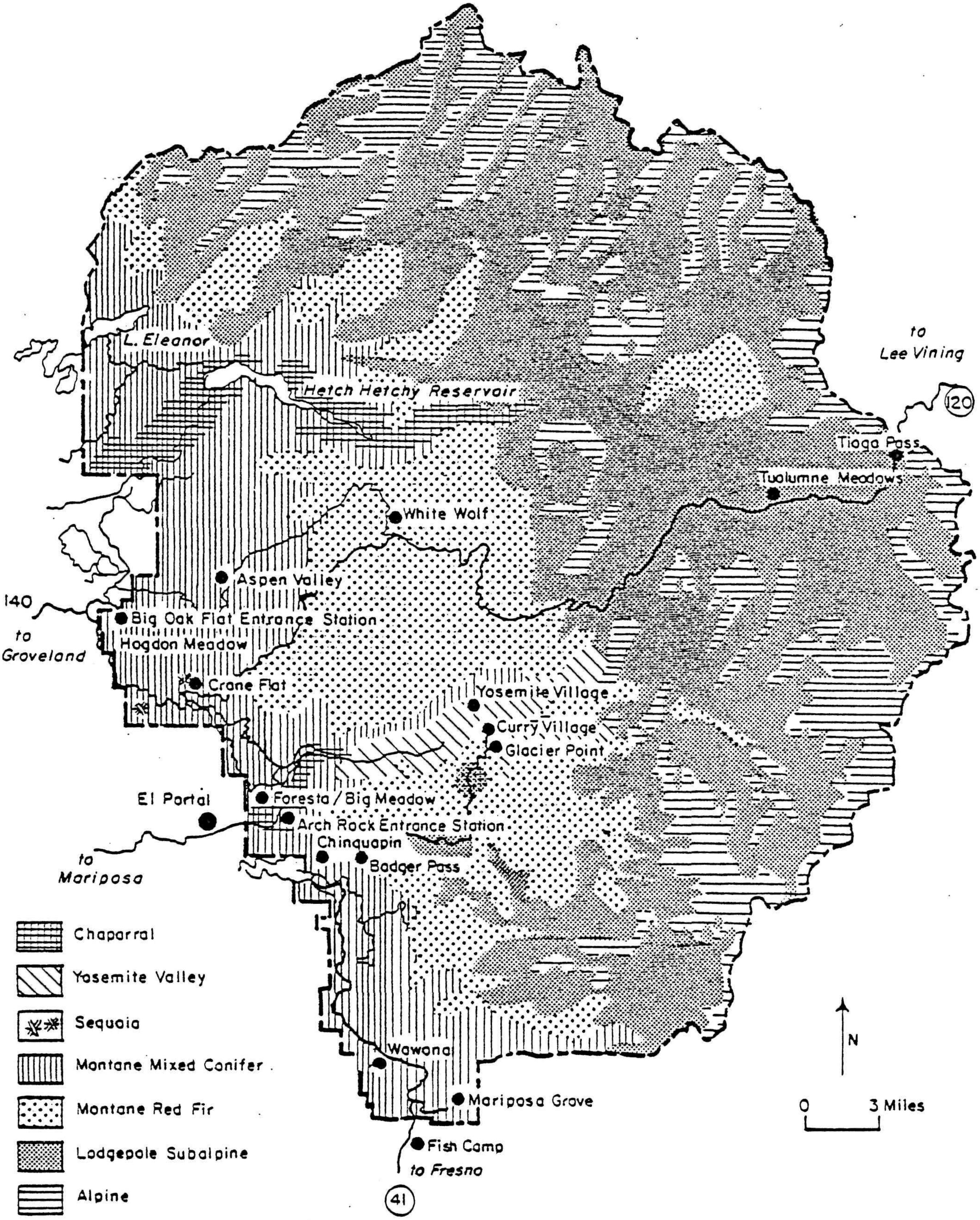


Fig. 5.1 Yosemite Environments.

original data regarding vegetation types associated with archeological sites.

(8) Archeological site locations correlate strongly with proximity to water (Table 5.5). Apart from 107 sites for which no data or questionable data about water sources have been recorded, 100 percent of the sites are located within a few hundred meters of water. Most sites--82 percent of the middens, 81 percent of the bedrock milling stations, and 81 percent of the lithic scatters--are situated near the rivers or their perennial tributaries. The few middens (10 percent) and lithic scatters (6 percent) near intermittent streams presumably reflect occupation during the wet season.

5.2: Condition of Resources

A review of all Yosemite site records--coupled with field inspections in the areas of Wawona, El Portal, Yosemite Valley, and the Grand Canyon of the Tuolumne River--shows that most of the known archeological resources in the park have been damaged, and some have been destroyed completely.

As early as 1952, Bennyhoff and his colleagues noted that "tourists" (backpackers) were collecting artifacts (and thus were gradually removing lithic scatters) at high elevation sites, and that large middens near Lake Eleanor and Mather had been "completely screened." Likewise, all 18 back-country sites discovered in 1966 by Knierimen (1967) had been conspicuously damaged by collecting and pothunting. More recent surveys have shown that nearly all of the back-country sites in Yosemite have been damaged--some extensively--by camping, collecting, and illicit digging. This is not surprising, given that more than 80,000 persons use the Yosemite back-country each season.

Archeological sites elsewhere in the park have been affected greatly by the building of roads, trails, and levees; excavation of utility trenches; digging borrow pits; construction of sewage treatment facilities and park buildings; landscaping; grading parking lots; and by the campground activities and artifact collecting of visitors. Napton (1978:210-278) has documented these and other adverse impacts to Yosemite's dwindling cultural resources. For present purposes, it is suffi-

Table 5.5
SITE ATTRIBUTES BY HYDROLOGIC FEATURES

HYDROLOGIC ASSOCIATION*	LITHIC SCATTER	MIDDEN	BEDROCK MORTARS	ROCKSHELTER	PICTOGRAPH
Rivers	79 / 26 %	39 / 28%	99 / 41 %	22 / 56%	6 / 86%
Perennial Tributaries	165 / 55 %	73 / 54%	95 / 40 %	15 / 38%	1 / 14%
Intermittent Streams	18 / 6 %	14 / 10%	31 / 13 %	0	0
Lake	33 / 11 %	4 / 3%	5 / 2 %	0	0
Marsh or Wet Meadow	2 / 1 %	4 / 3%	4 / 2 %	0	0
Pond	2 / 1 %	1 / 1%	1 / 0.5%	1 / 3%	0
Spring	1 / 0.3%	1 / 1%	4 / 2 %	1 / 3%	0
Lake/Spring	1 / 0.3%	0	0	0	0
Pond/Tributary	1 / 0.3%	0	0	0	0
TOTALS:*	302	136	239	39	7

* Plus 107 sites for which no data or only questionable data were available.

cient to say that time is running out for the archeological remains in Yosemite National Park. Their research potential has already been attenuated greatly, and the need for remedial action is urgent.

5.3: Excavations and Data Potentials

To date, five scientific excavation projects (involving 10 sites) have been completed in Yosemite National Park. In 1953 and 1954 two seasons of limited testing at four sites were designed to reveal the depths of deposits, cultural strata, and the nature of assemblages present. Between 1959 and 1966, minimal testing was done at three sites, and larger "salvage" excavations were undertaken at 4-Mrp-56, 4-Mrp-105 (previously tested), 4-Mrp-181, and 4-Tuo-236--all jeopardized by construction projects (Table 5.6).

The four excavated sites occurred in separate locations and at various elevations, namely at El Portal (560 m), Yosemite Valley (1,205 m), Hodgdon Meadow (1,395 m), and Crane Flat (1,880 m). Even though the sample of investigated sites is quite small and no scientific excavations have been done at altitudes above 1,900 m, the past studies permit several observations about the archeological deposits of Yosemite and their research potentials:

(1) Midden deposits vary greatly in extent, and range in maximum depth from less than 46 cm to more than 274 cm.

(2) Cultural deposits are often stratified, with evidence of not less than two (and perhaps three or more) prehistoric phases in addition to several historic phases.

(3) Artifacts tend to be abundant, particularly in view of the fact that not all of the excavated deposits were screened, and of types useful as temporal, cultural, and functional indicators (Table 5.6).

(4) The most common artifacts are lithic (chiefly obsidian) flakes and flake tools. Such items are of value for studies of technology, trade, activity areas, and chronology.

(5) The preservation of bone and shell is variable, ranging from fair at El Portal to poor at higher elevations. In general, bone and shell seem to preserve best in large ashy (presumably alkaline) middens such as 4-Mrp-181.

Table 5.6
ARCHEOLOGICAL EXCAVATIONS, YOSEMITE NATIONAL PARK

YEAR	SITE	NO. OF UNITS*	MAXIMUM DEPTH (cm)	STRATA**	FINDINGS (NO. AND TYPE)	REFERENCES
1953	4-Mrp-97	4	137	2A	163: FS, PP, M, CP, FK, D, MS; no recovered bone.	Bennyhoff (1956)
1953	4-Mrp-105	10	135	2A	319: FS, PP, M, MS, FK, D, SV, QC, CS; rare calcined deer bone.	Bennyhoff (1956)
1953	4-Mrp-106	2	142	1A?	M, FS, PP; ?.	Bennyhoff (1956)
1954	4-Mrp-9	3	89	1H/2A	95: FS, PP, D, SB, FK, M; bone poorly preserved.	Grosscup (1954); Bennyhoff (1956)
1959	4-Mrp-251	1	46	1A?	No data.	McKusick (n.d.)
1959-1960	4-Mrp-181	36	244	1H/2A	1400: FS, PP, D, M, MS, CP, QC, SB, SV, P, AF, BA, BAS, BB, HS, OS, GB; 23 flexed burials. Shell and bone are preserved.	Fitzwater (1962); Fitzwater and van Vlissingen (1960)
1960	4-Mrp-183	1	?		?	Fitzwater (1962)
1960	4-Mrp-105	43	274	2A?	2820: FS, PP, FK, C, D, MS, M, CH, H, QC, AW, O; rare bone; 3 seeds.	Fitzwater (1964, 1968)

Table 5.6--Continued

YEAR	SITE	NO. OF UNITS*	MAXIMUM DEPTH (cm)	STRATA**	FINDINGS (NO. AND TYPE)	REFERENCES
1960	4-Tuo-236	18	76	2A?	FS, PP, FK, D, H, M, MS, C.	Fitzwater (1968b)
1966	4-Mrp-56	16	91	2A	249: FS, FK, D, C, M, SB.	Rasson (1966)
1966	4-Mrp-80	1	?	?	No data.	Rasson (1966)

KEY

* All 5 x 5 ft.
** A, aboriginal; H, historic non-Indian

AF - Antler Flake
AW - Atlatl Weight
BA - Bone Awl
BAS - Bone Atlatl Spur
BB - Bone Bead
C - Core
CH - Chopper
CP - Cobble Pestle
CS - Core Scraper
D - Drill
FK - Flake Knife
FS - Flake Scraper
GB - Glass Bead
H - Hammerstone
HS - Haliotis Shell Artifact
M - Mano
MS - Millingstone
O - Ochre
OS - Olivella Shell Artifact
P - Pottery
PP - Projectile Point
SB - Steatite Bead
SV - Steatite Vessel

(6) Other nonartifactual midden constituents--thermally-cracked rock, ash, charcoal, carbonized seeds, etc.--are not consistently reported, but where records do exist the preservation seems good. This suggests that the middens of Yosemite may contain data suitable for economic reconstructions and the determination of activity areas.

(7) Although no subsurface structural remains are described in the excavation reports, this omission is more likely the result of limited sampling than of an absence of such remains in Yosemite. Based on historical accounts of aboriginal structures in the central Sierra, the discovery of surficial housepits in various parts of Yosemite, and the excavation of architectural features in nearby areas, one would expect to find structural remains preserved in Yosemite's cultural deposits.

(8) Human remains exhibit fair to good preservation. They have been found in a cemetery at 4-Mrp-181 (Fitzwater 1962) as well as in apparently isolated graves in several locations (Birkby 1973; Caywood 1954; Danziger 1980; LaJeunesse 1979).

The data potentials of Yosemite's cultual resources are further demonstrated by the recent microanalytic studies of several investigators. In 1976, personnel of the National Park Service Western Archeological and Conservation Center took soil samples for pollen, soil chemistry, and flotation studies from six sites--4-Mrp-3, 151, 181, 182, 183, and 355--in the vicinities of El Portal and Foresta/Big Meadow (Hewitt 1976b). The purpose of the investigations was to assess the extent and depth of midden in areas likely to be affected by development. Chemical analyses of the samples showed that: (1) pH and phosphorous concentrations were useful for defining limits of cultural deposits; (2) potassium readings were highly variable and of uncertain significance; and (3) no appreciable levels of nitrogen were detected (Hewitt 1976a:4-11). In particular, it was found that phosphate declined gradually away from bedrock mortars, suggesting that phosphate levels in middens may be a function of acorn processing (Hewitt 1976a: 15-16). A careful integration of soil analyses with controlled excavations will be needed to determine the cultural activities which produced each of the chemical traces. Still, the testing confirms that sufficient chemical variability may exist in the archeological deposits of Yosemite to permit studies of activity areas and subsistence practices.

The soil samples from 4-Mrp-3 and other sites (supra) also showed excellent pollen preservation. Most of the recovered pollen was of pine, spruce, fir, Douglas fir, cedar, and possibly juniper; also represented were grasses, alder, birch, goosefoot, evening primrose, compositae, and sagebrush (Bryant 1977:3). While no quantitative analysis of these samples has been done, initial work indicates that pollen preservation is good enough to permit reconstructions of paleoenvironmental conditions and investigations of economic uses of native plants. Such studies would augment the paleoenvironmental reconstructions developed by Adam (1967), Byrne et al. (1979b), and others on the basis of their research in and near Yosemite.

5.4: Summary

Taking into account the number, diversity, and context of known archeological resources, the research potentials of Yosemite National Park appear very good. Even though only about 5 percent of the park has been surveyed, nearly 600 cultural sites have been recorded. Among them are both Native American sites--middens, bedrock mortars, lithic scatters, petroglyphs, etc.--and such historic, non-Indian properties as mines, roads, Civilian Conservation Corps. camps, and homesteads. These occur in a variety of natural settings and elevation bands, thus permitting studies of cultural-environmental relationships.

The midden sites especially have high research potential. Previous investigations have shown that Yosemite's middens may be large, deep, culturally stratified, and as much as several thousand years old. Preserved within them may be data such as remnants of structures, features representing activity areas, floral and faunal remains, charcoal, chemical residues, lithic debitage, and a wide array of artifacts. Lithic scatters--although poorly understood and often neglected--are very important as sources of data regarding lithic technology, obsidian trade, seasonal occupation of high elevations, and land-use/settlement patterns. Other types of resources hold comparable potentials. In brief, then, the many kinds of data included in the cultural inventory of Yosemite National Park will be of considerable value for the advancement of archeological knowledge in the Sierra Nevada and adjacent regions.

6: METHODS

6.1: Conceptual Framework

A methodology links research objectives to procedures. As described in this and the following sections, the methodology proceeds from a conceptual background to the integration of specific research questions with data requirements and the development of a data recovery plan. Particular attention is given in this chapter to Yosemite's archeological data potentials in terms of specific research questions.

Ideally, one should investigate the archeological resources with the best data potentials to meet priority research objectives. In Yosemite, however, this process will be modified because of management and planning needs in addition to research interests. Accordingly, this research design is intended to serve the needs of conservation, planning, and archeological goals. Once research objectives are established, a means should be devised by which all levels of archeological information can be applied to those objectives. The chain of investigation begins with cultural site identification from surface observations. Following this, one may define sites and their contents more precisely by direct and indirect exploration. The data thus obtained serve various ends:

First, they provide planners with accurate information on site boundaries so that cultural remains can be avoided, or so that any impacts upon them can be anticipated and dealt with appropriately.

Second, they give a firm basis for estimating the scope and cost of salvage in cases where impacts to significant properties are unavoidable.

Third, each increment of accumulated data can be used directly to answer research questions.

A key step in this methodology is to determine the research objectives most appropriate to particular sites, a process that should include:

(1) Definition of vertical and horizontal site limits by means of systematic auger boring, chemical mapping, soil color reading, surficial pedology, features, and artifact distribution patterns;

(2) Subsurface testing to determine the nature of cultural deposits, stratification, quality of preservation, types of artifacts and features present, and the quantities and types of nonartifactual material (e.g., charcoal, faunal remains, and lithic debitage);

(3) An evaluation of research potentials in light of the materials present and the kinds of data required to achieve particular objectives, and

(4) The selection and ranking of appropriate research objectives to reflect both the site's data potentials and goals of the regional research design.

Some research objectives--e.g., determining the age of a given component--may be met by relatively direct and simple means (in this case, by reference to ^{14}C age determinations and time-sensitive artifacts). More complex objectives--e.g., determining whether certain social/settlement patterns may have advantaged some groups at the expense of others--cannot be achieved directly, but will require the development of explicit hypotheses suitable for archeological testing. For example:

Objective: To determine the causes of social replacement in central Sierran prehistory.

Observations: The Mariposa Phase replaced the Crane Flat Phase in Yosemite at ca AD 1400. The Mariposa Phase represents the ancestral Miwok, whereas the Crane Flat Phase is thought to mark ancestral Yokutsan culture.

Premise: Miwok groups supplanted pre-Yokuts people in the Yosemite area at ca AD 1400.

Question: Why? By what processes did the replacement occur?

Hypothesis 1: Miwok dominance was achieved because of intensive acorn exploitation and other economic practices superior to those of the pre-Yokuts.

Implications 1: (a) Crane Flat sites will lack evidence of extensive acorn processing; (b) early Mariposa sites will contain tanic acid, acorn hulls, abundant fire-cracked rock, mortars and pestles, and other evidence of intensive acorn processing; and (c) a reconstruction of Crane Flat subsistence practices will show them to be significantly inferior (in terms of such criteria as yield, dependability, storability, etc.) to those of the Mariposa Complex.

OR

Hypothesis 2: A social organization characterized by segmentary lineages, ranked status, dense population fronts, etc. permitted the Miwok to displace smaller, less dense, socially simpler Yokuts populations.

OR

Hypothesis 3: Due to a long interval of climatic adversity, the Yokuts had gradually abandoned the Yosemite area by ca AD 1400. As climatic conditions improved, the Miwok spread into an underutilized environment.

ETC.

Once research objectives and hypotheses have been formulated, a site-specific data recovery plan can be developed.

6.2: Data Recovery

Archeological data recovery may entail field survey (reconnaissance), surface collecting, subsurface testing, large-scale excavation, and/or other kinds of work. Such data recovery activities may be grouped into pre-excavation (or "pre-salvage") and excavation (or "salvage") categories. Comprising the former group are:

6.2.1: Cultural Inventory

This involves the systematic field survey and documentation of all significant cultural properties within a defined area. Much detailed information about site location, natural setting, and cultural features must be recorded for each site discovered. Photographs and maps also are usual parts of the documentation. An example of a Cultural Site Inventory form now in use in the Sierra Nevada is attached as Appendix 3. A comparable form has been designed by Napton (cf. Napton et al. 1974a, 1974b). Both forms show the kinds of data that should be recorded, at a minimum, for archeological properties in Yosemite National Park.

6.2.2: Remote Sensing

Included here are various studies that may help to define the na-

ture and extent of cultural remains without disturbing them. Useful techniques in this category are aerial photo (black-and-white, color, false-color infra-red, etc.) interpretation (Lyons and Avery 1977), soils mapping, studies of surficial vegetation patterns, and the use of proton magnetometry, metal detection, and resistivity devices to discover the location of subsurface remains without excavating (Hole and Heizer 1973:169-173).

6.2.3: Controlled Surface Collection

This refers to the systematic retrieval of surface artifacts and documenting their provenience, usually by mapping. Analysis of data from controlled surface collections may permit the reconstruction of intra-site activity areas and provide information about the nature of certain subsurface materials.

6.2.4: Minimal Impact Studies

In this category are techniques that may provide information about subsurface deposits while impacting them very little. Auger boring may be used to define the extent, depth, and gross stratification of sites. Soil pH analysis and mapping (both horizontal and vertical) can suggest the location of activity areas and certain kinds of cultural features. Similarly, other studies of soil chemistry--e.g., analyses of calcium, phosphorous, and nitrogen--can shed light on past activities and even indicate the former presence of features lacking other tangible residues. Limbrey (1975) gives an excellent summary of what can be learned from archeological soils analyses, most of which require only minimal disturbance of the site.

6.2.5: Testing

This aspect of "pre-excavation" work entails limited digging, usually in small (1 m x 1 m, 1 m x 2 m) units, to ascertain the extent and nature of subsurface deposits, features, and artifacts. Testing is a prerequisite for excavation, because it provides--better than any other technique--a reliable basis for estimating data potentials, the scope of needed data, recovery work, time, and cost budgets. To be useful, however, test data must be "representative;" that is, the accumulated

material must accurately (within reasonable limits) reflect the content of the site as a whole. Consequently, testing must be done according to a sampling design that considers archeological needs and realities as well as statistical procedures (cf. Mueller 1975).

6.2.6: Other Systematic Observations

Valuable pre-excavation data may be obtained in situations other than those outlined above. For example, careful observations of natural and artificial soil exposures may yield information about the presence or absence of cultural remains, nature and depth of archeological deposits, and/or the location of cultural features. For this reason, particularly in Yosemite, it is important for archeologists to monitor all earth-disturbing activities and to make systematic observations of natural and cultural soils. All such observations should be documented and filed as part of the data base to be used by archeologists and cultural resource management planners.

Once pre-excavation studies have been completed, and when excavations are planned, the data recovery effort normally will proceed according to the following sequence:

(1) Evaluation of test data to determine the research potentials of the site; selection of research objectives (per Section 6.1 [1-4] supra).

(2) Comprehensive review of published and manuscript reports germane to the intended research.

(3) Consultation with Native Americans, archeologists, and others with specialized knowledge of Yosemite's cultural resources to ensure that all significant data are considered in the site-specific excavation plan.

(4) Preparation of a statistically valid data recovery plan. This plan should explicate field procedures designed to recover data relevant to identified research issues and hypotheses as economically as possible and without collecting redundant information.

(5) Excavation of the site according to the data recovery plan. Beyond investigating cultural remains, the fieldwork also may involve pollen collection, soils studies, chemical analyses, or other special studies, depending upon the recovery plan and the nature of available data.

(6) Technical and statistical analyses of data to establish their age and to discover patterns of form, function, and distribution; interpretation of findings.

(7) Preparation of a report to fully describe: (a) the rationale, assumptions, goals, objectives, design, methods, and techniques, of research, and (b) the nature of the resources investigated, findings, and interpretations.

6.3: Integration of Research Objectives with Data

Integration of research objectives with site-specific data potentials is central to the process of research design. To optimize data recovery, one must link particular research objectives with sites having the best potential to meet those objectives. For example, investigating relationships between cultural and environmental change will require, among other things, data from archeological sites of different ages that can be related to particular episodes of environmental change. Upon testing, sites can be evaluated as to their potential contribution of data to help meet the objectives set forth in Chapter 4.

For purposes of integration, data are classed not in terms of form (such as chipped stone tools or faunal remains), but rather according to research issues, e.g., data which may be used to establish temporal control or to reconstruct subsistence practices. In the former category one might include obsidian flakes (for hydration dating), carbon, time-sensitive shell beads, and projectile points; in the latter, animal bones, millingstones, floral remains, basketry, and hunting paraphernalia.

Integration is best accomplished as a site-specific process. In Yosemite, however, few sites have been tested, and little is known of their data potentials. Nonetheless, progress can be made toward integration by describing what is known of archeological data potentials elsewhere in Yosemite (Chapter 5) and by identifying the kinds of data needed to meet identified research objectives in the park (this chapter).

Building upon the objectives and methodology described above, and taking into account Yosemite's archeological potentials as outlined in

Chapter 5, the following sections: (1) identify the kinds of data needed to address each research objective, and (2) relate those needs to the data potentials of Yosemite. Through this process of linkage or integration, one may address research potential in terms of archeological knowledge to be gained rather than in simply the kinds of data that might be found.

A detailed or site-specific integration of research objectives and data potentials in Yosemite is not yet possible because the sites most likely to require excavation have not yet been tested, and their individual potentials remain largely unknown. Once particular sites have been sampled, it will be possible to link their data categories with specific research objectives. Still, it is possible to show how such integration might proceed and, more broadly, to link research objectives with known archeological data categories in the park as a whole. The following section provides several examples of research objectives, entailed questions, and data requirements.

6.4: Some Parkwide Objectives

Examples of Integration

6.4.1: Objective

To determine the size and composition of populations in Yosemite National Park during each identified cultural phase.

6.4.1.1: Entailed Questions

(a) Based upon ethnographic and archeological models of household composition/household size and correlated house size and features, what is the estimated size and demographic composition of the population during each phase?

(b) Based upon anthropological models of site habitation area and number of occupants, what is the estimated population of each phase?

(c) Based upon all available data concerning local natural resources and past economic patterns, what is the estimated maximum population that could have been sustained in Yosemite (i.e., the area's carrying capacity) during each phase?

(d) From estimates of mortuary populations and mean life expectancy, what was the evident population size during each phase?

(e) How do the estimates based upon household size, habitation area, carrying capacity, and mortuary analyses compare? What factors may account for differences among estimates, and how might they be reconciled?

6.4.1.2: Required Data

For each phase: the number of simultaneously occupied habitation sites and their surface areas; the number, sizes, and types of houses occupied coevally during each phase; information about local food resources sufficient, when considered in light of economic patterns, to determine carrying capacity; mortuary population estimates, as determined by sampling; and life expectancy calculations, as determined by skeletal analyses.

6.4.2: Objective

To determine the extent and relative importance of hunting, fishing, gathering, and other subsistence activities in each phase.

6.4.2.1: Entailed Questions

(a) Based upon direct evidence (such as faunal remains), what can be learned of the intensity of hunting, species pursued, minimum number of individuals taken, and their relative importance to hunters in each phase?

(b) What can be learned of hunting intensity and techniques from analyses of indirect evidence, such as hunting blinds, rock art, and weapons?

(c) As determined by analyses of charred seeds, phytoliths, and other floral remains, what vegetal resources were acquired and in what proportion were they utilized during each phase?

(d) When was acorn-processing introduced, and to what extent did it augment or supplant previously used vegetal resources?

(e) What tools and techniques were used to prepare plant resources for dietary or other uses?

6.4.2.2: Required Data

For each phase: information about paleoenvironmental conditions, especially the nature and distribution of economically valuable plants and animals; quantifiable samples of faunal remains (bone, teeth, shell, etc.) and floral material (phytoliths, seeds, pollen, etc.) from datable contexts; and subsistence-related features and artifacts such as bedrock mortars, projectile points, and millingstones.

6.4.3: Objective

To reconstruct the sequence of paleo-climatic episodes in the Yosemite region as a basis for understanding changes in the effective human environment.

6.4.3.1: Entailed Questions

(a) What significant temperature changes occurred during the Holocene, and what were the nature (direction), intensity, rate, and duration of those changes?

(b) When did each major temperature interval occur?

(c) How did Holocene precipitation fluctuate with respect to amount, seasonal distribution, and rain/snow ratios; what were the intensity, rate, and duration of the changes?

(d) When did each precipitation episode occur?

(e) How did each major shift of temperature and/or precipitation affect the natural environment, especially as regards the availability of water, the distribution of biotic communities, and the nature of plant and animal resources?

6.4.3.2: Required Data

Datable soils, pollen, and faunal remains from archeological deposits; data regarding Holocene glaciology, palynology, mountain meadow cycles, geomorphology, pedology, tree-ring and tree line fluctuations, and tephrachronology; economically sensitive artifacts that might reflect adaptive responses to shifting environmental conditions.

6.5: Data Classification

Archeological data may be classified according to the kinds of research issues or objectives to which they may relate. For example, there are:

(1) Data which permit temporal-control (e.g., time-sensitive artifacts or materials suitable for ^{14}C dating);

(2) Data germane to paleoenvironmental reconstructions (e.g., pollen, microfaunal remains, and sediments);

(3) Data allowing the social or ethnic identification of particular groups (e.g., stylized artifacts, rock art, and distinctive architectural forms); and

(4) Data which can be used to interpret patterns of exchange (e.g., exotic artifacts or materials).

With this sort of classificatory approach, one may develop a linkage of data requirements with the research objectives listed in Chapter 4. Toward the end, the known categories of archeological data in Yosemite National Park may be grouped as follows:

6.5.1: Chronological Data

A. Time-sensitive artifacts (such as projectile points, beads, and ceramics).

B. Remains suitable for ^{14}C dating.

C. Dendrochronological samples.

D. Time-sensitive features (such as certain types of structural remains).

E. Historic documentation.

F. Time-sensitive mortuary patterns.

G. Obsidian (for hydration measurement).

H. Stratification.

I. Ceramic materials (for thermoluminescence dating).

J. Tephra (for tephrachronology).

6.5.2: Environmental Data

A. Aspect distribution.

B. Botanical resource distribution.

C. Elevation.

D. Faunal resource distribution.

E. Geological resource distribution.

F. Landform distribution.

G. Slope distribution.

H. Water resource distribution.

6.5.3: Paleoenvironmental Data

A. Paleobotanical data (e.g., relict communities, plant remains in preserved, datable packrat middens, etc.).

B. Evidence of past fires (as seen in charred tree rings, carbon in stillwater sediments, timber stand ages, etc.).

C. Glaciological data.

D. Mountain meadow stratigraphy.

E. Pollen spectra.

F. Soils data.

G. Tree-ring and treeline paleoclimatic records.

H. Data regarding vulcanism (tephra, datable extrusive flows, etc.).

I. Zoological data (including remains of microfauna).

6.5.4: Settlement and Land-use Data

A. Age of archeological sites.

B. Environmental setting of archeological sites (including data on the proximity of key resources).

C. Features (e.g., structural remains, bedrock mortars, etc.) associated with each site.

D. Archeological site locations; spatial distribution and relationships to one another.

E. Surface areas of archeological sites.

F. Types of archeological sites.

6.5.5: Formal Variability of Sites

A. Bedrock milling station (usually bedrock mortars).

B. Cemetery.

C. Civilian Conservation Corps. camp facilities.

D. Dump.

E. Homestead.

F. Hotel.

G. House Pit (or other aboriginal architectural feature).

H. Lithic scatter.

I. Midden.

J. Mine or quarry.

K. Pictograph or petroglyph.

L. Road.

M. Railroad.

N. Rockshelter (with evidence of occupation).

O. Isolated structure.

P. Stone circles.

Q. Trail.

6.5.6: Data Useful for Social or Ethnic Identification

A. Culturally "diagnostic" artifacts.

B. Dietary remains.

C. Distinctive architecture or other features.

D. Characteristic modes of production or technology.

E. Art Styles.

6.5.7: Exchange System Data

A. Exotic artifacts.

B. Historic records.

C. Exotic raw materials.

D. Evidence of local specilization in manufacturing items for trade.

E. Location of trade trails.

6.5.8: Subsistence Data (Midden Deposits)

A. Botanical remains (seeds, phytoliths, etc.).

B. Chemical residues produced by subsistence activities.

C. Faunal remains.

D. Hearths.

E. Economic pollen.

F. Fire-fractured rock (representing cooking areas).

G. Tools ascribable to subsistence activities (e.g., projectile points, mortars, pestles, etc.).

6.5.9: Demographic Data

A. Estimated age of individuals in mortuary populations.

B. Carrying capacity estimates based upon paleoenvironmental reconstructions for each phase.

C. Floor area of houses.

D. Osteological data (osteometry, records of discontinuous traits, paleopathology, etc.) for each mortuary population.

E. Determination of sex of individuals in mortuary populations.

F. (As above, surface areas of archeological sites).

6.5.10: Ceremonial Data

A. Mortuary patterns (types of disposal, associations, etc.).

B. Rock art (pictographs, petroglyphs).

C. Social-ceremonial architecture (such as dance houses).

6.6: Integration of Data and Objectives

It is now possible to link the archeological objectives described in Chapter 4 with the data categories listed above. Because the required types of data are known (through past archeological investigations) to exist in the central Sierra, the objectives should be achievable through research in and near Yosemite National Park. More refined objectives may be developed in the future, and better assessments of data potentials may be made when sites are tested. Meanwhile, the following integration serves to explicate the potentials of Yosemite in terms of information that might be gained through archeological research.

6.6.1: Paleoenvironmental Reconstruction

(1) Geomorphic changes: Data to be provided by geologists.

(2) Holocene vulcanism: Tephra in stratified, datable contexts.

(3) Paleoclimatic reconstruction: Paleobotanical data, glaciological evidence, mountain meadow stratigraphy, pollen spectra, soils data, tree-ring and treeline paleoclimatic records, and paleozoological remains.

(4) Glacial, hydrologic, erosional, and depositional changes: Glaciological evidence, mountain meadow stratigraphy, soils data, as well as valley sedimentology.

(5) Floral conditions: Paleobotanical data, pollen spectra, tree-ring and tree-line paleoclimatic records, botanical remains, and economic pollen.

(6) Faunal assemblages: Faunal resource distribution, zoological data, faunal remains, subsistence-related tools (particularly those related to hunting, fishing, etc.).

(7) Nature and location of resources: Botanical resource distribution, faunal resource distribution, geological resource distribution, water resource distribution, paleobotanical data, pollen spectra, paleozoological remains, botanical remains, faunal remains, and economic pollen.

(8) Sequence of effective environmental changes: All of the above categories of data.

6.6.2: Cultural Chronology

(1) Initial occupation: Time-sensitive artifacts, remains suitable for ^{14}C dating, obsidian for hydration measurement, and culturally-diagnostic artifacts; Holocene paleoenvironmental data to be used to identify likely site locations.

(2) Origins, affiliations, and cultural features of earliest populations: Time-sensitive artifacts, remains suitable for ^{14}C dating, obsidian for hydration measurement, stratification of cultural deposits, age of archeological sites, environmental setting of archeological sites, culturally-diagnostic artifacts, dietary remains, characteristic modes of production or technology, botanical remains, faunal remains, and tools ascribable to subsistence activities.

(3) Causes of migrations: Develop specific hypotheses, test implications, and required data sets.

(4) Number of cultural phases: Time-sensitive artifacts, materials suitable for ^{14}C dating, time-sensitive features, obsidian for hydration measurement, stratification of cultural deposits, age of archeological sites, types of archeological sites, culturally-diagnostic artifacts, dietary remains, distinctive architecture or other features, characteristic modes of production or technology, and art styles.

(5) Cultural characterization of each phase: As above, under 6.6.2(4).

(6) Temporal and spatial limits of each phase: Time-sensitive artifacts, remains suitable for ^{14}C dating, time-sensitive features, obsidian for hydration measurement, stratification of cultural deposits, age of archeological sites, types of archeological sites, culturally-diagnostic artifacts, distinctive architecture or other features, characteristic modes of production or technology, and osteological data.

(7) Timing and origin of innovations: Time-sensitive artifacts, remains suitable for ^{14}C dating, stratification of cultural deposits, culturally-diagnostic artifacts, dietary remains, distinctive architecture or other features, characteristic modes of production or technology, exotic artifacts, and tools ascribable to subsistence activities.

(8) Causes of change: Exotic artifacts, exotic materials, osteological data, culturally-diagnostic artifacts, distinctive features, characteristic modes of production or technology, art styles, and temporal control for these data (including stratification of cultural deposits).

(9) Linguistic prehistory: Culturally-diagnostic artifacts, distinctive features, characteristic modes of production or technology, and temporal control of these data.

(10) Yosemite as a refugium: Culturally-diagnostic artifacts, distinctive architecture or other features, characteristic modes of production or technology, art styles of historic age, time-sensitive artifacts, and historic documentation.

(11) Cultural and historical summary: All of the above categories of data.

6.6.3: Economic Patterns

(1) Extent of hunting, gathering, etc. in each phase: Age of ar-

cheological sites, environmental setting of archeological sites, bedrock milling stations, dietary remains, botanical remains, chemical residues produced by subsistence activities, faunal remains, evidence of past fires, tools ascribable to subsistence activities, hearths, and fire-fractured rock—all with temporal control.

(2) Plant and animal species taken: Botanical resource distribution, faunal resource distribution, paleobotanical data, paleozoological data, dietary remains, botanical remains, chemical residues produced by subsistence activities, faunal remains, hearths, economic pollen, and subsistence-related tools--all with temporal control.

(3) Effect of bow and arrow: Time-sensitive artifacts, stratification of cultural deposits, dietary remains, faunal remains, and tools ascribable to subsistence practices, especially datable deposits with both faunal remains and projectile points identifiable as to projectile type.

(4) Acorn and pinyon nut use: Materials suitable for ^{14}C dating, time-sensitive features, stratification of cultural deposits, botanical resource distribution, paleobotanical remains, pollen spectra, environmental setting of archeological sites, bedrock milling stations, dietary remains, botanical remains, chemical residues, hearths, economic pollen, fire-fractured rock, and milling tools such as acorn hammers, pestles, etc.

(5) Subsistence activities by phase: Time-sensitive artifacts, materials suitable for ^{14}C dating, time-sensitive features, stratification of cultural deposits, botanical resource distribution, faunal resource distribution, paleobotanical remains, faunal remains, age of archeological sites, environmental setting of archeological sites, bedrock milling stations, dietary remains, botanical remains, chemical residues produced by subsistence activities, faunal remains, hearths, economic pollen, fire-fractured rock, and tools ascribable to subsistence activities.

(6) Food processing: Time-sensitive artifacts, materials suitable for ^{14}C dating, time-sensitive features, stratification of archeological deposits, characteristic modes of production or technology, bedrock milling stations, chemical residues of subsistence activities, faunal remains, hearths, economic pollen, fire-fractured rock, and tools ascribable to food processing.

(7) Seasonal population movements: Botanical resource distribution, elevational data, faunal resource distribution, meteorological records, age of archeological sites, surface area of archeological sites, archeological site locations, types of archeological sites, bedrock milling stations, middens, rockshelters, lithic scatters, dietary remains, botanical remains, and faunal remains.

(8) High-elevation resources: Environmental setting of archeological sites, distribution of floral resources, distribution of faunal resources, botanical remains, chemical residues, faunal remains, economic pollen, and tools ascribable to particular subsistence activities.

(9) Environmental manipulation: Botanical resource distribution, faunal resource distribution, paleobotanical data, evidence of past fires, environmental setting of archeological sites, botanical remains, faunal remains, tools assignable to particular adaptive functions.

(10) Possible extinct plant foods: Botanical remains, economic pollen.

(11) Subsistence changes through time: All of the above categories of data.

(12) Types of abiotic resources: Geological resource distribution, exotic artifacts, exotic materials, and analysis of all cultural materials to determine their origins (as by trace element analysis and other means).

(13) Technical analyses: Time-sensitive artifacts, materials suitable for ^{14}C dating, obsidian for hydration measurement, stratification of cultural deposits, culturally-diagnostic artifacts, and characteristic modes of production or technology, lithicologic analyses, studies of bone and shell industries, etc.

(14) Craft specialization: Characteristic modes of production or technology, and evidence of local specialization in manufacturing items for trade (such as manufacturing debris of unusual quantity, evidence of quarrying, etc.).

(15) Exchange mechanisms: Exotic artifacts, historic records, exotic raw materials, evidence of local specialization in manufacturing items for trade, location of trade trails, botanical resource distribution, faunal resource distribution, and geological resource distribution, and patterns of variable wealth distribution within cemeteries, among village sites, etc.

(16) Prehistoric trade trails: Historic records, physical traces, modeling based on resource locations, economic considerations, and frequencies of exotic items in archeological sites.

(17) Covariance of changes in environmental conditions and exchange systems: Paleobotanical data, glaciological evidence, mountain meadow stratigraphy, pollen spectra, soils data, tree-ring and treeline paleoclimatic records, data regarding vulcanism, environmental setting of archeological sites, exotic artifacts, and exotic materials--all with good temporal control.

(18) Redistribution systems: Would require extremely large samples of data from excavations throughout the region: time-sensitive artifacts, materials suitable for ^{14}C dating, botanical resource distribution, age of archeological sites, environmental setting of archeological sites, features, types of archeological sites, exotic artifacts, historic records, exotic materials, evidence of local specialization in manufacturing, location of trade trails, carrying capacity estimates, mortuary patterns, and social-ceremonial architecture, as well as data on variability in wealth distribution within cemeteries, among houses, among villages, among localities, etc.

6.6.4: Settlement Patterns

(1) Types of sites represented in each phase: Time-sensitive artifacts, materials suitable for ^{14}C dating, time-sensitive features, time-sensitive mortuary patterns, obsidian for hydration measurement, stratification of cultural deposits, age of archeological components, spatial distribution of archeological sites, and types of archeological sites.

(2) Determinants of site location: Aspect distribution, botanical resource distribution, elevation, faunal resource distribution, geological resource distribution, landform patterns, slope, water resource distribution, age of archeological sites, environmental setting of archeological sites, archeological site locations, and types of archeological sites.

(3) Site function: Environmental setting of archeological sites, features, archeological site locations, surface areas of sites, types of archeological sites, exotic artifacts, evidence of local specialization

in manufacturing, location of trade trails, botanical remains, chemical residues, floor areas of houses, determination of sex of individuals in mortuary population, mortuary patterns, and social-ceremonial architecture.

(4) Site catchments: Botanical resource distribution, faunal resource distribution, geological resource distribution, water resource distribution, evidence of past fires, environmental setting of archeological sites, features, archeological site locations, types of archeological sites, exotic artifacts, exotic materials, botanical remains, faunal remains, tools ascribable to particular adaptive activities--all with temporal control.

(5) Permanent and seasonal occupations: Botanical resource distribution, elevation, meteorological data, distribution of faunal resources, distribution of water resources, environmental setting of archeological sites, features, archeological site locations, botanical remains, faunal remains, economic pollen, tools ascribable to particular subsistence activities, osteological remains, lithic scatters, middens, and bedrock milling stations.

(6) High altitude land use: Elevation, botanical resource distribution, faunal resource distribution, environmental setting of archeological sites, archeological site locations, surface areas of archeological sites, types of archeological sites, middens, lithic scatters, bedrock milling stations, botanical remains, chemical residues, faunal remains, economic pollen, and tools ascribable to particular adaptive activities.

(7) Changes in high elevation land use through time: As above, with the addition of paleobotanical data, glaciological evidence, meadow stratigraphy, pollen spectra, soils data, tree-ring and treeline paleoclimatic records, and zoological data.

(8) Ethnic markers and ethnic identification of settlements: Culturally-diagnostic artifacts, dietary remains, distinctive architecture or other features, characteristic modes of production and technology, and art styles--with temporal control--followed by analyses of types and locations of archeological sites.

(9) Diachronic changes in settlement: All of the above types of data analyzed with reference to time.

6.6.5: Demography

(1-5) Population estimates: Age of archeological sites, features, surface areas of archeological sites, types of archeological sites, house remains, bedrock milling stations, midden (volume and rate of accumulation), estimated age of individuals in mortuary populations, carrying capacity, floor areas of houses, and dietary remains.

(6-11) Biocultural profile: Estimated age of individuals in mortuary populations, osteological data, determination of sex of individuals in mortuary population, and other data as discussed in Section 4.5.

6.6.6: Social Organization

(1) Social organization of each phase: Time-sensitive artifacts, materials suitable for ^{14}C dating, stratification of cultural deposits, age of archeological sites, features, archeological site locations, types of archeological sites, exotic artifacts, evidence for local specialization in manufacturing, estimated age of individuals in mortuary populations, osteological data, determination of sex of individuals in mortuary populations, mortuary data, social-ceremonial architecture, and historic records.

(2) Nature of social units: As above, with emphasis on age, sex, status and population size as determined by studies of mortuary data, osteological data, and analyses of sociotechnic assemblages.

(3) Emergency of non-egalitarian societies: Floor areas of houses, mortuary data, social-ceremonial features, age of archeological sites, surface areas of archeological sites, and types of archeological sites, with emphasis on patterns of intrasite and intersite wealth distribution.

(4) Relationship of social patterns to particular ethnic groups: Culturally-diagnostic artifacts, dietary remains, distinctive architecture or other features, characteristic modes of production or technology, art styles, age of archeological sites, features, archeological site locations, surface areas of archeological sites, types of archeological sites, mortuary patterns, and social-ceremonial features--all with temporal control.

(5) <u>Social prehistory</u>: All of the above types of data, as well as data regarding linguistic prehistory, with an emphasis on the sequence and age of changes.

The foregoing examples are intended to show how particular kinds of data can be linked to varied research objectives. The list of examples could be extended considerably, but it is detailed enough to confirm that Yosemite's archeological data can be used to address varied social, economic, technical, and demographic aspects of prehistory and history.

7: MANAGEMENT CONSIDERATIONS

7.0: Introduction

The previous chapters have identified research topics, reviewed the status of archeological knowledge, and indicated how different kinds of data may relate to particular research objectives in Yosemite. Collectively, these chapters form a general background for designing future archeological work in the park. A followup to this document would evaluate General Management Plan proposals and recommend archeological responses to those proposals insofar as they may affect cultural properties. The present chapter falls between the generalization of the research design and the specificity of the mitigation plan. Its purpose is to establish procedures to manage Yosemite's cultural resources, whether or not they are jeopardized by a park undertaking.

The goal of cultural resources management in Yosemite should be to optimize the preservation, recovery, and interpretation of archeological and historic data. Often this may be accomplished by preservation *in situ*; at times it will require salvage excavations, and frequently it will entail collecting limited data in the course of normal park planning, operation, maintenance, and use. Future archeological work in Yosemite will occur over a long period and will be done by various investigators. In this situation, comparability of data becomes crucial. Therefore, one aim of this chapter is to draw up guidelines to ensure that future archeological studies in Yosemite--whether a major excavation or a casual discovery--will yield comparable data.

Three principles should govern any management decisions that may affect historic and archeological properties: (1) preference should be given to the actions least damaging to cultural resources; (2) the most productive use should be made of all archeological data and remains; (3) archeological studies in Yosemite should entail the continuous, systematic, staged collection of data as part of an ongoing research and management planning process. Consistent with these principles, certain management procedures--ranging from avoidance to excavation--are outlined below (Sections 7.1-7.3).

7.1: Protection

As recommended by the Advisory Council on Historic Preservation, archeological resources should be protected in place whenever feasible (Advisory Council on Historic Preservation 1980:8). Avoidance of impact is the best way to satisfy historic preservation law. It may also be the least costly alternative because, in most cases, there is no need to spend funds on defining the research value of a protected site (Advisory Council on Historic Preservation 1980:8). Moreover, protection is often the approach most acceptable to Native Americans who feel that archeological properties should not be disturbed. Finally, many archeologists would agree that protection is a good management option because it maximizes data preservation and retains the greatest potential for future research (assuming that data recovery will be possible, if not required, at some future time). In sum, the protection of archeological resources may be the best way to manage them as judged by legal standards, economic factors, traditional Indian values, and long-term professional interests. Hence avoidance of archeological and historic properties (i.e., protection in place) is the priority recommendation for their management (cf. Fig. 7.1).

7.2: Continuous Data Gathering

Archeologists customarily think of survey, testing, excavation, and other "formal" procedures as their main data sources. But much useful information about cultural resources also can be gained in various non-archeological circumstances, provided that the information be retrieved and interpreted systematically.

One example of this "incidental" approach to data collection would be monitoring earth-disturbing activities (e.g., road and trail construction, trenching for utility lines, removal of old structures, drilling wells, digging postholes, etc.). Monitoring such activities affords an opportunity to record both natural and cultural deposits and, where the latter are present, to minimize impacts upon them. Monitoring should be done by the Park Archeologist or other qualified observer, who, at a minimum, will:

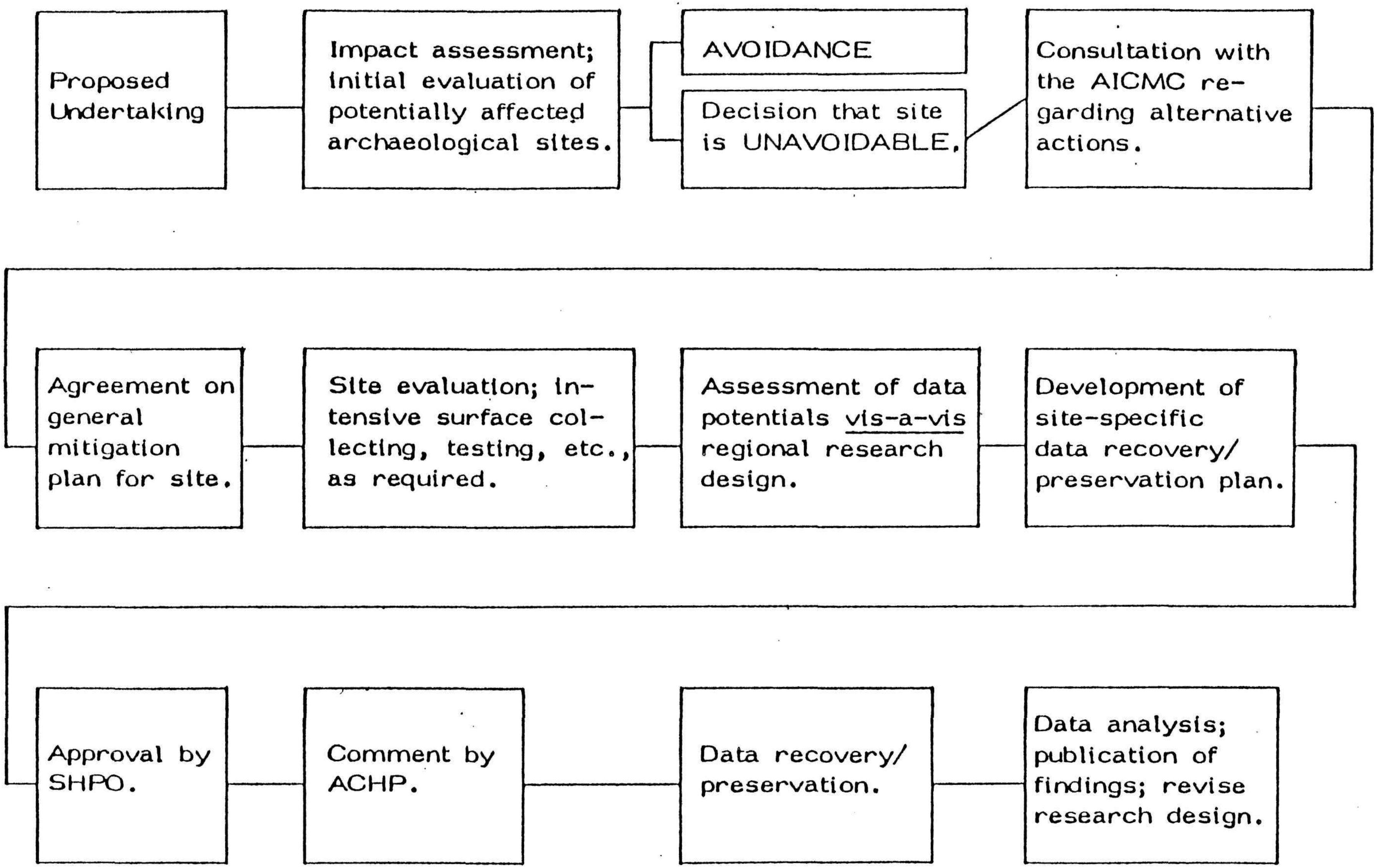


Fig. 7.1 Management Process for Cultural Resources That May be Affected by Park Undertakings.
AICMC = American Indian Council of Mariposa County.
SHPO = State Historic Preservation Officer.
ACHP = Advisory Council on Historic Preservation.

(1) Record the exact location of his/her observations and plot their locations on a 7.5' or 15' topographic map;

(2) Describe the nature and circumstances of the earth-disturbing activity;

(3) Describe in detail the observed soils in terms of their evident zonation, stratification, color, composition, density, and texture, with particular emphasis on any cultural remains that may be present;

(4) Photograph the overall work area and any important findings;

(5) Draw a sketch map of the study site showing the relationship (bearings and distance) between a permanent datum and all significant natural and cultural materials observed;

(6) Interpret the findings in the context of the Yosemite archeological research design and with the benefit of all available information;

(7) Systematically file the report, map, and photographs so that they will be preserved for convenient reference and study by others.

Such systematic recording will lead to the gradual accumulation of information about subsurface remains in various parts of Yosemite. In this regard, "negative" findings (i.e., the discovery of natural deposits only) are valuable too, not only because they can shed light on local geomorphic processes and past environmental conditions, but also because the confirmed absence of cultural remains at a given place may assist resource managers in their land-use planning. Monitoring, as an important source of incidental data, should be performed whenever earth-disturbing activities may affect cultural remains, particularly in the case of such undertakings as trenching, road grading, establishing new facilities or removing old ones, and any redirection of visitor traffic.

Archeological information also may be produced by incidental means other than monitoring. For instance, a fire may burn away dense brush or duff and expose archeological remains (e.g., structural remains or bedrock milling features) previously obscured. Similarly, natural erosion may expose human interments or other features. The systematic survey of recent burns, active erosional sites, and other naturally-disturbed places may result in the discovery of cultural remains that might not have been found otherwise.

One of the most common and potentially useful incidental sources of data takes the form of specimens and information provided by park staff and visitors. While casual collecting in Yosemite is not to be encouraged (indeed, it is illegal), it does occur, and when findings are brought forth, they should be recorded as part of a systematic documentation effort. Even single items, such as beads, porcelain sherds, or projectile points, are important because they may indicate something of the age and nature of cultural activity at the discovery site. Casual finds also may represent previously unknown archeological sites, and they should be investigated with that possibility in mind.

All isolated finds and single artifacts brought to the attention of park personnel should be recorded. The use of an Artifact Collection Record (Appendix 3) or similar form ensures the comparability of data regarding artifacts collected at different times and by various persons. Once completed, Artifact Collection Records should be filed as supplements to the appropriate Cultural Site Inventory Records (Appendix 3) or, if the artifact was an isolated find, filed separately. Appendix 3 shows the minimum information that should be recorded for each isolated find or single artifact. The locations of such discoveries also should be plotted on a 7.5' or 15' topographic base map.

Finally, useful data may be gathered incidentally whenever an archeological site is visited in the course of normal planning operations or inspection work. A concise record of any earth-disturbance, exposed artifacts or features, unusual vegetation patterns, or conditions requiring management action should be noted. All such observations should be entered on a Continuation of Data form to be appended to the original Cultural Site Inventory Record (Appendix 3). In this way, site recording will become a dynamic process rather than the result of a single visit, and a considerable amount of valuable data will be accumulated over a span of years.

7.3: Mitigation of Impacts

In the previous sections I have discussed how cultural resources may be preserved through *in situ* protection and through continuous, incidental retrieval of data. However, outright protection and/or gradual

data recovery are not always possible. Formal, intensive studies may be necessary in some cases. For example, whenever impacts to a significant archeological property are unavoidable, such impacts must be mitigated. But what constitutes "adequate mitigation?" As noted by the General Accounting Office (1979), there are no established criteria to indicate the type or amount of work that must be done to satisfy the law (much less to satisfy the profession) with regard to archeological properties affected by Federal undertakings. Yet the question of adequacy remains central to the problem of managing endangered cultural resources.

Selecting appropriate "mitigative" procedures is a complex process that must take into account the status of prior knowledge, the nature of the cultural resource and its data potentials, and both regional and local research contexts. Mitigation of adverse impacts may be achieved by various means, such as project redesign to minimize effects or data recovery (e.g., excavation, analysis, and publication). In the final accounting, "adequacy" must be measured against some sort of standard; a research design may be the best instrument for this purpose. In this light, an adequate "mitigation" program is one which realizes the data potentials of an archeological site as judged by a regional research design. When the data from the endangered site become redundant (i.e., when further work would yield diminishing returns) with regard to explicit research objectives, then the "mitigation" is adequate--or, more accurately, the data loss is reduced to an "acceptable" level. Since adequacy is defined in terms of research objectives and data potentials, it is not possible in most cases to determine *a priori* the minimum sample size that will be required for adequate mitigation. This problem is partly resolved by conducting "pre-salvage" investigations (Sec. 7.5) before excavating.

Finally, "mitigation" by data recovery (i.e., salvage or rescue archeology) may not entirely satisfy the concerns of Native Americans (Sec. 7.4). Nor is salvage work the best way to optimize data potentials in the long term. Nonetheless, while emphasizing once again that data recovery may be less advisable than protection *in situ*, there are many situations where salvage is the only feasible course of action. Sections 7.5 and 7.6 discuss those situations.

7.4: Native American Concerns

An important management goal is to ensure Native American participation in decisions affecting relevant cultural properties. This is especially true whenever resource disturbance and/or data recovery are contemplated. The Native American group most directly involved with Yosemite National Park is the American Indian Council of Mariposa County. The Council has expressed concern about archeological issues, advocating that:

> all archeological resources in the park should remain intact and undisturbed. Simply stated, this means that no archeological excavation or testing should take place. Instead, all construction and other activities which would potentially disturb archeological sites should be planned so as to eliminate the impacts on the sites and thus obviate the need for testing or excavation (American Indian Council of Mariposa County 1980: 2).

The council's position is largely compatible with the one taken here insofar as it advocates that archeological remains should not be disturbed by park activities. The avoidance of impacts is the ideal way to defer costly and time-consuming excavations. However, given the nature of park plans and operations, as well as Yosemite's archeological sensitivity, it seems likely that some archeological and historic resources may suffer adverse impacts as the General Management Plan is implemented and as intensive park use continues. In this light it is probable that salvage work will be necessary to mitigate <u>unavoidable</u> impacts at some sites. In those situations, it is imperative that local Native Americans (1) be informed of any National Park Service intent to disturb archeological sites, and (2) be invited to participate in decisions about how such sites are to be managed.

7.5: Resource Evaluation

Cultural resources must be evaluated before excavations (whether for salvage or "pure research" purposes) can be designed. Studies may be needed to assess the significance of properties, to evaluate data potentials, and to determine the nature, scope, and costs of needed work. More specifically, pre-excavation (or pre-salvage) evaluation may:

(1) Permit better definition of site boundaries so that planners can avoid or minimize impacts;

(2) Lead to reliable assessments of research potentials and significance;

(3) Provide a basis for estimating time and costs of needed data recovery work;

(4) Allow researchers to conduct later excavations in the places most likely to yield data relevant to their objectives; and

(5) Directly answer some relatively simple research aims, such as determining the age of deposits or types of materials preserved.

Thus, evaluation is an indispensible part of the management process and a prerequisite to excavations in salvage and other contexts. Most, or all, of the following studies may be needed to evaluate cultural properties where excavations are contemplated:

(1) Development of an evaluation plan to specify goals, field and analytic methods, kinds of data to be gathered, and the types of analyses to be performed. The evaluation plan should reflect coordination with local Native Americans.

(2) Examination of historic and ethnographic reports about the study area, with particular reference to accounts of activities and events at and near the site in question. Useful documents might include traditional ethnographies and modern ethnohistoric works, early diaries and journals, formal histories, government records of exploration, survey, military administration and early National Park Service management of Yosemite, mining, homestead, and land title records, Government Land Office plats, historic maps including old USGS maps, and historic photos (among them old black-and-white aerial photos). These sources of data, coupled with oral history and topical or locality-specific records, will provide the necessary background for field testing and for interpreting what is found.

(3) Accurate mapping of site boundaries, relief, and surface features as well as the relationship between the site and its natural setting. Normally, pre-excavation maps will be produced with the aid of instruments (e.g., alidade/plane table or theodolite transit) and will represent topographic (including cultural) features with small contour intervals (less than 50 cm). Maps should also depict a permanent datum

and show the location of all archeological sampling.

(4) Photographic documentation, including close-up recording of features, ground level site overviews, and remote sensing imagery such as aerial black-and-white, true color, and infra-red false color photography (cf. Lyons and Avery 1977).

(5) Pedologic studies sufficient to record and plot the horizontal distribution of significant variability in soil color, pH, phosphates, and nitrates. Methods of chemical and physical analyses of archeological deposits or anthrosols are discussed by Cook and Treganza (1947), Cook and Heizer (1962, 1965), and Limbrey (1975).

(6) Systematic auger boring to help determine vertical and horizontal site boundaries and to permit estimates of site volume. In my experience, a 2-inch (5 cm) barrel auger (not a screw type) works well to determine midden depth, but does not extract large enough volumes of earth to permit subtle differentiation between natural and cultural soils; for that, a larger auger may be necessary, but larger manual augers tend to require a great deal more effort to operate. Some researchers have found that power (screw type) augers as large as 16 inches (40 cm) in diameter may reveal a surprising amount of information about the nature of anthrosols and their contents (A. Treganza 1965: personal communication). Auger samples may or may not be screened, depending on the kinds of data being collected.

(7) Intensive, controlled surface collecting and mapping of artifacts, faunal remains, fire-fractured rock, and other cultural materials. This should be followed by analysis and comparison of <u>surface</u> patterns as indicated by the distribution of cultural remains, soil color, remote sensing, chemical testing, and surface features.

(8) Identification and mapping of possible <u>subsurface</u> features by means of: resistivity and/or proton magnetometry survey methods, auger boring, surface artifact and feature distribution patterns, systematic soil pH sampling and plotting, and observation of soil color and vegetation patterns. Provisional maps generated on the basis of these approaches must be confirmed by subsurface testing. None of these methods alone is a sufficiently reliable indicator of buried features.

(9) Manual excavation of test units (usually but not invariably 1 m x 1 m or 1 m x 2 m) to determine: site dimensions, nature and con-

dition of deposits, stratification, approximate age of deposits, and the kinds of preserved remains (e.g., housefloors, hearths, charcoal, pollen, animal bones, fire-fractured rock, and artifacts of bone, shell, chipped stone, etc.). In order to ensure comparability of data among testing projects conducted by different investigators, certain minimum categories of data should be collected or recorded. These are itemized on the Unit Level Record included at the end of this paper (cf. Appendix 3).

(10) Laboratory processing of all material remains and data. This includes such diverse housekeeping and research tasks as: cleaning, stabilizing, and cataloguing specimens; development of a typology and classification of artifacts; identification of all faunal, floral, and lithic materials recovered; qualitative and quantitative descriptions of all specimens; special analyses of obsidian (hydration measurement, trace element analysis), carbon (^{14}C dating), and other materials; comparative studies; interpretation of findings in light of research objectives; and preparation of a comprehensive report of methods and results.

(11) Identification of the regional research topics most appropriate for investigation at the site, given its data potentials.

(12) Development of a final plan for data recovery, along with a budget and time schedule. The plan should--indeed must--provide for work to meet Federal quality standards, to be undertaken by archeologists fully qualified and experienced in central Californian studies. The data recovery plan is subject to review and comment by the State Historic Preservation Officer and Advisory Council on Historic Places.

Evaluation thus proceeds from non-destructive to minimally-destructive techniques--from studies of surface remains to subsurface testing. This work should yield information relevant not only to excavation planning, but also to particular research topics. At least preliminary indications of the site's age, function, activity areas, major features, etc. may be gained by evaluative work. To ensure that the most useful, comparable data are acquired in the course of diverse investigations, the kinds of information discussed above and listed in Appendix 3, should be collected. More specialized data probably will be needed in any given study, but the cited categories represent the baseline or minimum to be collected. In this regard, it is advisable to: collect

and retain all samples of organic material that might be used for the radiocarbon dating of significant contexts, save all faunal remains, by unit and level, for zooarcheological studies, preserve a sample of obsidian (after debitage analysis) from each unit level for future hydration and trace element studies, perform micro-analyses of hearths, ovens, and soil samples to discover any floral or faunal remains, and collect and preserve for future study a small (approximately 1 liter) soil sample from each unit level excavated.

7.6: Data Recovery

Data recovery through salvage or rescue procedures may be required whenever a significant resource unavoidably will be disturbed. It is expected that most rescue work will consist of (1) excavations, following evaluative studies in subsurface deposits, and (2) controlled surface collecting of surface scatters. Where data recovery through excavation is contemplated, the following sequence of studies is likely to be appropriate:

(1) Evaluative studies, as described in Section 7.5.

(2) Formulation of a research design, including explicit goals, objectives, methods, and plans for data recovery (cf. Chapters 3-4 and 6).

(3) Excavations conducted according to the research design.

(4) Documentation of all findings by means of maps, plans, photographs, measured drawings, sketches, notes, and descriptive reports.

(5) Description and interpretation of soil variability in terms of type, color, texture, structure, permeability, induration, lithology, and chemistry, with particular reference to stratification and inferred pedogenic processes.

(6) Quantitative analysis of such constituents as unmodified bone, shell, ash, floral remains, fire-fractured rock, exotic rocks and minerals, and lithic debitage.

(7) Palynological research designed to: reconstruct paleoenvironmental conditions and their changes through time, determine the economic utilization of native plants by way of pollen in residues on food-processing implements, seek evidence of any cultigens which can be used

to date the advent of historic contacts (cf. Byrne _et al_. 1979a), and to ascertain the presence or absence of controlled burning and its effect on vegetative patterns.

(8) Dating of selected strata and features by means of radiocarbon, obsidian hydration, and other methods.

(9) Formal, technical, and functional analyses of artifacts; classification and description of specimens.

(10) Description and interpretation of findings; articulation of data with research objectives; publication of research results.

(11) Revision of regional research design in light of findings.

Hewitt (1977) has noted that defining the appropriate sample size will be a key problem in "mitigation" design. Having reviewed several papers on sampling in archeology--including a study of sample fractions at excavated sites in California--Hewitt (1977:9) concluded that a sample fraction of about 15 percent might be appropriate, on the average, for a data recovery program in Yosemite National Park. A similar figure was arrived at by Ammerman _et al_. (1978) based upon their simulated excavation of a Masai village in Kenya. Ammerman _et al_. found that reliable generalizations began to emerge with samples in the 3-10 percent range, that samples of 10-15 percent were generally representative, and that the point of diminishing returns would seem to occur at 15-20 percent. Both Hewitt and Ammerman _et al_. make the point that large numbers of small excavation units provide a more representative sample than small numbers of large units.

The approach to archeological sampling taken here is rather different than that of Hewitt or Ammerman _et al_. in that no ideal or average sample fraction is proposed. While an average sample of 15 percent may be representative of some phenomena, it surely cannot be applied in all cases. As noted previously with respect to "adequate mitigation," an appropriate sample is one which (a) permits valid generalizations to be made about the culture history of the site, and (b) allows major research questions to be addressed. Certain research objectives--e.g., defining the age of occupation--might easily be met with a 1 percent sample, while other objectives--e.g., reconstructing aspects of social organization from mortuary patterns--might require a 100 percent sample (see King 1976). Hence, the appropriate sample size is a function of

research questions and data potentials and cannot be fixed a priori as an arbitrary percentage.

Turning to the related matter of costs, the National Park Service (1978b) has published budget estimates for various types of archeological work (site identification, testing, excavation, etc.) that may be required to mitigate adverse effects of General Management Plan undertakings. Those budget projections should be viewed as conceptual approximations rather than as precise estimates for several reasons:

(1) General Management Plan development plans have not been refined or finalized; hence the extent of project impacts (and therefore the need for mitigative work) is unknown;

(2) Because evaluative studies (including testing) have not been done at jeopardized sites, their age, complexity, volume, and data potentials remain largely unknown;

(3) The cost of data recovery estimates per unit are surely too low as they are based upon unrealistic assumptions (discussed below); and

(4) The cost estimate of more than two millon dollars for "total data recovery" (National Park Service 1978b) could be greatly reduced if sites were avoided rather than impacted by developments.

The National Park Service data recovery cost rates were based upon the premises that: (1) excavations would proceed by 20 cm unit levels, (2) fieldworkers would process about 0.25 m/person-day, (3) excavators would be paid at the GS-4 rate, and (4) the Project Director would be salaried at the GS-9 rate. These assumptions must be reevaluated. First, excavation by 20 cm level is surely too gross; 10-cm levels have been the standard minimum throughout California for at least a decade. Second, the proposed rate of earthmoving is more than double the rate (0.12 m/person-day) achieved by experienced excavators from local universities working in the central Sierra during the 1970s (see Moratto 1976:515), and nearly four times the rate (0.07 m/person-day) recently acheived during a very large contract project in the same area (J. Fitting 1980: personal communication). A projected rate of 0.15 m/person-day would seem to represent the upper limit of feasability. Next, field technicians or excavators earn $45 to $75 per day, depending on qualifications and experience; the former rate, as an absolute minimum, is

equivalent to a GS-5 or GS-6 level salary. It is doubtful that a competent crew could be fielded if only GS-4 level wages were offered. Finally, Project Directors normally earn $120 to $150 per day (about 70 percent of a carpenter's salary or 50 percent of a plumber's wages). To expect a Project Director to work for about half of his/her regular income would be unrealistic.

These observations do not mean that the National Park Service budget totals should be increased, only that the per unit costs are too conservative. As noted above, total costs could be reduced substantially if sites were protected instead of impacted. However, in the event that impacts are unavoidable and data recovery efforts become necessary, the basis for budget projections must be reevaluated in light of current costs.

7.7: Further Management Recommendations

Beyond the archeological studies discussed above, the following management actions are recommended:

(1) The National Park Service should assign a permanent, full-time professional archeologist to Yosemite. The park archeologist would: serve as a liaison between the American Indian Council of Mariposa County and archeologists working in the park, supervise research, direct archeological survey activity, oversee resource preservation and stabilization, conduct studies of extant collections, provide archeological clearance for proposed undertakings, develop interpretive programs for park visitors, maintain archeological records, and prepare cultural resource management plans.

(2) In order to satisfy EO-11593 and to provide a solid data base for research and management planning, the intensive survey of the park should be completed (Napton 1980: personal communication). Priority should be given to areas of heavy use and proposed development.

(3) As part of the survey process, controlled surface collections should be made at all sites where surface disturbance is imminent or ongoing. The surface collecting should entail studies of the distribution, patterning, and cultural origin of obsidian scatters--the most

abundant and widespread type of archeological resource in the park (Napton 1980: personal communication).

(4) In coordination with the Curator of Collections, the park archeologist should establish an archeological data repository to include maps, site survey records, survey and excavation reports, catalogues, reports of analyses, and other data pertaining to the archeological resources of Yosemite. Priority should be given to the recording of all known site locations on 7.5' or 15' USGS quadrangles. Currently, Yosemite's archeological sites are plotted on a ½ in:1 mi map--a scale much too small to locate sites accurately for management or research purposes.

(5) The park should expand and modernize its curatorial facilities so as to accommodate materials that may be acquired through survey, excavation, or donation. The specimen repository should be designed as well to meet the curatorial needs of the Indian Cultural Museum.

(6) The park should develop a program to acquaint seasonal employees--particularly those who work in the backcountry--with the value of Yosemite's archeological resources and the need to preserve and protect those resources. Such training hopefully would diminish the illicit collecting and digging in remote areas of the park.

(7) Site 4-Tuo-22 in Pate Valley should be documented and nominated to the National Register of Historic Places. The site should be mapped; its rock art should be recorded by means of measured drawings and color photographs to scale, and small pigment samples should be collected for direct ^{14}C detection (see Banning and Pavlish 1978). Lastly, in coordination with the American Indian Council of Mariposa County and professional archeologists, steps should be taken to eliminate adverse impacts on the site being caused by visitation.

(8) Administrative procedures should be developed to ensure that archeological properties are not inadvertently impacted by park activities. In this regard, undertakings that may cause earth disturbance should be reviewed by the park archeologist (see Section 7.2). Lastly, any cultural resources subject to impacts should be monitored so as to maintain current information about their condition and to permit timely management actions.

(9) The National Park Service may wish to encourage research by external agencies (such as universities) at sites where: data are being lost unavoidably, the park has insufficient resources to mitigate the loss, the agency's research plan is compatible with park management and research goals, and the agency is qualified to perform the needed work.

BIBLIOGRAPHY

Adam, D. P.
1967 Late Pleistocene and Recent Palynology in the Central Sierra Nevada, California. In Quaternary Paleoecology. E. J. Cushing and H. E. Wright, eds. pp. 275-301. New Haven: Yale University Press.

Advisory Council on Historic Preservation
1980 (Draft) Supplementary Guidance: Treatment of Archeological Properties. On file, Advisory Council on Historic Preservation, Washington, D. C.

Aginsky, B. W.
1943 Culture Element Distribution, XXIV: Central Sierra. Berkeley: University of California Anthropological Records 8(4).

American Indian Council of Mariposa County
1980 Comments on Yosemite Management Plan. On file, Yosemite National Park.

Ammerman, A. M., D. P. Gifford, and A. Voorrips
1978 Towards an Evaluation of Sampling Strategies: Simulated Excavations of a Kenyan Pastoralist Site. In Simulation Studies in Archaeology. I. Hodder, ed. pp. 123-132. London: Cambridge University Press.

Anderson, K. M.
1976 Trip report: Yosemite National Park, January 29-31, 1976. On file, Western Archeological and Conservation Center, National Park Service, Tucson.

1980 Trip report: Sacramento and Yosemite. On file, Western Archeological and Conservation Center, National Park Service, Tucson.

Anderson, K. M., and N. W. Ackerly
1978 National Register of Historic Places nomination form, Foresta/Big Meadow Archeological District. On file, Heritage Conservation and Recreation Service, Washington, D. C.

Anderson, K. M., and C. Coe
1978 National Register of Historic Places nomination form, Hodgdon Meadow Archeological District. On file, Heritage Conservation and Recreation Service, Washington, D. C.

Anderson, K. M., and N. Hammack
n.d. National Register of Historic Places nomination form, Tuolumne Meadows Archeological District. On file, Heritage Conservation and Recreation Service, Washington, D. C.

Anderson, K. M., and M. Morehead
n.d. National Register of Historic Places nomination form, Yosemite Valley Archeological District. On file, Heritage Conservation and Recreation Service, Washington, D. C.

Anonymous
1857 The Grizzly Bear of California. Harpers New Monthly Magazine 15:816-826.

1976 Archeological report for Tuolumne Wild and Scenic River study. Ms. and map on file, Western Archeological and Conservation Center, National Park Service, Tucson.

1979 Auger results, Yosemite Village Mall. Ms. and auger logs on file, Western Archeological and Conservation Center, National Park Service, Tucson.

n.d.a National Register of Historic Places nomination form, Aspen Valley Archeological District. On file, Heritage Conservation and Recreation Service, Washington, D. C.

n.d.b National Register of Historic Places nomination form, Crane Flat Archeological District. On file, Heritage Conservation and Recreation Service, Washington, D. C.

n.d.c National Register of Historic Places nomination form, Eagle Peak Archeological District. On file, Heritage Conservation and Recreation Service, Washington, D. C.

n.d.d National Register of Historic Places nomination form, Hetch Hetchy Archeological District. On file, Heritage Conservation and Recreation Service, Washington, D. C.

n.d.e National Register of Historic Places nomination form, Mariposa Grove Archeological District. On file, Heritage Conservation and Recreation Service, Washington, D. C.

n.d.f National Register of Historic Places nomination form, Snow Creek/Mt. Watkins Archeological District. On file, Heritage Conservation and Recreation Service, Washington, D. C.

n.d.g National Register of Historic Places nomination form, White Wolf Archeological District. On file, Heritage Conservation and Recreation Service, Washington, D. C.

Antevs, E.
1953 On Division of the Last 20,000 Years. Berkeley: University of California Archaeological Survey Reports 22:5-8.

Ascher, R.
1959 A Prehistoric Population Estimate Using Midden Analysis and Two Population Models. Southwestern Journal of Anthropology 15:168-178.

Baker, L., D. Brose, M. Brown III, J. Costello, H. Crew, B. Keel, M. Moratto, and W. Weakly
1980 Archeological Research Design: New Melones Reservoir Project, California. Ms. on file, Heritage Conservation and Recreation Service, Washington, D. C.

Banning, E. B., and L. A. Pavlish
1978 Direct Detection in Radiocarbon Dating. Journal of Field Archaeology 5(4):480-483.

Barbour, M. G., and J. Major, eds.
1977 Terrestrial Vegetation of California. New York: John Wiley and Sons.

Barrett, S. A.
1908 The Geography and Dialects of the Miwok Indians. Berkeley: University of California Publications in American Archaeology and Ethnology 6:333-368.

1917 The Washo Indians. Milwaukee: Bulletin of the Public Museum of the City of Milwaukee 2(1).

Barrett, S. A., and E. W. Gifford
1933 Miwok Material Culture. Milwaukee: Bulletin of the Public Museum of the City of Milwaukee 2(4).

Bateman, P. C.
1974 Model for the Origin of Sierran Granites. California Geology 27(1):3-5.

Bateman, P. C., and C. Wahrhaftig
1966 Geology of the Sierra Nevada. San Francisco: California Division of Mines and Geology Bulletin 190:107-172.

Bates, C.
1975 A History of the Indian People of Mariposa County. Ms. No. 10,937 on file, Yosemite National Park.

Baumhoff, M. A.
1963 Ecological Determinants of Aboriginal California Populations. Berkeley: University of California Publications in American Archaeology and Ethnology 49:155-235.

Baumhoff, M. A., and R. F. Heizer
1965 Postglacial Climate and Archaeology in the Desert West. In The Quaternary of the United States. H. E. Wright and D. C. Frey, eds. pp. 697-707. Princeton: Princeton University Press.

Beals, R. L., and J. A. Hester
1960 A New Ecological Typology of California Indians. Philadelphia: Acts of the International Congress of Anthropological and Ethnological Sciences 5:411-419.

Bean, L. J.
1976 Social Organization in Native California. In Native Californians: A Theoretical Retrospective. L. J. Bean and T. C. Blackburn, eds. pp. 99-123. Ramona: Ballena Press.

Bean, L. J., and T. F. King, eds.
1974 ?Antap: California Indian Political and Economic Organization. Ramona: Ballena Press Anthropological Papers 2.

Bean, L. J., and H. W. Lawton
1973 Some Explanations for the Rise of Cultural Complexity in Native California with Comments on Proto-agriculture and Agriculture. Ramona: Ballena Press Anthropological Papers 1:i-xlvii.

Beatty, M. E.
1933a More Indian Caves Discovered. Yosemite: Yosemite Nature Notes 12:7-8.

1933b The Last Indian Cremation in Yosemite. Yosemite: Yosemite Nature Notes 12(9):89-90.

Bennett, K. A.
1973 The Indians of Point of Pines, Arizona: A Comparison of Their Physical Characteristics. Tucson: Anthropological Papers of the University of Arizona 23.

1975 Skeletal Remains from Mesa Verde National Park, Colorado. Washington, D. C.: National Park Service, Wetherill Mesa Studies, Publications in Archeology 7F.

Bennyhoff, J. A.
1953 High Altitude Occupation in the Yosemite National Park Region. Berkeley: University of California Archaeological Survey Reports 21:31-32.

1956 An Appraisal of the Archaeological Resources of Yosemite National Park. Berkeley: University of California Archaeological Survey Reports 34.

Bickel, P. McW., and A. G. King
1980 A Research Design for Anthropological Work in Redwood National Park, California. Ms. on file, Redwood National Park, Arcata.

Binford, L. R.
1962 Archaeology as Anthropology. American Antiquity 28(2):217-225.
1964 A Consideration of Archaeological Research Design. American Antiquity 29(4):425-441.

1967 Smudge Pits and Hide-smoking: The Use of Analogy in Archaeological Reasoning. American Antiquity 32(1):1-2.

1971 Mortuary Practices: Their Study and Their Potential. Society for American Archaeology Memoirs 25:6-29.

1972 An Archaeological Perspective. New York: Seminar Press.

Binford, L. R., and S. Binford, eds.
1968 New Perspectives in Archaeology. Chicago: Aldine.

Birkby, W. H.
1973 Report on the Excavation, Removal, and Re-Burial of a Human Skeleton in Yosemite National Park, June, 1973. Ms. on file, Arizona State Museum, University of Arizona, Tucson.

Birkeland, P. W., R. M. Burke, and J. C. Yount
1976 Preliminary Comments on Late Cenozoic Glaciations in the Sierra Nevada. In Quaternary Stratigraphy of North America. W. C. Mahaney, ed. pp. 282-295. New York: Dowden, Hutchingson and Ross.

Birman, J. H.
1964 Glacial Geology Across the Crest of the Sierra Nevada, California. Geological Society of America Special Paper 75.

Bohannan, P. J.
1963 Social Anthropology. New York: Holt, Rinehart, and Winston.

Bombin, M.
1980 Phytoliths and Past Human Activity. Paper delivered at the 45th Annual Meeting of the Society for American Archaeology, Philadelphia.

Breschini, G. S., and T. Haversat
n.d. Archaeological Overview of the Central Coast Counties. Ms. on file, Cabrillo College, Aptos.

Brim, J., and D. H. Spain
1974 Research Design in Anthropology. New York: Holt, Rinehart, and Winston.

Brose, D. S., M. R. Brown III, and W. F. Weakley
1979 Preliminary Research Design, New Melones Lake, California. On file, Heritage Conservation and Recreation Service, Washington, D. C.

Brothwell, D.
1963 Digging Up Bones. London: British Museum.

Brothwell, D., and A. T. Sandison
1967 Diseases in Antiquity. Springfield: Charles C. Thomas Publishers.

Bryant, V. M.
1977 Report of Preliminary Analysis of Pollen Samples from Archaeological Sites in Yosemite National Park. On file, Western Archeological and Conservation Center, National Park Service, Tucson.

Buckley, J. M.
1883 Two Weeks in the Yosemite and Vicinity. New York: Phillips and Hunt.

Bunnell, L. H.
1911 Discovery of the Yosemite and the Indian War of 1851. Los Angeles: G. W. Gerlicher. (Originally published 1880.)

Burcham, L. T.
1974 Fire and Chaparral before European Settlement. In Proceedings, Symposium on Living with the Chaparral. M. Rosenthal, ed. pp. 101-120. San Francisco: Sierra Club.

Byrne, R., D. Araki, and S. Peterson
1979a Pollen Evidence for Recent Vegetation Change in the New Melones Dam Area. Ms. on file, Department of Geography, University of California, Berkeley.

1979b Report on Pollen Analyses of a Cove from Tule Lake, Mono County, California. Ms. on file, Department of Geography, University of California, Berkeley.

Canouts, V.
1977 Problem Domains in the Santa Rosa Wash Project, Arizona. In Conservation Archaeology: A Guide for Cultural Resource Management. M. G. Schiffer and G. J. Gumerman, eds. pp. 135-143. New York: Academic Press.

Casteel, R. W., D. P. Adam, and J. D. Sims
1977 Late Pleistocene and Holocene Remains of Hysterocarpus traski (tule perch) from Clear Lake, California, and Inferred Holocene Temperature Fluctuations. Quaternary Research 7: 133-143.

Castillo, E. D.
1978 Petition to Congress on Behalf of the Yosemite Indians. The Journal of California Anthropology 5(2):271-277.

Caywood, L. R.
1954 An Indian Medicine Man's Grave Located. Yosemite Nature Notes 33(5):48-49.

Chang, K. C.
1968 Settlement Archaeology. Palo Alto: National Press.

Chappell, G.
1977 National Register of Historic Places nomination form, Tuolumne Meadow Historic Structures. On file, Heritage Conservation and Recreation Service, Washington, D. C.

Chappell, G., and B. Cox
1977 National Register of Historic Places nomination form, Yosemite Village Historic District. On file, Heritage Conservation and Recreation Service, Washington, D. C.

Clark, G.
1904 Indians of the Yosemite Valley and Vicinity, Their History, Customs, and Traditions. Ms. on file, Yosemite National Park.

Clark, J. D.
1960 Human Ecology During the Pleistocene and Later Times in Africa South of the Sahara. Current Anthropology 1:307-324.

Cohen, Y. A.
1968 Culture as Adaptation. In Man in Adaptation: The Cultural Present. Y. A. Cohen, ed. pp. 40-61. Chicago: Aldine.

Cook, S. F.
1955 The Aboriginal Population of the San Joaquin Valley, California. Berkeley: University of California Anthropological Records 16(2):31-74.

1972a Can Pottery Residues be Used as an Index to Population? Berkeley: Contributions of the University of California Archaeological Research Facility 14:17-40.

1972b Prehistoric Demography. McCaleb Module in Anthropology 16: 1-42. Reading, Massachusetts: Addison-Wesley.

Cook, S. F. (continued)
1976 The Population of the California Indians, 1769-1970. Berkeley: University of California Press.

Cook, S. F., and R. F. Heizer
1962 Chemical and Physical Analysis of the Hotchkiss Site (CCo-138). Berkeley: University of California Archeological Survey Reports 57:1-24.

1965 The Quantitative Approach to the Relation Between Population and Settlement Size. Berkeley: University of California Archaeological Survey Reports 64:1-97.

1968 Relationships Among Houses, Settlement Areas, and Population in Aboriginal California. In Settlement Archaeology. K. C. Chang, ed. pp. 79-116. Palo Alto: National Press.

Cook, S. F., and A. E. Treganza
1947 The Quantitative Investigation of Aboriginal Sites: Comparative Physical and Chemical Analysis of Two California Indian Mounds. American Antiquity 13(2):135-141.

Coombs, G. B.
1979a The Archeology of the Northeast Mojave Desert. Cultural Resource Publications, Archeology. Bureau of Land Management, California area.

1979b The Archeology of the Western Mojave (Desert). Cultural Resource Publications, Archeology. Bureau of Land Management, California area.

Curry, R. R.
1969 Holocene Climate and Glacial History of the Central Sierra Nevada, California. Geological Society of America Special Paper 123:1-47.

1971 Glacial and Pleistocene History of the Mammoth Lakes Sierra, California--a Geologic Guidebook. Missoula: University of Montana, Geological Series Publications 11.

Curtis, E. S.
1924 The North American Indian. Norwood, Massachusetts: privately printed.

Danziger, S.
1980 The Yosemite General Management Plan and Its Impact on the Park's Archeology. Yosemite 47(8).

Davis, E. L., and R. Shutler, Jr.
1969 Recent Discoveries of Fluted Points in California and Nevada. Carson City: Nevada State Museum Anthropological Papers 14.

Davis, J. T.
1961 Trade Routes and Economic Exchange Among the Indians of California. Berkeley: University of California Archaeological Survey Reports 54:1-71.

D'Azevedo, W. L., ed.
1963 The Washo Indians of California and Nevada. Salt Lake City: University of Utah Anthropological Papers 67.

Deetz, J.
1965 The Dynamics of Stylistic Change in Arikara Ceramics. Urbana: Illinois Studies in Anthropology 4.

Divale, W., and M. Harris
1976 Population, Warfare, and the Male Supremacist Complex. American Anthropologist 78(3):521-538.

Dobyns, H. F.
1966 Estimating Aboriginal American Population: An Appraisal of Techniques with a New Hemisphere Estimate. Current Anthropology 7(4):395-416.

Downs, J. F.
1966 The Two Worlds of the Washo. New York: Holt, Rinehart, and Winston.

Dumond, D.
1977 Science in Archaeology. The Saints go Marching in. American Antiquity 42(3):330-349.

Earle, T. K., and J. E. Ericson
1977 Exchange Systems in Prehistory. New York: Academic Press.

Elsasser, A. B.
1958 Aboriginal Use of Restrictive Sierran Environments. Berkeley: University of California Archaeological Survey Reports 41.

1960 The Archaeology of the Sierra Nevada in California and Nevada. Berkeley: University of California Archaeological Survey Reports 51.

1966 An Archaeological Assessment of Sequoia and Kings Canyon National Parks, California. On file, Western Archeological and Conservation Center, National Park Service, Tucson.

Elston, R., J. O. Davis, A. Leventhal, and C. Covington
1977 The Archaeology of the Tahoe Reach of the Truckee River. Reno: North Division of the Nevada Archaeological Survey, University of Nevada.

Farquhar, F.
1966 History of the Sierra Nevada. Berkeley: University of California Press.

Fenenga, F. F.
1973 Archaeological Work in the Hidden Valley Reservoir Area, Madera County, California. Ms. on file, Western Archeological and Conservation Center, National Park Service, Tucson.

Fitting, J. E.
1969 Settlement Analysis in the Great Lakes Region. Southwestern Journal of Anthropology 23(4):360-377.

Fitting, J. E., J. Costello, and H. Crew, with constributions by many others
1979 Cultural Resources Mitigation (sic) Program, New Melones Lake Project, Phase I. Ms. on file, Corps of Engineers, Sacramento.

Fitzwater, R. J.
1962 Final Report on Two Seasons of Excavations at El Portal, Mariposa County, California. Los Angeles: University of California Archaeological Survey Annual Report 4:234-285.

1964 Excavations at Crane Flat, Yosemite National Park. Ms. on file, Western Region Office, National Park Service, San Francisco.

1968a Excavations at Crane Flat, Yosemite National Park. Los Angeles: University of California Archaeological Survey Annual Report 10:276-302.

1968b Excavations at the Hodgdon Ranch Site (Tuo-236). Los Angeles: University of California Archaeological Survey Annual Report 10:303-314.

Fitzwater, R. J., and M. Van Vlissingen
1960 Preliminary Report on an Archaeological Site at El Portal, California. Los Angeles: University of California Archaeological Survey Annual Report 2:155-200.

Ford, R. I.
1979 Paleoethnobotany in American Archaeology. In Advances in Archaeological Method and Theory 2. M. B. Schiffer, ed. pp. 286-336. New York: Academic Press.

Fredrickson, D. A.
1974 Social Change in Prehistory. A Central California Example. In Antap: California Indian Political and Economic Organization. L. J. Bean and T. F. King, eds. pp. 2:57-73. Ramona: Ballena Press Anthropological Papers.

Fritz, J. M., and C. Smith
1978 Archaeological Overview of Pinnacles National Monument, San Benito County, California. Ms. on file, Western Archeological and Conservation Center, National Park Service, Tucson.

Gabel, C.
1967 Analysis of Prehistoric Economic Patterns. New York: Holt, Rinehart, and Winston.

Gayton, A. H.
1929 Yokuts and Western Mono Pottery Making. Berkeley: University of California Publications in American Archaeology and Ethnology 24(3):239-251.

1948 Yokuts and Western Mono Ethnography, II: Northern Foothill Yokuts and Western Mono. Berkeley: University of California Anthropological Records 19(2):143-302.

Gehr, E., with L. Conton, D. Parrella, and J. Scott
1979 Cultural Resources Survey of Range 31E, Tule River Indian Reservation. Ms. on file, Western Archeological and Conservation Center, National Park Service, Tucson.

General Accounting Office
1979 Uncertainties over Federal Requirements for Archeological Preservation at New Melones Dam in California. On file, General Accounting Office, Washington, D. C.

Gibbens, R. P., and H. F. Heady
1964 The Influence of Modern Man on the Vegetation of Yosemite Valley. California Agricultural Experimental Station, Extension Service Manual 36:1-44.

Gifford, E. W.
1916a Dichotomous Social Organization in South Central California. Berkeley: University of California Publications in American Archaeology and Ethnology 11(5):291-296.

1916b Miwok Moieties. Berkeley: University of California Publications in American Archaeology and Ethnology 12:139-194.

1917 Northern and Central (Sierra) Miwok. Ms. No. 203 on file, University Archives, Bancroft Library, University of California, Berkeley.

1951 Miwok Lineages and the Political Unit in Aboriginal California. In The California Indians: A Source Book. R. F. Heizer and M. A. Whipple, eds. pp. 326-335. Berkeley: University of California Press.

Gifford, E. W. (continued)
1955 Central Miwok Ceremonies. Berkeley: University of California Anthropological Records 14(4).

Glassow, M. A.
1977a An Archaeological Overview of the Northern Channel Islands, California. Ms. on file, Western Archeological and Conservation Center, National Park Service, Tucson.

1977b Issues in Evaluating the Significance of Archaeological Resources. American Antiquity 42(3):413-420.

1978 The Concept of Carrying Capacity in the Study of Culture Process. In Advances in Archaeological Method and Theory 1. M. B. Schiffer, ed. pp. 31-48. New York: Academic Press.

Goodyear, A. C.
1976 Current and Future Developments in Archaeological Theory Building Within the Contract Framework. Columbia: University of South Carolina, Institute of Archaeology and Anthropology, Research Manuscript Series 101.

1977 Research Design in Highway Archaeology: An Example from South Carolina. In Conservation Archaeology: A Guide for Cultural Resource Management Studies. M. B. Schiffer and G. J. Gumerman, eds. pp. 157-165. New York: Academic Press.

Gould, S. J., and N. Eldridge
1977 Punctuated Equilibria: The Tempo and Mode of Evolution Reconsidered. Paleobiology 3:115-151.

Grayson, D. K.
1979 On the Quantification of Vertebrate Archaeofaunas. In Advances in Archaeological Method and Theory 2. M. B. Schiffer, ed. pp. 199-237. New York: Academic Press.

Green, E. L. (compiler)
1973 In Search of Man. Boston: Little Brown.

Griffin, J. R.
1977 Oak Woodland. In Terrestrial Vegetation of California. M. Barbour and J. Major, eds. pp. 383-416. New York: John Whiley and Sons.

Grinnell, J., and T. I. Storer
1924 Animal Life in the Yosemite. Berkeley: University of California Press.

Grosscup, G. L.
1954 An Archaeological Survey of Yosemite National Park, 1954. Ms. on file, Western Region Office, National Park Service, San Francisco.

Hall, A. L.
1978 Ethnohistorical Studies of the Central Sierra Miwok, 1800-1900. Unpublished M.A. thesis, Department of Anthropology, San Francisco State University.

Hammack, N., and K. M. Anderson
1978 National Register of Historic Places nomination form, Wawona Archeological District. On file, Heritage Conservation and Recreation Service, Washington, D. C.

Hanes, T. L.
1977 Chaparral. In Terrestrial Vegetation of California. M. G. Barbour and J. Major, eds. pp. 417-470. New York: John Wiley and Sons.

Harden, E. W.
1908 Indian Pictographs in Pate Valley. Sierra Club Bulletin 6(4):258-259.

Hardesty, D. L.
1977 Ecological Anthropology. New York: John Wiley and Sons.

Harris, M.
1979 Cultural Materialism: The Struggle for a Science of Culture. New York: Random House.

Hart, L. S.
1975 National Register of Historic Places nomination form, Lemon Orchard. On file, Heritage Conservation and Recreation Service, Washington, D. C.

1976a National Register of Historic Places nomination form, McGurk Cabin. On file, Heritage Conservation and Recreation Service, Washington, D. C.

1976b National Register of Historic Places nomination form, Old Coulterville Road and Trail. On file, Heritage Conservation and Recreation Service, Washington, D. C.

1977 National Register of Historic Places nomination form, Bridalveil Meadow Historic Site. On file, Heritage Conservation and Recreation Service, Washington, D. C.

Hart, L. S., and M. A. Wilson
1976a National Register of Historic Places nomination form, George Anderson Cabin. On file, Heritage Conservation and Recreation Service, Washington, D. C.

1976b National Register of Historic Places nomination form, Golden Crown Mine. On file, Heritage Conservation and Recreation Service, Washington, D. C.

Hart, L. S., and M. A. Wilson (continued)
1976c National Register of Historic Places nomination form, Great Sierra Mine. On file, Heritage Conservation and Recreation Service, Washington, D. C.

1976d National Register of Historic Places nomination form, Hodgdon Homestead Cabin. On file, Heritage Conservation and Recreation Service, Washington, D. C.

1976e National Register of Historic Places nomination form, McCauley Barn/Meyer Barns. On file, Heritage Conservation and Recreation Service, Washington, D. C.

1979 National Register of Historic Places nomination form, Camp Curry Archeological District. On file, Heritage Conservation and Recreation Service, Washington, D. C.

Hartesveldt, R. J.
1953 Indian Sites Study Adds to Yosemite's Story. Yosemite Nature Notes 32:53-59.

Hassan, F. A.
1978 Demographic Archaeology. In Advances in Archaeological Method and Theory 1. M. B. Schiffer, ed. pp. 49-103. New York: Academic Press.

Heizer, R. F.
1960 Physical Analysis of Habitation Residues. Viking Fund Publications in Anthropology 28:93-157.

1964 The Western Coast of North America. In Prehistoric Man in the New World. J. D. Jennings and E. Norbeck, eds. pp. 117-148. Chicago: University of Chicago Press.

1978 Trade and Trails. In California: Handbook of North American Indians 8. R. F. Heizer, ed. pp. 690-693. Washington, D. C.: Smithsonian Institution.

Heizer, R. F., and T. R. Hester
1978 Great Basin Projectile Points: Forms and Chronology. Socoro: Ballena Press Publications in Archaeology, Ethnology and History 10.

Heizer, R. F., and A. E. Treganza
1944 Mines and Quarries of the Indians of California. Sacramento: California Journal of Mines and Geology 40(3):291-359.

Hewitt, J. M.
1976a Chemical Analysis of Archeological Soils in Yosemite National Park, California. Ms. on file, Western Archeological and Conservation Center, National Park Service, Tucson.

Hewitt, J. M. (continued)
1976b Trip report, Yosemite and Sequoia National Parks, October 17-26, 1976. On file, Western Archeological and Conservation Center, National Park Service, Tucson.

1977 Archeological Testing and Salvage Cost Estimates for MRP-181, 182, and 183, El Portal, Yosemite National Park. Ms. on file, Western Archeological and Conservation Center, National Park Service, Tucson.

Hill, J. A.
1970 Broken K Pueblo: Prehistoric Social Organization in the American Southwest. Tucson: University of Arizona Anthropological Papers 18.

Hill, M.
1975 Geology of the Sierra Nevada. Berkeley: University of California Press.

Hole, F., and R. F. Heizer
1973 An Introduction to Prehistoric Archaeology. New York: Holt, Rinehart, and Winston.

House, J. H., and M. B. Schiffer
1975 Significance of the Archaeological Resources of the Cache River Basin. Arkansas Archaeological Survey Research Series 8:163-186.

Howells, W. W.
1960 Estimating Population Numbers Through Archaeological and Skeletal Remains. Viking Fund Publications in Anthropology 28:158-185.

Hutchings, J. M.
1886 In the Heart of the Sierras. Oakland: Pacific Press.

Jackson, T. L.
1974 The Economics of Obsidian in Central California Prehistory. Unpublished M. A. thesis, Department of Anthropology, San Francisco State University.

1976 Report of the Middle Eel Planning Unit Archeological Survey. Ms. on file, U.S. Forest Service, San Francisco.

1979 Technical proposal, Cultural Resource Survey of Three Timber Sales, Sierra National Forest. On file, Sierra National Forest, Fresno.

Jochim, M. A.
1976 Hunter Gatherer Subsistence and Settlement: A Predictive Model. New York: Academic Press.

Johnson, D. L.
1977 The Late Quaternary Climate of Coastal California: Evidence for an Ice Age Refugium. Quaternary Research 8:154-179.

Johnson, L., Jr.
1972 Problems in "Avant-garde" Archaeology. American Anthropologist 74(3):366-377.

Kelly, J. F.
1974 China Diggings, CA-Mad-173: An Archaeological Site in the Upper Sonoran Life Zone of the Sierra Nevada. Unpublished M. A. thesis, Department of Anthropology, California State University, Long Beach.

Kelly, R.
1975 Trip report, Yosemite National Park, May 8-12, 1975. On file, Western Region Office, National Park Service, San Francisco.

Kilgore, B. M., and D. Taylor
1979 Fire History of a Sequoia-Mixed Conifer Forest. Ecology 60 (1):129-142.

King, C. D., and L. B. King
1973 General Research Design: Bay Area Archaeological Cooperative. In The Southern Santa Clara Valley: A General Plan for Archaeology, Appendix III. T. F. King and P. P. Hickman, eds. San Francisco: Treganza Anthropology Museum.

King. L. B.
1969 The Medea Creek Cemetery (LAn-243): An Investigation of Social Organization from Mortuary Practices. Los Angeles: University of California Archaeological Survey Annual Reports 11:23-68.

King. T. F.
1968 The Archaeology of the Schwabacher Site, 4-Mad-117. San Francisco: Treganza Anthropology Museum Papers 4(2).

1970 Archaeological Problems and Research in the Coast Miwok Area. San Francisco: Treganza Anthropology Museum Papers 6: 275-288.

1975 Fifty Years of Archeology in the California Desert: An Archeological Overview of Joshua Tree National Monument. Ms. on file, Western Archeological and Conservation Center, National Park Service, Tucson.

1976 Political Differentiation Among Hunter-Gatherers: An Archaeological Test. Unpublished Ph.D. dissertation, Department of Anthropology, University of California, Riverside.

King, T. F., and P. P. Hickman
1973 The Southern Santa Clara Valley: A General Plan for Archaeology. San Francisco: Treganza Anthropology Museum.

Knierimen, I.
1967 Unrecorded Central Miwok Sites in Yosemite National Park. Ms. on file, Yosemite National Park.

Kowta, M.
1975 Research Design: Northeastern California. Ms. on file, Department of Anthropology, California State University, Chico.

Kroeber, A. L.
1921 Indians of Yosemite. In Handbook of Yosemite National Park. A. F. Hall, ed. pp. 51-76. New York: G. P. Putnam's Sons.

1925 Handbook of the Indians of California. Washington, D. C.: Bureau of American Ethnology Bulletin 78.

1939 Cultural and Natural Areas of Native North America. Berkeley: University of California Publications in American Archaeology and Ethnology 38.

Krogman, M.
1962 The Human Skeleton in Forensic Medicine. Springfield, Illinois: Charles C. Thomas.

Kushner, G.
1970 A Consideration of Some Processual Designs for Archaeology as Anthropology. American Antiquity 35(2):125-132.

LaJeunesse, R. M.
1972 A Morphological Investigation of a Prehistoric Population from the Southern Sierra Nevada of California. Unpublished M. A. thesis, Department of Anthropology, San Francisco State University.

1979 Report on the Osteological Analysis of an Aboriginal Human Skeleton from Yosemite National Park, September, 1979. Ms. on file, Western Archeological and Conservation Center, National Park Service, Tucson.

LaMarche, V. C., Jr.
1973 Holocene Climatic Variations Inferred from Treeline Fluctuations in the White Mountains, California. Quaternary Research 3:632-660.

1974 Paleoclimatic Inferences from Long Tree-ring Records. Science 183:1043-1048.

LaMarche, V. C., Jr. (continued)
1978 Tree-ring Evidence of Past Climatic Variability. Nature 276:334-338.

LaMarche, V. C., Jr., C. W. Ferguson, and W. B. Woolfenden
1974 Holocene Climatic Correlations in the Western United States: Tree-ring and Glacial Evidence. AMQUA Abstracts.

LaMarche, V. C., Jr., and H. A. Mooney
1967 Altithermal Timberline Advance in the Western United States. Nature 213:980-982.

Latta, F. F.
1977 Handbook of the Yokuts Indians (second edition). Santa Cruz: Bear State Books.

Layton, T. N.
1979 Archaeology and Paleo-ecology of Pluvial Lake Parman, Northwestern Great Basin. Los Angeles: Journal of New World Archaeology 3(3):41-56.

Levy, R.
1978 Eastern Miwok. In California: Handbook of North American Indians 8. R. F. Heizer, ed. pp. 398-413. Washington, D. C.: Smithsonian Institution.

Lewis, H. T.
1973 Patterns of Indian Burning in California: Ecology and Ethnohistory. Ramona: Ballena Press Anthropological Papers 1: 1-101.

Limbrey, S.
1975 Soil Science and Archaeology. New York: Academic Press.

Longacre, W.
1970 Archaeology as Anthropology, A Case Study. Tucson: University of Arizona Anthropological Papers 17.

Lyons, T. R., and T. L. Avery
1977 Remote Sensing: A Handbook for Archeologists and Cultural Resource Managers. Washington, D. C.: National Park Service.

Martin, P. S.
1972 The Revolution in Archaeology. In Contemporary Archaeology. M. P. Leone, ed. pp. 5-13. Carbondale: Southern Illinois University Press.

Matthes, F. E.
1930 Geologic History of the Yosemite Valley. Washington, D. C.: U.S. Geological Survey Professional Papers 160.

Matthes, F. E. (continued)
1950 The Incomparable Valley: A Geologic Interpretation of the Yosemite. F. Fryxell, ed. Berkeley: University of California Press.

McGuire, K. R., and A. P. Garfinkle (eds.)
1979 Archaeological Investigations in the Southern Sierra Nevada: The Bear Mountain Segment of the Pacific Crest Trail. Ms. on file, Bureau of Land Management, Bakersfield.

McIntyre, R.
n.d. Unpublished notes and map showing location of archeological sites in Yosemite National Park. On file, Yosemite National Park.

McKusick, M. B.
n.d. Archaeological site inventory form for 4-MRP-251. On file, Yosemite National Park.

McLellan, P. M.
1952 The 7000-Year Mistake. Yosemite: Yosemite Nature Notes 31 (7):110-115.

McMillan, B., M. Grady, and W. Lipe (compilers)
1977 Cultural Resources Management. In The Management of Archaeological Resources: The Airlie House Report. C. R. McGimsey and H. A. Davis, eds. pp. 25-63. Washington, D. C.: The Society for American Archaeology.

Mehringer, P. J., Jr.
1977 Great Basin Late Quaternary Environments and Chronology. Reno: Desert Research Institute Publications in the Social Sciences 12:113-168.

Meggers, B. M.
1956 Functional and Evolutionary Implications of Community Patterning. Society for American Archaeology Memoirs 11:130-155.

Merriam, C. H.
1917 Indian Village and Camp Sites in Yosemite Valley. San Francisco: Sierra Club Bulletin 10:202-209.

1955 Studies of California Indians. Berkeley: University of California Press.

1967 Ethnographic Notes on California Indian Tribes, III: Central California Indian Tribes. Berkeley: University of California Archaeological Survey Reports 68(3).

Moffitt, K., and K. Anderson

1979 National Register of Historic Places nomination form, El Portal Archeological District. On file, Heritage Conservation and Recreation Service, Washington, D. C.

Moratto, M. J.

1968 A Survey of the Archaeological Resources of the Buchanan Reservoir Area, Madera County, California. San Francisco: San Francisco State College Occasional Papers in Anthropology 4(1):1-121.

1972a A Study of Prehistory in the Southern Sierra Nevada Foothills, California. Unpublished Ph.D. dissertation, Departemtn of Anthropology, University of Oregon, Eugene.

1972b Paleodemography in the Western Sierra Nevada, California. Manuscript. Paper presented at the annual meeting of the Society for American Archaeology, Miami.

1973 A Survey of Cultural Resources in and Near Redwood National Park, California. Ms. on file, Western Archeological and Conservation Center, National Park Service, Tucson.

1974 An Archaeological Overview of the New Melones Reservoir Project Area, Calaveras and Tuolumne Counties, California. Report to the National Park Service, San Francisco.

1976 New Melones Archaeological Project, Stanislaus River, Calaveras and Tuolumne Counties, California: Phase VI. San Francisco: Conservation Archaeology Papers 3:1-574.

1977 Research Prospects: New Melones Archaeological Project. In Conservation Archaeology: A Guide for Cultural Resource Management Studies. M. B. Schiffer and G. J. Gumerman, eds. pp. 401-411. New York: Academic Press.

1979 Comments on endangered cultural resources in the New Melones Dam/Reservoir project area. Report on file, Joint Review Committee, New Melones archaeological project, Sacramento.

n.d. California Archaeology. New York: Academic Press. (In preparation.)

Moratto, M. J., and R. E. Kelly

1978 Optimizing Strategies for Evaluating Archaeological Significance. In Advances in Archaeological Method and Theory 1. M. B. Schiffer, ed. pp. 1-30. New York: Academic Press.

Moratto, M. J., T. F. King, and W. B. Woolfenden

1978 Archaeology and California's Climate. The Journal of California Anthropology 5(2):147-161.

Moratto, M. J., and L. M. Riley
1980 Balsam Meadow: Archaeological Testing at Six Sites in Eastern Fresno County, California. Report to Southern California Edison Company, Rosemead.

Moratto, M. J., with L. M. Riley
1974 An Archeological Overview of the New Melones Reservoir Project Area, Calaveras and Tuolumne Counties, California. Ms. on file, Western Archeological and Conservation Center, National Park Service, Tucson.

Mueller, J. W.
1975 Sampling in Archeology. Tucson: University of Arizona Press.

Muir, J.
1898 Among the Animals of Yosemite. Atlantic Monthly 82:617-622.

Muñoz, J.
1975a The Ethnocartography of the Southern Sierra Foothills and the Fresno Indian Reservation. Paper presented at the annual meeting of the Society for California Archaeology, Santa Cruz.

1975b The Indian Population of the Fresno River Reservation, 1850-1860. Ms. on file, Department of Anthropology, California State University, Long Beach.

Napton, L. K.
1974a Archeological Research in Yosemite National Park, California: Review and Evaluation of Reconnaissance, Survey, Testing, and Excavation. Ms. on file, Western Archeological and Conservation Center, National Park Service, Tucson.

1974b Field Report - Yosemite and Badger Sewerlines. Letter report on file, Western Archeological and Conservation Center, National Park Service, Tucson.

1978 Archeological Overview of Yosemite National Park, California. Ms. on file, Western Archeological and Conservation Center, National Park Service, Tucson.

Napton, L. K., and A. D. Albee
1974 Archeological Survey in Yosemite National Park, California: DCP Areas, 1974. Ms. on file, Western Archeological and Conservation Center, National Park Service, Tucson.

Napton, L. K., A. D. Albee, and E. A. Greathouse
1974a Archeological Survey in Yosemite National Park, California: Wawona (Parts 1-2). Ms. on file, Western Archeological and Conservation Center, National Park Service, Tucson.

Napton, L. K., A. D. Albee, and E. A. Greathouse (continued)
1974b Archeological Survey in Yosemite National Park, California: Yosemite Valley (Parts 1-2). Ms. on file, Western Archeological and Conservation Center, National Park Service, Tucson.

Napton, L. K., and E. A. Greathouse
1976 Archeological Investigations in Yosemite National Park, California: Part 1, Project Summary, CSC/IAR 1976. Ms. on file, Western Archeological and Conservation Center, National Park Service, Tucson.

Naroll, R.
1962 Floor Area and Settlement Population. American Antiquity 27:587-589.

National Park Service
1978a Draft Environmental Statement, General Management Plan, Yosemite National Park, California. On file, Denver Service Center, National Park Service.

1978b General Management Plan, Cultural Resources Management. On file, Yosemite National Park.

1979 Computer-generated printout of data regarding the slope and vegetation association of archeological sites in Yosemite National Park. On file, Yosemite National Park.

1980a Environmental Assessment, Yosemite National Park, Redesign of Yosemite Village Mall. Ms. on file, Denver Service Center, National Park Service.

1980b General Management Plan, Yosemite National Park. On file, Yosemite National Park.

1980c General Management Plan Changes. On file, Yosemite National Park.

1980d Task Directive, Yosemite National Park, Package 313: El Portal, Comprehensive Design and Preliminary Design. On file, Yosemite National Park.

1980e Untitled budget projections and construction program plans for Yosemite National Park, FY-1981 to FY-1989. On file, Yosemite National Park.

Nelson, N. C.
1910 The Ellis Landing Shellmound. Berkeley: University of California Publications in American Archaeology and Ethnology 7:357-426.

Nystuen, J. D.
1968 Identification of Some Fundamental Spatial Concepts. In Spatial Analysis: A Reader in Statistical Geography. B. J. Berry and D. F. Marbles, eds. pp. 35-41. Englewood Cliffs: Prentice-Hall.

Oakeshott, G. B.
1971 California's Changing Landscapes. New York: McGraw-Hill.

Plog, F.
1975 Demographic Studies in Southwestern Prehistory. Society for American Archaeology Memoirs 30:94-103.

Powers, S.
1976 Tribes of California. Berkeley: University of California Press. (Originally published 1877.)

Presnall, C. C.
1930 Indian Rancherias Found. Yosemite: Yosemite Nature Notes 9(5):33-55.

Purves, S.
1975a An Archeological Survey of Proposed Development Areas in Yosemite National Park. Ms. on file, Western Archeological and Conservation Center, National Park Service, Tucson.

1975b Trip report, Sequoia-Kings Canyon National Parks and Yosemite National Park, September 15-26, 1975. On file, Western Archeological and Conservation Center, National Park Service, Tucson.

Raab, L. M.
1977 The Santa Rosa Wash Project: Notes on Archaeological Research Design Under Contract. In Conservation Archaeology: A Guide for Cultural Resource Management Studies. M. B. Schiffer and G. J. Gumerman, eds. pp. 167-182. New York: Academic Press.

Ragir, S. R.
1972 The Early Horizon in Central California Prehistory. Berkeley: Contributions of the University of California Archaeological Research Facility 15.

Rasson, J.
1966 Excavations at Ahwahnee, Yosemite National Park, California. Los Angeles: University of California Archaeological Survey Annual Reports 8:165-184.

Redman, C. R.
1978 Social Archaeology. New York: Academic Press.

Renfrew, C.
1973 The Explanation of Culture Change: Models in Prehistory. London: Duckworth.

Reynolds, R. D.
1959 Effects of Natural Fires and Aboriginal Burning Upon the Forest of the Central Sierra Nevada. Unpublished M.A. thesis, Department of Anthropology, University of California, Berkeley.

Riddell, F. A.
1969 Aspects of Miwok Indian Culture. Report by the Central California Archaeological Foundation to United States Land, Inc., Sacramento.

Riddell, F. A., N. Wilson, W. J. Beeson, D. G. Wood, and W. E. Pritchard
1969 Prospectus for Additional Investigations at the New Melones Reservoir Project, Stanislaus River, California. Ms. on file, Western Region Office, National Park Service, San Francisco.

Rinehart, C. D., and N. K. Huber
1965 The Inyo Crater Lakes--A Blast in the Past. Sacramento: California Division of Mines and Geology Mineral Information Service 18(9):169-172.

Ritter, E. W., B. W. Hatoff, and L. A. Payen
1976 Chronology of the Farmington Complex. American Antiquity 41 (3):334-341.

Roper, D.
1979 The Method and Theory of Site Catchment Analysis: A Review. In Advances in Archaeological Method and Theory 2. M. B. Schiffer, ed. pp. 119-140. New York: Academic Press.

Rundel, P. W., D. J. Parsons, and D. T. Gordon
1977 Montane and Subalpine Vegetation of the Sierra Nevada and Cascade Ranges. In Terrestrial Vegetation of California. M. Barbour and J. Major, eds. pp. 559-599. New York: John Wiley and Sons.

Russell, C. P.
1968 100 Years in Yosemite National Park: The Story of a Great National Park and Its Friends. Yosemite: Yosemite Natural History Association.

Sample, L. L.
1950 Trade and Trails in Aboriginal California. Berkeley: University of California Archaeological Survey Report 8:1-30.

Saxe, A. A.
1970 Social Dimensions of Mortuary Practices. Unpublished Ph.D. dissertation, Department of Anthropology, University of Michigan, Ann Arbor.

Schaffer, J. P.
1977 Pleistocene Lake Yosemite and the Wisconsin Glaciation of Yosemite Valley. California Geology 30(11):243-248.

Schiffer, M. B., and G. J. Gumerman, eds.
1977 Conservation Archaeology: A Guide for Cultural Resource Management Studies. New York: Academic Press.

Šercelj, A., and D. P. Adam
1975 A Late Holocene Pollen Diagram from Near Lake Tahoe, El Dorado County, California. Washington, D.C.: U.S. Geological Survey Journal of Research 3(6):737-745.

Sharp, R. P.
1972 Pleistocene Glaciation, Bridgeport Basin, California. Geological Society of America Bulletin 83:2233-2260.

Shenk, D.
1976 National Register of Historic Places nomination form, Galen Clark Homestead Historic Site. On file, Heritage Conservation and Recreation Service, Washington, D. C.

Steward, J. H.
1933 Ethnography of the Owens Valley Paiute. Berkeley: University of California Publications in American Archaeology and Ethnology 33(3).

1938 Basin-Plateau Socio-Political Groups. Washington, D. C.: Bureau of American Ethnology Bulletin 120.

Stewart, O. C.
1939 The Northern Paiute Bands. Berkeley: University of California Anthropological Records 2(3):127-149.

Stickel, E. G.
1978 New Melones General Project Research Design. Ms. on file, Science Applications, Inc., La Jolla.

Storer, T. I., and L. P. Tevis, Jr.
1955 California Grizzly. Lincoln: University of Nebraska Press.

Storer, T., and R. Usinger
1970 Sierra Nevada Natural History. Berkeley: University of California Press.

Suchey, J. M..
1975 Biological Distance of Prehistoric Central California Populations Derived from Non-metric Traits of the Cranium. Unpublished Ph.D. dissertation, Department of Anthropology, University of California, Riverside.

Swedlund, A. C., and G. J. Armelagos
1976 Demographic Anthropology. Dubuque: W. C. Brown.

Tainter, J. A.
1978 Mortuary Practices and the Study of Prehistoric Social Systems. In Advances in Archaeological Method and Theory 1. M. B. Schiffer, ed. pp. 105-101. New York: Academic Press.

Theodoratus, D.
1976 An Ethnohistoric Study of the New Melones Lake Project. On file, U.S. Army Corps of Engineers, Sacramento.

Treganza, A. E.
1952 Archaeological Investigations in the Farmington Reservoir Area, Stanislaus County, California. Berkeley: University of California Archaeological Survey Reports 14:1-37.

Treganza, A. E., and R. F. Heizer
1953 Additional Data on the Farmington Complex, A Stone Implement Assemblage of Probable Early Postglacial Date from Central California. Berkeley: University of California Archaeological Survey Reports 22:28-41.

Trigger, B.
1965 History and Settlement in Lower Nubia. New Haven: Yale University Publications in Anthropology 69.

1968 The Determinants of Settlements Patterns. In Settlement Archaeology. K. C. Chang, ed. pp. 53-78. Palo Alto: National Press.

Ubelaker, D. H.
1974 Reconstruction of Demographic Profiles from Ossuary Skeletal Samples: A Case Study from the Tidewater Potomac. Washington, D. C. Smithsonian Institution Contributions in Anthropology 18.

Varner, D. M.
1976 Archaeological Excavations at Bass Lake Recreation Point Site (F. S. #05-15-57-20), Madera County. Ms. on file, U.S. Forest Service, San Francisco.

Vita-Finzi, C., and E. S. Higgs
1970 Prehistoric Economy in the Mount Carmel Area of Palestine: Site Catchment Analysis. Proceedings of the Prehistoric Society 36:1-37.

Vivian, G. (compiler)
1977 Guidelines for the Preparation and Evaluation of Archaeological Reports. In The Management of Archaeological Resources: The Airlie House Report. C. R. McGimsey III and H. A. Davis, eds. pp. 64-77. Washington, D. C.: The Society for American Archaeology.

von Bertalanffy, L.
1962 General System Theory: A Critical Review. General Systems 7:1-20.

Wahrhaftig, C.
1962 Geomorphology of the Yosemite Valley Region, California. In Geologic Guide to the Merced Canyon and Yosemite Valley, California. Sacramento: California Division of Mines and Geology Bulletin 182.

Watson, P. J.
1973 The Future of Archaeology in Anthropology: Culture History and Social Science. In Research and Theory in Current Archaeology. C. Redman, ed. pp. 113-124. New York: Wiley Interscience.

1976 In Pursuit of Prehistoric Subsistence: A Comparative Account of Some Contemporary Flotation Techniques. Mid-Continental Journal of Archaeology 1:77-100.

Watson, P. J., S. A. LeBlanc, and C. L. Redman
1971 Explanation in Archaeology: An Explicitly Scientific Approach. New York: Columbia University Press.

Weiss, K.
1973 Demographic Models for Anthropology. Memoirs of the Society for American Archaeology 27.

Western Archeological and Conservation Center, National Park Service
1980 Scope of Work for Yosemite National Park Archeological Research Design. On file, Western Archeological and Conservation Center, National Park Service, Tucson.

White, L. A.
1959 The Evolution of Culture. New York: McGraw-Hill.

White, T.
1955 The Technique of Collecting Osteological Materials. American Antiquity 21(1):85-87.

Willey, G. R., and P. Phillips
1958 Method and Theory in American Archaeology. Chicago: University of Chicago Press.

Wood, S. H.
1975 Holocene Stratigraphy and Chronology of Mountain Meadows, Sierra Nevada, California. San Francisco: U.S. Forest Service, Earth Resources Monograph 4.

Zubrow, E.
1971 Carrying Capacity and Dynamic Equilibrium in the Prehistoric Southwest. American Antiquity 36:127-138.

GLOSSARY

ADAPTATION: Cultural developments by which a society relates successfully to its effective environment.

ALLUVIUM: Unsorted sediments (mixed silt, sand, gravel, cobbles, etc.) deposited by a stream.

ALTITHERMAL: The interval of predominantly warm/dry climates, dated ca 8000-2000 B.P., in western North America.

ANATHERMAL: The earliest Holocene climatic age, dated ca 11,000-8000 B.P., in western North America; a cool/moist postglacial episode which became progressively warmer through time.

ANTHROPOLOGY: The scientific study of human cultures and physical traits; includes archeology, ethnology, linguistic anthropology, and biological anthropology.

ARTIFACT: Any product of human cultural activity (such as tools, weapons, works of art, etc.).

ARCHEOLOGY: The branch of anthropology devoted to the scientific study of past cultures through their material remains. Archeology seeks to describe and explain the nature and evolution of cultural systems.

ASPHALTUM: Natural tar or bitumen used by the Indians as an adhesive, for caulking, as a base for applique work, and for joining parts of a composite artifact.

ATLATL: An Aztec term for spear-thrower; a wooden device with a handle at one end and at the other a hook or spur which fits into the proximal end of a dart shaft. The atlatl gives increased velocity to the dart by effectively lengthening the arm of the user, which improves leverage during the cast.

AURIFEROUS: Gold-bearing (rock); in the Sierra Nevada, most of the auriferous gravels are of Paleocene to Eocene age, i.e., between 70 million and 40 million years old.

BASALT: A dense, fine-grained, tough, extrusive, igneous rock; a common material in California lava flows. Indians chipped basalt into knives, points, scrapers, and other artifacts.

BATHOLITH: An intrusive mass of rock (usually granitic), which extends over an area larger than 100 km^2.

BEDROCK MILLING STATION: An outcrop of bedrock with one or more mortar cups, milling slicks ("bedrock metates"), gyratory mills, or other features related to food grinding or crushing.

BEDROCK MORTAR: A mortar "cup" or hole in a bedrock outcrop.

BIFACE: Any stone artifact chipped on both sides or faces; most projectile points, knives, drills, etc., are bifaces.

B.P.: Before Present; by convention, before A.D. 1950; often used in citing radiocarbon dates.

^{14}C: See Carbon-14 dating.

CALCITE: A calcareous precipitate ($CaCO_3$) which often forms as stalactites, dripstone, etc., in cases; used by the California Indians to manufacture ornaments and charmstones.

CARBON-14 (RADIOCARBON) DATING: A method for determining the age of organic material by measuring the extent to which the isotope carbon-14 (^{14}C) has decayed into stable nitrogen-14 (^{14}N), comparing the ^{14}C fraction with its known half-life of 5,568 ± 30 years.

CATCHMENT: The area near a settlement that can be exploited efficiently by residents of that settlement; among hunter-gatherers in California, catchments tended to be only a few kilometers in diameter.

CHALCEDONY: A hard, light-colored rock comprised of microscopic (cryptocrystaline) quartz. Knives, drills, and projectile points were often made of chalcedony.

CHARMSTONE: A carefully shaped, often elongate, stone artifact made in a spindle, pencil, phallic, ovoid, plum bob, or other shape; charmstones may be grooved or plain, perforate, or imperforate. They are often found with burials. Their function is uncertain.

CHERT: A flint-like rock comprised of chalcedony with variable amounts of clay and other impurities.

CHOPPER: A large, usually crude pebble, cobble, or core tool—typically percussion-flaked to form an axe-like cutting edge along part of the margin; used for various chopping and cleaving work.

CLOVIS POINT: A concave-base, lanceolate, projectile point (and/or knife), 4-12 cm long, with characteristic bifacial flutes extending about half the length of the point. Clovis points have been ^{14}C-dated in the 11,500-11,000 BP range, although the specimens from California have not yet been dated directly.

CLOVISOID: Resembling a Clovis point.

COBBLE PESTLE: A minimally shaped, naturally elongate cobble intended for use in a bedrock mortar.

COMPLEX: A patterned grouping of similar artifact assemblages from two or more sites, presumed to represent an archeological culture.

COMPONENT: A site or a stratum within a site which represents the activities of one cultural group during a relatively brief interval of time. Similar components within a locality or region comprise a phase.

CONTROLLED SURFACE COLLECTION: The systematic collection of materials from the surface of a site in such a way that the position of each item is recorded.

CULTURE: The nonbiological and socially transmitted system of concepts, institutions, behavior, and materials by which a society adapts to its natural and human environments.

CULTURE HISTORY: The archeological sequence of cultural activity through time, either within a defined geographic space or with reference to a particular group of people.

DEBITAGE: Lithic refuse or debris produced by flaked stone tool manufacture. The analysis of debitage can yield much information about technology, skills, and economic variables.

DEMOGRAPHY: The study of human populations with special reference to their size, density, composition, and distribution.

ECOTONE: A transition between two or more vegetation types (e.g., the jucture of meadow and forest); ecotones are rich in biotic diversity because they may contain species from both communities or types at the interface.

EGALITARIAN SOCIETY: A society in which all persons have equal access to resources. In an egalitarian society, status, wealth, and prestige are acquired through individual effort rather than by birthright.

ETHNOGRAPHY: The direct anthropological study of living human groups or the indirect study of groups through interviews and archival research.

EXPLANATION: Accounting for observations by reference to a law or empirical generalization.

FEATURE: A large, complex artifact or part of a cultural site (e.g., a hearth, cairn, house remains, rock alignment, etc.).

FIRE-CRACKED ROCK: Clastic rock fragments broken by heat from fires in the past.

FLAKE SCRAPER: A small flake of stone used as a scraping tool; flakes may be retouched or used without such modification.

FOLIATE: Leaf-shaped, as applied to chipped stone artifacts; having a form approximating that of a willow leaf.

GYRATORY MILL: A mortar-like milling device in which foods or other products are ground by the rotation of a pestle against the inner wall of the mill; in the Sierra Nevada, deep mortars were at times used as gyratory mills.

HAMMERSTONE: A hard, tough, fist-sized rock used as a hammer to work stone, drive wedges, splinter bones, etc.

HEARTH: A feature consisting of ash, charcoal, burned rock, charred faunal remains, oxidized earth, and/or other evidence of fire kindled by humans.

HEMATITE (OCHRE): An earthy iron oxide (Fe_2O_3), usually red to brown in color, which the indians used as a pigment.

HOLOCENE (RECENT): The post-Pleistocene geologic epoch characterized by fluctuating but generally moderate climates and modern faunal assemblages; dated ca 11,000 B.P. to the present.

HORIZON: A primarily spatial continuity represented by cultural traits and assemblages whose nature and mode of occurrence permit the assumption of broad and rapid spread (Willey and Phillips 1958:32).

HOUSE PIT: A depression of any shape representing the former location of a partly subsurface structure.

HYPOTHESIS: A testable statement about the relationship(s) between or among phenomena.

IDEOTECHNIC: Ideotechnic artifacts are those which function primarily in the ideological component of the social system (Binford 1962).

IN SITU: In place; a term applied to archeological phenomena which are found in their original, undisturbed position or location.

LANGUAGE FAMILY: A group of two or more languages that developed from a single ancestral language; the latter is referred to as the proto-language for that family.

LAW: A general principle to which all relevant observations conform; laws allow the prediction and explanation of events.

LICHENOMETRY: The study of lichen growth rates to determine the minimum age of surfaces sustaining the lichens.

MAGNETOMETRY: The use of a magnetometer to locate subsurface archeological features (such as walls, monuments, or footings). The action of magnetometers is based on their ability to detect anomalies in the static magnetic field.

MAGNESITE: A metamorphic rock ($MgCO_3$) aboriginally quarried in Lake County, fashioned into beads and cylinders of value, and traded widely in California.

MANO: From the Spanish la mano ("hand")—a loaf-shaped handstone used for grinding seeds, pigments, etc., on a metate or millingstone.

MEDITHERMAL: The third climatic age of the Holocene epoch, dated ca 2900 BP until the present; a period marked by moderate precipitation and temperature in the western United States.

METATE: From the Aztec metatl, a stone slab upon which corn and other grains are milled with the aid of a mano, which is used in a push-pull motion.

MIDDEN: A deposit, marking a former habitation, which contains such materials as discarded artifacts, bone and shell food refuse, charcoal, ash, rock, human remains, and structural remnants.

MILLINGSTONE: An amorphous or partly shaped stone slab upon which seeds and other plant products are ground with the aid of a mano; the milling basin of the slab may be ovoid to round, depending on the elliptical or rotary motion of the mano during milling.

MITIGATION: Minimization; in colloquial jargon, the reduction of adverse effécts to cultural resources by avoidance, data collection, or other means to preserve potential data.

MORAINE: Rocky debris deposited by a glacier.

NEOGLACIAL INTERVAL: The most recent episode of montane glaciation in the Far West, dated ca 600-50 BP.

OBSIDIAN: Natural volcanic glass. This was the most prized material for chipped stone artifacts in California.

OBSIDIAN HYDRATION DATING: A method for determining the age of obsidian artifacts by measuring the thickness of a specimen's hydration "rim" (layer of water penetration) and comparing the rim depth with a rate for the particular climatic/geographic area and type of obsidian being studied.

OCHRE: (See Hematite.)

PALYNOLOGY: The study of fossil pollen for the purpose of reconstructing former vegetation assemblages and climatic conditions.

PESTLE: An elongate, often cylindrical, stone or wooden artifact used to pulverize food products and other stuff in a mortar.

PETROGLYPH: A design or motif pecked or scratched into the surface of a rock; unpainted "rock art."

PICTOGRAPH: A design or motif painted onto a rock surface; painted "rock art."

PHASE: A distinctive archeological unit representing a fairly brief interval of time within a locality or region. A phase may be a single component at one site or a prolonged occupation of numerous related sites (Willey and Phillips 1958).

PHYTOLITH: A distinctive silicate cast of plant cellular material which may be preserved archeologically, and which, in many cases, can be identified to the genus or species level.

PLEISTOCENE: A late Cenozoic geologic epoch characterized by fluctuating, generally cool climates--often accompanied by glaciation--and distinctive faunal assemblages; dated from 3 or 4 million years ago until ca 11,000 B.P.

PREHISTORY: The archeological record of nonliterate culture; the cultural past before the advent of written records.

PRESSURE FLAKING: The manufacture of stone artifacts through removing flakes by pressured applied with a bone, antler, or metal knapping tool.

PROBLEM DOMAIN: A group of related questions or topics to be investigated, along with a discussion of possible ways to study them.

PROJECTILE POINT: A sharp stone or bone tip or point affixed to the distal end of a spear, lance, dart, or arrow.

PROTO-LANGUAGE: The ancestral language from which two or more languages in a family were derived.

QUATERNARY: The youngest period of geologic time, comprised of the Pleistocene and Holocene epochs. Following the Tertiary period, the Quaternary incorporates the most recent 3 million years of the Cenozoic era.

REMOTE SENSING: The use of instrumentation (such as radar, aerial photography, multiband imagery, etc.) to discover, analyze, and/or map cultural sites.

REPRESENTATIVE SAMPLE: A sample accurately characterizing the variability of the "universe" from which it was drawn; a sample adequate to permit reliable generalizations about the "statistical universe."

RESEARCH DESIGN: An explicit, formal articulation of research objectives with a systematic plan for the recovery and analysis of data to achieve those objectives.

RESEARCH STRATEGY: The system of concepts by which a theoretical stance is related to a particular research design.

ROCKSHELTER: A rock overhang or shallow cave used as a shelter by people.

SAMPLE: Part of a whole; a collection of data taken from and representing a "statistical universe" (a larger body of potential data).

SAMPLING PLAN: The explicit procedures by which data are to be collected.

SAMPLING STRATEGY: The conceptual approach and rationale which determine a sampling plan. A sampling strategy seeks to maximize the yield of data relevant to particular research questions.

SCARP: A line of cliffs produced by erosion or faulting, such as the precipitously steep eastern wall of the Sierra Nevada.

SCRAPER: Any of the myriad tool forms used chiefly for such scraping functions as stripping bark, planing wood, removing scarf skin from hides, etc.

SHERD: A broken piece of a pottery or stone vessel.

SOCIOTECHNIC: Sociotechnic artifacts are those having their primary functional context in the social sphere of a cultural system (Binford 1962).

STEATITE: Hydrous magnesium silicate ($H_2Mg_3Si_4O_{12}$); a very soft and easily carved metamorphic rock valued by the Indians as a raw material for bowls, beads, cooking vessels, etc.

STERILE: Devoid of archeological material.

STRATIGRAPHY: The study of cultural and natural strata or layers in archeological and geological deposits.

TECHNOMIC: Technomic artifacts are those designed primarily to cope directly with the physical environment, such as food-processing or hunting implements (Binford 1962).

TEPHRA: Volcanic ash. Ash fall from a single eruption may be used to show the contemporaneity of deposits at different sites and to date those deposits.

TERTIARY: The period of geologic time encompassing the Paleocene to Pliocene epochs of the Cenozoic era. The Tertiary period covers the time between 70 million and 3 million years ago.

THEORY: A general statement from which specific propositions may be deduced; a conceptual device integrating verified hypotheses.

TIOGA: The last stage of Pleistocene glaciation in the Sierra Nevada, dated ca 30,000-10,000 BP.

TRADITION: A way of life or a consistent patterning of technology, subsistence practices, and ecological adaptation which persists through a relatively long interval of time (Willey and Phillips 1958).

TRAIT: Any definable element or aspect of culture suitable for comparative purposes.

TRANSHUMANCE: Patterned movements of people, such as the seasonal population shifts up and downslope in the Sierra Nevada.

VERIFICATION: The process by which an hypothesis is tested and confirmed or refuted.

KEY FOR APPENDICES 1 AND 2

Site Type

BRM: Bedrock milling station
C: Cemetery
IA: Isolated artifact
LS: Lithic scatter
MID: Midden (subsurface deposits)
PIC: Pictograph
RS: Rockshelter
SC: Stone circle(s)

Drainage Class

1: Rivers: Tuolumne, Merced, South Fork of Merced
2: Perennial tributaries
3: Intermittent streams
U: Unsurveyed
L: Lake
M: Marsh or wet meadow
P: Pond
S: Spring

Attributes

BRM: Bedrock mortars
HP: Housepits

APPENDIX I

ATTRIBUTES OF ARCHEOLOGICAL RESOURCES

APPENDIX 1
ATTRIBUTES OF ARCHEOLOGICAL RESOURCES

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
MNO-21	LS	213 x 283	5+					Upper Sardine Lake
MRP-3	MID, BRM	549 x 244	100+		433	Pioneer cemetery onsite	Coring by Bennyhoff	"One of the most important sites in Yosemite National Park" Big Meadow
MRP-5	MID, BRM	140 x 90			52			Tamarack Flat Road
MRP-6	RS, MID, BRM	549 x 304	Subsurface?		179	Foundations of historic Indian cabins		Sas'-oo-lah, Crane Creek, El Portal Village
MRP-7	MID?, LS, BRM	106 x 90			7			Wawona Valley
MRP-8	MID, BRM	182 x 274	Subsurface?		75			Wawona Valley
MRP-9	MID, BRM	65 x 30			59		Grosscup 1954	Former Chowchilla Ranger Station
MRP-13	LS, MID?	70 x 20	Slight					Tioga Road
MRP-15	MID	91 x 167	Subsurface					Yosemite Valley

*All site designations are within the state of California and are officially written preceeded by the number "4" (i.e., 4-MNO-21).

Appendix 1--Continued

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
MRP-45	MID?, BRM	30 x 46			3			Hoo-ke'-hahtcho-ke? (45, 46, 47, 74, 326), Yosemite Valley
MRP-46	MID?, BRM	30 x 152			4			Yosemite Valley, Clark's Bridge
MRP-47	MID?, BRM	18 x 36			6			Yosemite Valley
MRP-48	BRM	20 x 20			3			Happy Isles vicinity
MRP-49	RS, PIC	20 x 20						Near Happy Isles Bridge, Yosemite Valley
MRP-50	LS, BRM	30 x 50			7			Near Tenaya Creek or Merced River, Yosemite Valley
MRP-51	LS, MID, BRM	66 x 100			56			Near Royal Arches, Yosemite Valley
MRP-52	BRM	93 x 93			4			Near Royal Arches, Yosemite Valley

Appendix 1--Continued

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
MRP-53	BRM	61 x 91			40			Near Sugarpine br. Indian Cave, Yosemite Valley
MRP-54	BRM	33 x 66			12			Under Royal Arches, Yosemite Valley
MRP-55	LS, RS, -BRM	46 x 122		1	11			Associated with MRP-54?, Yosemite Valley
MRP-56	MID, BRM	183 x 213	100+		65		Rasson	Ahwahnee, Yosemite Valley
MRP-57	RS, PIC*, BRM	91 x 152	Subsurface		29			Hol'luw, Indian Caves, Yosemite Valley
MRP-58	RS, BRM	30 x 61			3			Northside, south of Yosemite Falls, Yosemite Valley
MRP-59	BRM	30 x 45			17			North of Yosemite Lodge, Yosemite Valley
MRP-60	BRM	20 x 20			6			Below Indian Canyon, Yosemite Valley

*Now destroyed.

Appendix 1--Continued

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
MRP-61	MID, BRM	122 x 247	Subsurface		31			Near hospital, Yosemite Valley
MRP-62	RS, MID?, BRS	76 x 76	Subsurface		13			El Capitan area, Yosemite Valley
MRP-63	BRM	30 x 30			18			Sunnyside walk-in campground, Yosemite Valley
MRP-64	LS, RS, MID, BRM	91 x 91	Subsurface		12			Near El Capitan, Yosemite Valley
MRP-65	MID, BRM	91 x 183	Subsurface	2	31			Near El Capitan, Yosemite Valley
MRP-66	MID, BRM	46 x 76	Subsurface		3			Near Eagle Creek, Yosemite Valley
MRP-67	LS, MID, BRM	91 x 122	Subsurface		3			South of Eagle Creek Canyon, Yosemite Valley
MRP-68	RS, MID, BRM	48 x 76	Subsurface		5			Three Brothers area, Yosemite Valley
MRP-69	BRM	48 x 48			13			Eagle Creek, Yosemite Valley

Appendix 1--Continued

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
MRP-70	LS, MID?	76 x 183	Subsurface					El Capitan area, Yosemite Valley
MRP-71	RS, PIC, MID?, BRM	61 x 91	Subsurface in RS		4	Pictographs		Yosemite Valley
MRP-72	BRM	152 x 259	Subsurface		5			Bridalveil Falls area, Yosemite Valley
MRP-73	LS, BRM	91 x 152	Subsurface		8			Bridalveil Falls area, Yosemite Valley
MRP-74	RS, PIC, BRM	30 x 61	Subsurface		4	Pictograph		Medial Moraine Cluster, Yosemite Valley
MRP-75	BRM	38 x 68	Subsurface		26			Cathedral Spires Cluster, Yosemite Valley area
MRP-76	LS, BRM	122 x 244			38			Near Taft Point, Yosemite Valley
MRP-77	RS	46 x 91						Old Village Cluster, Yosemite Valley

Appendix 1--Continued

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
MRP-78	BRM	30 x 61	Subsurface		10			Sentinel Ridge area, Yosemite Valley
MRP-79	LS, MID, BRM	91 x 122	Subsurface	2?	50			Old Village Cluster, Yosemite Valley
MRP-80	BRM	91 x 152	Susurface		52			Happy Isles Cluster, Yosemite Valley
MRP-81	BRM	20 x 20			12			Happy Isles Cluster, Yosemite Valley
MRP-82	BRM	30 x 30			17			Le Conte Memorial area, Yosemite Valley
MRP-83	RS, MID, BRM	61 x 122			2			Sentinel Cluster, Yosemite Valley
MRP-84	Camp							East end of Camp Curry, Yosemite Valley
MRP-85	RS, dark soil							South end Vernal Falls Bridge, site reported by park personnel

Appendix 1--Continued

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
MRP-86	BRM				3			Little Yosemite Valley above Nevada Falls
MRP-87	LS, MID, BRM	259 x 137	Subsurface		10		Bennyhoff 1952	Trail Side Site
MRP-88	MID	46 x 30						Little Yosemite Valley
MRP-89	MID, BRM	183 x 137			1			Little Yosemite Valley
MRP-90	MID, BRM	213 x 137			11		University of Califor- nia, Berke- ley Fisher 1952	Little Yosemite Valley
MRP-91	MID	100 x 17						Little Yosemite Valley
MRP-92	LS	100 x 166						Sentinel Cluster, Yosemite Valley
MRP-93	MID?	15 x 20						Below L. Wash- burn, Upper Merced River
MRP-94	MID	10 x 15						Tamarack Flat

Appendix 1--Continued

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
MRP-95	MID, BRM	90 x 25			1			Tamarack Flat
MRP-96	MID	70 x 70						Tamarack Flat
MRP-97	MID, BRM	70 x 110			12			Tamarack Flat area
MRP-98	MID	15 x 20						Tamarack Flat area
MRP-99	MID	10 x 20						Tamarack Creek
MRP-100	LS, BRM	15 x 30			13			
MRP-101	BRM				6			Tamarack Road/ Cascade Creek
MRP-102	MID	20 x 40						Tamarack Road at Coyote Creek
MRP-103	MID, BRM	79 x 73			29			Tipi Site
MRP-104	MID, BRM	99 x 79			5			Crane Flat
MRP-105	MID, BRM	91 x 152	100+		31		Fitzwater	Crane Flat Site
MRP-106	MID, BRM	61 x 107	80		3		Bennyhoff	Crane Flat
MRP-107	BRM	76 x 92			6			Crane Flat

Appendix 1--Continued

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
MRP-108	MID	70 x 90						Crane Flat
MRP-109	LS	20 x 45						Porcupine Flat
MRP-110	MID?, LS	20 x 20	10?					Porcupine Creek
MRP-111	MID?, LS	15 x 15						Porcupine Creek
MRP-112	MID?, LS	40 x 70						Porcupine Creek
MRP-113	MID?	20 x 20						Porcupine Creek
MRP-114	MID?, LS	10 x 12						Porcupine Creek
MRP-115	MID, LS	15 x 10						Yosemite Creek
MRP-116	MID, LS	15 x 15						Yosemite Creek
MRP-117	MID, BRM	22 x 26			6			Yosemite Creek
MRP-118	MID?, LS	32 x 47	10?					Yosemite Creek
MRP-119	MID?, LS	32 x 64						Yosemite Creek
MRP-120	MID, BRM	32 x 32			3			Yosemite Creek
MRP-121	LS, BRM	152 x 76			1			Yosemite Creek

Appendix 1--Continued

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
MRP-122	LS	91 x 30	0?				University of California, Berkely, Brooks 1952	Yosemite Creek
MRP-123	MID, BRM	107 x 122			17		University of California, Berkeley, Fischer 1952	Yosemite Creek
MRP-124	MID, BRM	32 x 32			8			West Branch, Yosemite Creek
MRP-125	LS	9 x 7	0?					West Branch, Yosemite Creek
MRP-126	BRM				12			(Mining may have destroyed midden) South Fork Merced, Hites Cove
MRP-127	LS	18 x 9	2					Yosemite Creek
MRP-128	LS	18 x 5						Yosemite Creek
MRP-129	MID, LS	55 x 95						Yosemite Creek
MRP-130	LS	7 x 13						Yosemite Creek

Appendix 1--Continued

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
MRP-131	LS	15 x 45						Yosemite Creek
MRP-132	LS	15 x 18						Yosemite Creek
MRP-133	LS	7 x 13						Yosemite Creek headwaters
MRP-134	LS	14 x 18						Uppermost Yosemite Creek
MRP-135	MID, LS	160 x 157						Crane Creek
MRP-136	RS, LS	76 x 30						Yosemite Creek
MRP-137	LS	45 x 45						Yosemite Creek
MRP-138	LS	18 x 85						Yosemite Creek
MRP-139	LS	23 x 9						Yosemite Creek
MRP-140	LS	23 x 23						Yosemite Creek
MRP-141	LS	45 x 45						Crane Creek
MRP-142	LS, BRM	70 x 55			12			Tributary of Crane Creek
MRP-143	LS, BRM	61 x 122			7		Bennyhoff 1952	Big Meadow/ Crane Creek

Appendix 1--Continued

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
MRP-144	LS, BRM	183 x 122					Bennyhoff 1952	Crane Creek/Big Meadow area
MRP-145	LS	60 x 30					Bennyhoff 1952	Crane Creek/ Foresta/Big Meadow area
MRP-146	BRM, MID	46 x 46			10+		Bennyhoff 1952	Foresta area
MRP-147	LS, BRM	91 x 60			2		Brooks 1952	Foresta area
MRP-148	MID, BRM	192 x 84			65		Brooks 1952	Foresta area
MRP-149	LS, BRM	68 x 62			2		Brooks 1952	Foresta area
MRP-150	LS, BRM	68 x 62			1		Brooks 1952	Foresta area
MRP-151	LS, MID, BRM	243 x 152			66		Bennyhoff 1952	Big Meadow
MRP-152	LS	15 x 15						Big Meadow
MRP-153	LS	22 x 13	0					Lake Tenaya
MRP-154	LS	10 x 20	0					Lake Tenaya
MRP-155	LS		0					Lake Tenaya
MRP-156	LS	10 x 7	0					Boothe Lake

Appendix 2--Continued

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
MRP-157	LS	95 x 285						Fletcher Lake
MRP-158	MID, PIC, RS	61 x 165	Subsurface			Pictographs on boulder		Devil's Elbow, Yosemite Valley
MRP-159	BRM	30 x 30			24			Yosemite Valley
MRP-160	BRM	30 x 61			10			Yosemite Valley
MRP-161	RS, BRM	76 x 91			16			Yosemite Valley
MRP-162	BRM	61 x 61			4			Yosemite Valley
MRP-163	RS, BRM	32 x 41			7			Yosemite Valley
MRP-164	LS	60 x 50						Peregoy Meadow
MRP-165	LS	15 x 20						Peregoy Meadow
MRP-166	MID, BRM	75 x 75			8			Peregoy Meadow
MRP-167	LS	30 x 75						Bridalveil Creek
MRP-168	BRM	61 x 122			60			Wawona
MRP-169	BRM	91 x 122			6			Wawona
MRP-170	MID?, LS	61 x 305	Subsurface					Wawona golf course

Appendix 1--Continued

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
MRP-171	LS	107 x 488	Subsurface					Wawona
MRP-172	LS, BRM	91 x 183	Subsurface		32			Wawona
MRP-173	LS, MID	61 x 274	20					Wawona
MRP-174	BRM	20 x 20			11			Wawona
MRP-175	LS, MID, BRM	76 x 91	Subsurface		12			Wawona
MRP-176	LS, MID, BRM	61 x 91	Subsurface		27			Wawona
MRP-177	BRM	61 x 152	Subsurface		68+			Wawona
MRP-178	BRM	45 x 45			6		University of California, Berkeley 1952	El Portal
MRP-179	BRM	152 x 91			3		Brooks 1952	El Portal
MRP-180	LS, MID, BRM	63 x 120			80		Fisher 1952	El Portal
MRP-181	MID, BRM	99 x 274	Deep?		29	Burials	Fitzwater 1952	El Portal Sewage Site
MRP-182	MID, BRM	107 x 204			33			El Portal

Appendix 1--Continued

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
MRP-183	LS, MID, BRM	563 x 229	Subsurface		13		University of California, Los Angeles 1959-1960	El Portal
MRP-184	MID, BRM	76 x 137	Subsurface		15			El Portal, Moss Canyon
MRP-186	LS, BRM	20 x 20			3			Yosemite Valley, Pines Camp
MRP-187	BRM	61 x 91			2			Yosemite Valley
MRP-188	BRM	30 x 61			4			Yosemite Valley
MRP-189	BRM	91 x 244	Subsurface	2	3			Yosemite Valley, Black Springs
MRP-190	BRM	30 x 30			23			Yosemite Valley
MRP-191	BRM	30 x 30			4			Yosemite Valley
MRP-192	1							Yosemite Creek
MRP-193								
MRP-194								
MRP-195								

Appendix 1--Continued

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
MRP-196	LS	137 x 137						Yosemite Valley
MRP-197	BRM							Wawona
MRP-198	BRM	50 x 84			9			Mariposa Grove
MRP-199	LS, MID, BRM	91 x 183			24			Mariposa Grove
MRP-200	Ceremonial circles					Two pair of stone cobble circles		Two pair of circles, rock, 9' and 10-15' diameters, east of Turtle Dome
MRP-201	LS, BRM				15			Junction of Big Creek
MRP-202	LS, BRM	30 x 60						Between Chowchilla Ranger Station and Big Creek
MRP-203	LS, BRM	46 x 61			4			Wawona
MRP-204	BRM	61 x 76			1			Wawona
MRP-205	BRM	30 x 30			4			Wawona
MRP-206	LS	30 x 30						Wawona

Appendix 1--Continued

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
MRP-207	LS	8 x 16						Wawona
MRP-208	BRM	40 x 40			11			Wawona
MRP-209	LS, BRM	20 m^2						
MRP-210	LS, BRM							Lower Chilnaulna Falls
MRP-211	LS	122 x 244						Wawona
MRP-212	LS, BRM	91 x 122			13			Wawona
MRP-213	LS, BRM	45 x 70						
MRP-214	BRM	76 x 137			44			Wawona
MRP-215	BRM				3?			
MRP-216	LS, BRM	46 x 76			16			Wawona
MRP-217	LS	106 x 152						Wawona
MRP-218	LS, MID, BRM	69 x 107			64			Wawona
MRP-219	MID, BRM	91 x 91			10+			Wawona
MRP-220	LS, BRM	30 x 150						Bridalveil Creek

Appendix 1--Continued

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
MRP-221	LS	60 x 60						Bridalveil Creek
MRP-222	LS, BRM	30 x 30						Bridalveil Creek
MRP-223	BRM	2 x 3						Bridalveil Creek
MRP-224	MID, BRM	5 x 40			34			Bridalveil Creek
MRP-225	BRM							Tributary Bridal-veil Creek
MRP-226	LS, BRM	20 x 20						Grouse Creek
MRP-227	MID, BRM	15 x 15			1			Grouse Creek
MRP-228	BRM	3 x 5	2					Grouse Creek
MRP-229	MID	60 x 60						Alder Creek?
MRP-230	LS	60 x 60						
MRP-231	LS, BRM	60 x 60			16+			Alder Creek
MRP-232	LS	ca 400 acres (sic)						North of Edson Lake
MRP-233	LS							Near Ostrander Lake

Appendix 1--Continued

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
MRP-234	BRM, LS	30 x 50			Some			Illilonette Creek
MRP-235	LS, MID BRM							Illilonette Creek
MRP-236	MID, BRM	122 x 152			178+			Hodgdon Meadow*
MRP-237	MID, BRM	60 x 200			6			Porcupine Flat
MRP-238	LS, MID, BRM	40 x 60			19			Near Crane Flat
MRP-239	1							Peregoy Meadow
MRP-240	LS, BRM	30 x 30			40			Yosemite Falls parking lot, Yosemite Valley
MRP-241	RS, BRM	91 x 152			9			Yosemite Valley, Cascades picnic area
MRP-242	BRM	30 x 61			5			Yosemite Valley
MRP-250	LS, MID, BRM	305 x 549	30+	15?	71+		Tested by McKusick 1959	Merriam's (1917) Po-ko-no, El Portal Chapel

*1954 University of California, Berkeley, survey recorded no BRMs, site "60 ft.^{2}"

Appendix 1--Continued

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
MRP-251	LS, BRM	65 x 109	50+ sub-surface		22		Tested by McKusick 1959	El Portal
MRP-254	PIC, BRM				5	1 BRM has red stain		Pictographs not described; Wawona
MRP-277	MID, LS							Chilnualna Falls/ Turner Meadows
MRP-285	LS	66 x 166						Yosemite Valley
MRP-286	LS, RS, BRM	66 x 66	Subsurface		3			Below Royal Arches, Yosemite Valley
MRP-287	RS, BRM	18 x 18	Subsurface		1			Yosemite Valley
MRP-288	RS, BRM	16 x 50	Subsurface		3			Yosemite Valley
MRP-289	BRM	30 x 91			8			Yosemite Valley
MRP-290	BRM	30 x 30			10			Yosemite Valley
MRP-291	LS, BRM	30 x 46			5			Yosemite Valley
MRP-292	RS, MID, BRM	50 x 50			21			Ahwahnee Hotel area, Yosemite Valley

Appendix 1--Continued

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
MRP-293	RS, BRM	20 x 20			1			Yosemite Valley
MRP-294	RS, BRM	30 x 30			1			Yosemite Valley
MRP-295	BRM	30 x 30			2			Yosemite Valley
MRP-296	RS, BRM	30 x 30			1			Yosemite Valley
MRP-297	BRM	20 x 20			1			Yosemite Valley
MRP-298	BRM	38 x 61			14			Associated with MRP-56, Yosemite Valley
MRP-299	BRM	30 x 30			2			Yosemite Valley
MRP-300	MID?, LS	152 x 244						Ranger Club, Yosemite Valley
MRP-301	BRM	20 x 20			8			Yosemite Valley
MRP-302	BRM	20 x 20			3			Yosemite Valley
MRP-303	BRM	20 x 20			4			Yosemite Valley
MRP-304	RS, BRM	27 x 27			7			Yosemite Valley
MRP-305	MID, BRM	213 x 243			44			Yosemite Valley
MRP-306	BRM	20 x 20			6			Yosemite Valley

Appendix 1--Continued

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
MRP-307	BRM	30 x 30			29			Yosemite Valley
MRP-308	LS	91 x 91						Yosemite Valley
MRP-309	RS, BRM	20 x 20			2			Yosemite Valley
MRP-310	RS, BRM	20 x 20			1			Yosemite Valley
MRP-311	BRM	23 x 48			2			Yosemite Valley
MRP-312	RS, BRM	53 x 91			3+			El Capitan area, Yosemite Valley
MRP-313	RS, BRM	46 x 244			5			Yosemite Valley
MRP-314	BRM	122 x 198			9			Yosemite Valley
MRP-315	RS, BRM	61 x 91			6			Bridalveil Mea-dow, Yosemite Valley
MRP-316	LS, BRM	61 x 91			4			Yosemite Valley
MRP-317	RS, LS, BRM	91 x 213	Subsurface		1			Yosemite Valley
MRP-318	BRM	20 x 30			3			Yosemite Valley
MRP-319	BRM	30 x 30			10			Yosemite Valley

Appendix 1--Continued

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
MRP-320	RS, BRM	30 x 61			2			Yosemite Valley
MRP-321	BRM	20 x 20			6			Yosemite Valley
MRP-322	LS	61 x 122						Yosemite Valley
MRP-323	BRM	61 x 122			17			Yosemite Valley
MRP-324	BRM	30 x 61			2			Yosemite Valley
MRP-325	BRM	100 x 122			6			Yosemite Valley
MRP-326	BRM	30 x 61			3			Yosemite Valley
MRP-327	LS, MID?, BRM	30 x 76			54			Wawona
MRP-328	BRM				38			Wawona
MRP-329	LS, BRM	30 x 61			30+			Wawona
MRP-330	MID, BRM	30 x 91			1			Wawona
MRP-331	BRM	61 x 76			12			Wawona
MRP-332	BRM	20 x 20			10			Wawona
MRP-333	BRM	20 x 20			10			Wawona
MRP-334	BRM	20 x 20			2			Wawona

Appendix 1--Continued

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
MRP-335	BRM	46 x 61			6			Wawona
MRP-336	LS, BRM	46 x 91			25			Wawona
MRP-337	LS, BRM	15 x 15			34			Wawona
MRP-338	BRM	30 x 91			40+			Near 3M Trailer Park
MRP-339	BRM	20 x 20			4			Wawona
MRP-340	BRM	61 x 76			3			Wawona (Meadow Loop Drive)
MRP-341	LS, BRM	53 x 76			4			Wawona
MRP-342	BRM	20 x 20			2			Wawona
MRP-343	LS, MID, BRM	91 x 122			27			Wawona
MRP-344	LS, MID, BRM	70 x 140			13			Bavarian Village
MRP-345	LS	45 x 120						Bavarian Village
MRP-346	LS, BRM	91 x 122			30+			Foresta
MRP-347	BRM	76 x 152			19+			Foresta

Appendix 1--Continued

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
MRP-348	BRM	122 x 122			10			Foresta/Big Meadow
MRP-349	LS, MID, BRM	91 x 152			6+			Big Meadow
MRP-350	MID, LS, BRM	76 x 152			5			Foresta
MRP-351	MID, BRM	76 x 121			22+			Foresta
MRP-352	LS	60 x 76						Foresta
MRP-353	LS, MID, BRM	91 x 152			15			Foresta
MRP-354	MID?, BRM	91 x 121			12			Foresta
MRP-355	BRM	122 x 122			17			El Portal/ Foresta Bridge
MRP-356	BRM	15 x 30			1			El Portal
MRP-357	LS, BRM	122 x 213			50			El Portal
MRP-358	LS, BRM	122 x 305			13			El Portal
MRP-360	BRM	110 x 180			50			El Portal
MRP-361	LS, BRM	38 x 76			1			El Portal

Appendix 1--Continued

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
MRP-362	MID, BRM	183 x 1,097	Subsurface		16	Rancheria Cemetery		El Portal Rancheria
MRP-363	C	67 x 102	Subsurface			1 marked grave		Rancheria Cemetery, El Portal
MRP-364	BRM	61 x 91			3			Ribbon Meadow
MRP-365	BRM, MID	15 x 27			1			Crane Flat
MRP-366	LS	45 x 122						Eagle Peak Meadow
MRP-367	LS	91 x 152						Eagle Peak Meadow
MRP-368	LS	61 x 107						Eagle Peak Meadow
MRP-369	RS, MID, BRM	30 x 91			11			Cascade Camp
MRP-370	LS	49 x 61						Yosemite Creek
MRP-371	LS	183 x 366						Snow Creek/Mt. Watkins
MRP-372	MID, LS, BRM	61 x 61			7			Mariposa Grove

Appendix 1--Continued

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
MRP-373	LS	30 x 30						Wawona
MRP-374	LS, BRM	30 x 91			1			Wawona
MRP-375	LS, BRM	94 x 107			20			Wawona
MRP-376	LS, BRM	61 x 107			10+			Snow Creek/Mt. Watkins
MRP-377	LS	30 x 46						Snow Creek/Mt. Watkins
MRP-378	LS, MID, BRM	107 x 183			10			Snow Creek/Mt. Watkins
MRP-379	LS, BRM	183 x 305			21			Foresta/Big Meadow
MRP-380	BRM, LS	152 x 244			7	Hunting Blind?		Foresta/Big Meadow
MRP-381	LS, BRM	91 x 183			9			Foresta/Big Meadow
MRP-382	RS, BRM	183 x 243			42			El Portal
MRP-440	LS	53 x 70						Fletcher Falls
MRP-441	LS	61 x 76						Emerick Lake Trail

Appendix 1--Continued

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
MRP-442	LS, BRS	46 x 91			9			Tenaya Lake
MRP-443	LS	122 x 272						Tenaya Lake
MRP-444	LS	274 x 305						Polly Dome Lake
MRP-445	LS	30 x 15						Cathedral Lake
MRP-446	LS	61 x 91						Upper Cathedral Lake
MRP-447	LS	30 x 30						Long Meadow
MRP-448	LS	61 x 107						Sunrise Creek
MRP-449	LS	61 x 122						Sunrise Creek
MRP-450	LS	61 x 91						Echo Valley
MRP-451	BRM	61 x 46			1			Echo Valley
MRP-452	LS	30 x 61						Echo Valley
MRP-453	LS, BRM	229 x 289			3			Merced Lake
MRP-454	LS	122 x 137						Merced Lake
MRP-457	LS	50 x 100						Foresta Dump Site

Appendix 1--Continued

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
MRP-458	LS					Historic Structures		Foresta MacCauley Saw-mill Site
MRP-514	LS, BRM	27 x 27			2			Wawona
MRP-515	LS	21 x 40						Wawona
MRP-516	LS	18 x 24						Wawona
TUO-22	PIC, LS, MID, RS, BRM	305 x 549	Subsurface	8	48	Pictographs on rock 70' high x 900' long		Pate Valley
TUO-28	LS	61 x 91						Harden Lake
TUO-29	Camp Site							Rancheria Creek
TUO-45	LS							Upper Lyell Base Camp
TUO-46	LS							Middle Lyell Base Camp
TUO-47	LS	15 x 20						
TUO-48	LS, BRM		65					Lake Eleanor

Appendix 1--Continued

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
TUO-49	MID, BRM					Numerous artifacts		Lake Eleanor
TUO-50	LS					Slatey points		Lake Eleanor
TUO-51								Destroyed Eleanor Stream
TUO-52	MID	30 x 30						Eleanor Creek
TUO-53	LS	15 x 15	Subsurface?			slate points		Near Lake Eleanor
TUO-54	LS, BRM	3 x 5			12			Lake Eleanor
TUO-55	LS, MID, BRM	15 x 45			35			Lake Eleanor
TUO-56	MID, BRM	250	Subsurface		20			Bead Island Lake Eleanor
TUO-57	BRM							Wilkinson Flat
TUO-58								
TUO-59								Lake Eleanor
TUO-61								Above Poopenaut Valley

Appendix 1--Continued

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
TUO-62								Across stream from TUO-61
TUO-63								Rancheria on north side
TUO-65								Up Kibee Creek
TUO-66	LS?, MID							
TUO-67								On top of Wapama Falls
TUO-68								At beehive on Vernon Lake Trail
TUO-69								Below Lake Eleanor
TUO-70								South side of Lake Eleanor
TUO-71								Mouth of Hat Creek
TUO-72								
TUO-73								At the extreme end of Hetch-Hetchy

Appendix 1--Continued

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
TUO-74								ca ¼ mi. west of the point where the Tuo-lumne empties into Hetch-Hetchy
TUO-75								Just east of the mouth of Hat Creek
TUO-76								½ mi. east of mouth of Kibee Creek on old Lake Eleanor
TUO-77								½ mi. east of mouth of Kibee Creek on old Lake Eleanor
TUO-78								3/4 mi. east of mouth of Kibee Creek on old Lake Eleanor
TUO-79								Just east of Soldiers Point, 1 mi. west of old Lake Eleanor

Appendix 1--Continued

Designation	Site Type	Area (m^2)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
TUO-80	BRM				6			(Site not visited by Univ.CA, Berkeley) Miguel Meadow
TUO-81								Mouth of Frog Creek; Lake Eleanor
TUO-82								Above Camp Mather Bridge
TUO-83								Northeast of the most southeast arm of old Lake Eleanor
TUO-84								On east bank of Tiltil Creek where water is low at Hetch-Hetchy
TUO-85								¼ mi. west of old Lake Eleanor outlet
TUO-86								¼ mi. up Vernon Lake Trail from Hetch-Hetchy

Appendix 1--Continued

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
TUO-87								½ mi. up Vernon Lake Trail from Hetch-Hetchy
TUO-88								3/4 mi. up Vernon Lake Trail from Hetch-Hetchy
TUO-89								1 mi. up Vernon Lake Trail from Hetch-Hetchy
TUO-90								On north side of outlet to Vernon Lake
TUO-91								On south side of Vernon Lake outlet
TUO-92								1/3 mi. upstream from Vernon Lake outlet
TUO-99	LS					Small points		
TUO-102	BRM							On northwest edge, Swamp Lake

Appendix 1--Continued

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
TUO-103	LS	10 x 10						Tioga Road
TUO-104	MID							Tioga Road
TUO-105	LS	30 x 61						White Wolf
TUO-106	MID?, LS	15 x 15						East of White Wolf
TUO-107	MID, LS	120 x 30						Lukens Lake
TUO-108	LS	65 x 137						Tuolumne Meadows
TUO-109	LS	200 x 245						Tuolumne Meadows
TUO-110	LS	38 x 76						Tuolumne Meadows
TUO-111	LS, BRM	92 x 92			10			Tuolumne Meadows
TUO-112	LS	61 x 91						Tuolumne Meadows
TUO-113	LS	63 x 80						Tuolumne Meadows
TUO-114	LS	95 x 122						Tuolumne Meadows
TUO-115	LS	41 x 55						Tuolumne Meadows
TUO-116	LS	30 x 36						Tuolumne Meadows
TUO-117	LS	30 x 36						Tuolumne Meadows

Appendix 1--Continued

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
TUO-118	LS	41 x 100						Tuolumne Meadows
TUO-119	LS	61 x 109						Tuolumne Meadows
TUO-120	LS	74 x 135						Tuolumne Meadows
TUO-121	LS	82 x 98						Tuolumne Meadows
TUO-122	LS, MID	15 x 15						Tuolumne Meadows
TUO-123	LS	122 x 168						Tuolumne Meadows
TUO-124	BRM, LS	168 x 229			3			Tuolumne Meadows
TUO-125	LS	65 x 76						Tuolumne Meadows
TUO-126	BRM, LS	122 x 152			6+			Tuolumne Meadows
TUO-127	LS	62 x 75						Tuolumne Meadows
TUO-128	MID?, LS	24 x 76						Tuolumne Meadows
TUO-129	LS	76 x 137						Tuolumne Meadows
TUO-130	LS	80 x 168						Tuolumne Meadows
TUO-131	LS	91 x 122						Tuolumne Meadows
TUO-132	LS	79 x 102						Tuolumne Meadows

Appendix 1--Continued

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
TUO-133	MID	152 x 247						Tuolumne Meadows
TUO-134	MID	61 x 381						Tuolumne Meadows
TUO-135	MID	11 x 15						Lyell Fork
TUO-145	MID	9 x 14						Lyell Fork
TUO-146	MID	91 x 183						Tuolumne Meadows
TUO-147	MID	11 x 18						Lyell Fork
TUO-148	BRM				21			Miguel Meadow
TUO-149	MID	15 x 20						Lyell Fork
TUO-150	MID							Lyell Fork
TUO-151	MID	13 x 18						Lyell Fork
TUO-152	LS	45 x 45						Rafferty Creek
TUO-153	LS	30 x 15						Rafferty Creek
TUO-154	LS	40 x 40						Rafferty Creek
TUO-155	LS	3 x 6						Rafferty Creek
TUO-156	LS	70 x 95						Evelyn Lake

Appendix 1--Continued

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
TUO-157	LS	30 x 60						Evelyn Lake
TUO-158	LS	7 x 9						
TUO-159	MID	15 x 15						
TUO-160	LS	15 x 30						
TUO-161	LS	20 x 100						Lyell Canyon
TUO-162	LS	5 x 10						
TUO-163	LS	64 x 114						
TUO-164	LS	61 x 91						Elizabeth Lake
TUO-165	LS	30 x 46						Elizabeth Lake
TUO-166	BRM?, LS	91 x 122			1?			Lembert Dome
TUO-167	BRM, LS	106 x 137			2			
TUO-168	LS	41 x 67						Dog Lake
TUO-169	LS	30 x 73						Dog Lake
TUO-170	LS	76 x 137						Dog Lake
TUO-171	LS	20 x 60						Delaney Meadow

Appendix 1--Continued

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
TUO-172	LS	91 x 183						Delaney Meadow
TUO-173	LS	20 x 35						Delaney Creek
TUO-174	LS	20 x 55						Delaney Creek
TUO-175	LS	10 x 30						Delaney Creek
TUO-176	LS	15 x 15						Delaney Creek
TUO-177	LS	30 x 85						Delaney Creek
TUO-178	LS	30 x 30						Delaney Creek
TUO-179	LS	15 x 15						
TUO-180	LS	15 x 45						Dana Creek
TUO-181	LS	25 x 30						Dana Creek
TUO-182	LS	20 x 20						Dana Creek
TUO-183	LS	12 x 12						Parker Pass Creek
TUO-184	LS	30 x 60						Parker Pass Creek
TUO-185	LS	12 x 15						Park Pass Creek

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
TUO-186	LS	13 x 20						Parker Pass Creek
TUO-187	LS	15 x 15						Parker Pass Creek
TUO-188	LS	13 x 13						Parker Pass Creek
TUO-189	LS	15 x 20						Parker Pass Creek
TUO-190	LS	30 x 60						Parker Pass Creek
TUO-191	LS	12 x 12						Parker Pass Creek
TUO-192	LS	7 x 7						Parker Pass Creek
TUO-193	LS	15 x 15						Parker Pass Creek
TUO-194	LS	10 x 20						Parker Pass Creek
TUO-195	LS	30 x 30						Parker Pass Creek

Appendix 1--Continued

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
TUO-196	LS	15 x 30						Parker Pass Creek
TUO-197	LS	20 x 20						Parker Pass Creek
TUO-198	LS	15 x 30						Parker Pass Creek
TUO-199	MID?, LS	50 x 115						Parker Pass Creek
TUO-200	LS	15 x 45						Parker Pass Creek
TUO-201	LS	10 x 15						Dana Meadow
TUO-202	LS	11 x 30						Dana Meadow
TUO-203	MID, LS	13 x 25						Dana Meadow
TUO-204	LS	25 x 27						Parker Pass
TUO-205	LS, BRM	76 x 122			5			Morrison Creek
TUO-206	LS, BRM	25 x 30			9			Paiute Creek
TUO-207	LS, BRM	61 x 91			15			Harden Lake
TUO-208	LS	91 x 152						Harden Lake

Appendix 1--Continued

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
TUO-209	LS, BRM	122 x 168		1	7			Harden Lake
TUO-210	LS, BRM	183 x 183			15			Harden Lake
TUO-211	MID, BRM	30 x 80			3			Ackerson Meadow
TUO-212	MID, BRM	15 x 15			11			Ackerson Meadow
TUO-213	MID?, BRM				3			Ackerson Meadow
TUO-214	MID, BRM	15 x 15			9			Mather Rock-shelter
TUO-215	MID?, BRM				3			Mather Rock-shelter
TUO-216	MID?, BRM				25			Mather Camp
TUO-217	MID, BRM					Most of rock blasted		Mather Camp
TUO-218	MID, BRM	50 x 60			22			Mather Camp
TUO-219	MID, BRM	15 x 15			13			Mather Camp
TUO-220	LS, BRM				1			Mather Camp Dump Road
TUO-221	BRM				10			Mather Camp

Appendix 1--Continued

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
TUO-222	BRM	20 x 30			7			
TUO-223	MID, BRM	30 x 30						Middle Fork, Tuolumne River
TUO-224	LS	30 x 45						Middle Fork, Tuolumne River
TUO-225	LS	15 x 25						Middle Fork, Tuolumne River
TUO-226	MID, BRM	15 x 15			9			Middle Fork, Tuolumne River
TUO-227	LS	15 x 15						Middle Fork, Tuolumne River
TUO-228	MID	20 x 30						Middle Fork, Tuolumne
TUO-229	LS	15 x 15						Middle Fork, Tuolumne
TUO-230	LS, MID, BRM	20 x 40			46			Cottonwood Creek
TUO-231	MID, BRM	35 x 70		3?	8			Cottonwood Creek
TUO-232	LS	20 x 30						Cottonwood Creek

Appendix 1--Continued

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
TUO-233	LS	15 x 20						Cottonwood Creek
TUO-234	BRM	3 x 5			8			Smith Meadow
TUO-235	BRM				1			Mather Camp
TUO-236	LS, BRM	106 x 114			3			Hodgdon Meadow
TUO-237	LS, BRM	106 x 114			3			Hodgdon Meadow
TUO-238	LS	61 x 91						Hodgdon Meadow
TUO-239	MID, BRM	15 x 25			3			
TUO-240	1					Projectile Point (Desert Side-notched)		Lyell Fork
TUO-241	1					Projectile Point (Rose Spring Side-notched)		Near Evelyn Lake
TUO-245	LS	20,000 m^2						Ireland Lake
TUO-246	LS	600 x 800						Near Ireland Lake
TUO-258	LS, MID, BRM	35 x 35						Tiltill Valley

Appendix 1--Continued

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
TUO-259	MID	15 x 20						Tiltill Valley
TUO-260	MID, BRM	7 x 10			1			Tiltill Valley
TUO-261	LS	7 x 5						Tiltill Valley
TUO-262	LS	7 x 10						Tiltill Valley
TUO-263	LS	5 x 7						Tiltill Valley
TUO-264	MID	14 x 20						Rancheria Falls
TUO-490	LS, MID	122 x 152						Tuolumne Meadows
TUO-491	LS	76 x 91						Tuolumne Meadows
TUO-492	LS	80 x 137						Tuolumne Meadows
TUO-493	LS	73 x 91						Tuolumne Meadows
TUO-494	LS	69 x 130						Tuolumne Meadows
TUO-495	LS	107 x 129						Tuolumne Meadows
TUO-496	LS	59 x 99						Tuolumne Meadows
TUO-497	LS	62 x 114						Tuolumne Meadows
TUO-498	LS	32 x 47						Tuolumne Meadows

Appendix 1--Continued

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
TUO-499	BRM	95 x 122			2			Tuolumne Meadows
TUO-500	LS	98 x 129						Tuolumne Meadows
TUO-501	LS	160 x 183						Tuolumne Meadows
TUO-502	LS	91 x 183						Tuolumne Meadows
TUO-503	MID	53 x 122						Tuolumne Meadows
TUO-504	LS	69 x 91						Tuolumne Meadows
TUO-505	LS	78 x 114						Tuolumne Meadows
TUO-506	LS	40 x 62						Tuolumne Meadows
TUO-507	LS, BRM	76 x 119			4+			Tuolumne Meadows
TUO-508	LS	62 x 111						Tuolumne Meadows
TUO-509	LS	83 x 93						Tuolumne Meadows
TUO-510	LS	82 x 91						Tuolumne Meadows
TUO-511	LS	46 x 122						Tuolumne Meadows
TUO-512	LS	53 x 130						White Wolf
TUO-513	LS	61 x 122						White Wolf

Appendix 1--Continued

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
TUO-514	LS, MID, BRM, RS	152 x 488	Subsurface		48			White Wolf
TUO-515	LS, BRM	29 x 32			8			Hetch-Hetchy
TUO-516	LS, BRM	77 x 137			6			Hetch-Hetchy
TUO-517	LS, MID, BRM	91 x 137			44			Aspen Valley
TUO-518	MID?, BRM	76 x 91			2			Aspen Valley
TUO-519	MID?, BRM	46 x 46			2			Aspen Valley
TUO-520	MID, BRM	137 x 160			13			Aspen Valley
TUO-521	LS	30 x 55						Aspen Valley
TUO-522	LS, BRM	91 x 107			12			Hodgdon Meadow
TUO-523	LS, BRM	52 x 80			6			Hodgdon Meadow
TUO-524	BRM, MID	76 x 76			6			Hodgdon Meadow
TUO-525	MID, BRM	84 x 88			8			Hodgdon Meadow
TUO-526	LS	81 x 82						Hodgdon Meadow
TUO-527	LS	117 x 122						Tuolumne Meadows

Appendix 1--Continued

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
TUO-528	LS	61 x 76						Tuolumne Meadows
TUO-529	LS	85 x 99						Tuolumne Meadows
TUO-530	LS	73 x 110						Tuolumne Meadows
TUO-531	LS	152 x 198						Tuolumne Meadows
TUO-532	LS	81 x 91						Tuolumne Meadows
TUO-733	LS	213 x 305						Bent Point
TUO-734	LS	158 x 244						
TUO-735	LS	137 x 213						
TUO-736	LS	137 x 152						
TUO-737	LS	41 x 137						
TUO-738	LS	23 x 46						
TUO-739	LS	107 x 152						Glen Aulin
TUO-740	LS	68 x 152						
TUO-741	LS, RS, MID	274 x 716						
TUO-742	LS	213 x 640						

Appendix 1--Continued

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
TUO-743	LS	76 x 152						Return Creek
TUO-744	LS	198 x 274						Return Creek
TUO-745	LS	106 x 198						Return Creek
TUO-746	LS	122 x 183						Return Creek
TUO-747	LS	91 x 137						
TUO-748	LS	47 x 76						Return Creek
TUO-749	LS	61 x 117				3 stone circles		Return Creek
TUO-750	LS, BRM	213 x 762		2	6			Return Creek
TUO-751	LS	152 x 305						Summit Pass
TUO-752	LS	23 x 30						
TUO-753	LS	152 x 366						Young Lake
TUO-754	LS	183 x 396						Gaylor Creek
TUO-755	LS	244 x 384						Gaylor Meadow
TUO-756	LS	152 x 229						Gaylor Lake
TUO-757	LS	137 x 305						Granite Lake

Appendix 1--Continued

Designation	Site Type	Area (m)	Depth (cm)	No. HP	No. BRM	Other Features	Excavations	Comments, References
TUO-758	LS	122 x 366						
TUO-759	BRM, LS	610 x 762						
TUO-760	LS	154 x 178						Rafferty Creek
TUO-761	LS	76 x 107						Rafferty Creek
TUO-762	LS	152 x 366						
TUO-763	LS, BRM	76 x 108			5			
TUO-764	MID, RS, BRM	152 x 366			1			
TUO-765	LS, BRM	137 x 213			9			
TUO-766	RS, LS	152 x 152						
TUO-925*	LS, BRM	50 x 80			34			Kibbie Creek
TUO-926	LS	1 x 2						Lake Eleanor
TUO-927	LS	5.5 x 9						Dana Lakes
TUO-928	LS	3 x 20						
TUO-929	MID	24 x 52						

*"No midden," but "pothunting" has occurred.

APPENDIX 2

ENVIRONMENTAL CONTEXT OF ARCHEOLOGICAL RESOURCES

APPENDIX 2
ENVIRONMENTAL CONTEXT OF ARCHEOLOGICAL RESOURCES

Designation*	Site Type	Elevation (m)	Vegetation Type	Drainage Class
MNO-21	LS	3,171	Whitebark pine forest	L/S
MRP-3	MID	1,314	Ponderosa pine forest with cedar and black oak	M
MRP-5	MID	1,982	Lodgepole pine forest with red fir	?
MRP-6	RS, MID, BRM	633	Black oak woodland	2
MRP-7	MID?, LS, BRM	1,201	Ponderosa pine forest with cedar and black oak; grass	3
MRP-8	MID, BRM	1,213	Ponderosa pine forest with cedar and black oak	1
MRP-9	MID, BRM	?		?
MRP-13	LS, MID?	2,655	Lodgepole pine forest with red fir; alpine meadow	3
MRP-15	MID	1,216	Ponderosa pine forest with cedar and black oak	?
MRP-45	MID?, BRM	1,216	Ponderosa pine forest with cedar and black oak	1
MRP-46	MID?, BRM	1,229	Ponderosa pine forest with cedar and black oak	1
MRP-47	MID?, BRM	1,229	Ponderosa pine forest with cedar and black oak	1
MRP-48	BRM	1226	White fir forest with sugar pine, red fir, jeffrey pine, and Douglas fir	1
MRP-49	RS, PIC	1,238	Ponderosa pine forest with cedar anJ black oak	1
MRP-50	LS, BRM	1,213	Ponderosa pine forest with cedar and black oak	1

* All site designations are within the state of California and are officially written preceeded by the number "4" (i.e., 4-MNO-21).

Appendix 2--Continued

Designation	Site Type	Elevation (m)	Vegetation Type	Drainage Class
MRP-51	LS, MID, BRM	1,213	Ponderosa pine forest with cedar and black oak	1
MRP-52	BRM	1,213	Ponderosa pine forest with cedar and black oak	1
MRP-53	BRM	1,212	Ponderosa pine forest with cedar and black oak	2
MRP-54	BRM	1,220	Ponderosa pine forest with cedar and black oak	3
MRP-55	RS, LS, BRM	1,189	Ponderosa pine forest with cedar and black oak	1
MRP-56	MID, BRM	1,220	Ponderosa pine forest with cedar and black oak	?
MRP-57	RS, PIC*, BRM	1,220	Ponderosa pine forest with cedar and black oak	2
MRP-58	RS, BRM	1,220	Ponderosa pine forest with cedar and black oak	2
MRP-59	BRM	1,220	Ponderosa pine forest with cedar and black oak	2
MRP-60	BRM	1,271	Ponderosa pine forest with cedar and black oak	2
MRP-61	MID, BRM	1,220	oak woodland (mixed species)	2
MRP-62	RS, MID, BRM	1,207	Ponderosa pine forest with cedar and black oak	1
MRP-63	BRM	1,213	Ponderosa pine forest with cedar and black oak	1
MRP-64	LS, RS, MID, BRM	1,226	?	2

*Now destroyed

Appendix 2--Continued

Designation	Site Type	Elevation (m)	Vegetation Type	Drainage Class
MRP-65	MID, BRM	1,220	Ponderosa pine forest with cedar and black oak	2
MRP-66	MID, BRM	1,210	Ponderosa pine forest with cedar and black oak	1
MRP-67	LS, MID, BRM	1,207	Ponderosa pine forest with cedar and black oak	1
MRP-68	RS, MID, BRM	1,220	Ponderosa pine fores with cedar and black oak	2
MRP-69	BRM	1,216	Ponderosa pine forest with cedar and black oak	1
MRP-70	LS, MID?	1,207	Ponderosa pine forest with cedar and black oak	1
MRP-71	RS, MID?, PIC, BRM	1,195	White fir forest with sugar pine, red fir, jeffrey pine, and Douglas fir	1
MRP-72	BRM	1,201	Ponderosa pine forest with cedar and black oak; grass	?
MRP-73	LS, BRM	1,197	White fir forest with sugar pine, red fir, jeffrey pine, and Douglas fir	1
MRP-74	RS, PIC, BRM	1,220	Ponderosa pine forest with cedar and black oak	1
MRP-75	BRM	1,210	Ponderosa pine forest with cedar and black oak; grass	1
MRP-76	LS, BRM	1,212	Ponderosa pine forest with cedar and black oak	1
MRP-77	RS	1,209	Ponderosa pine forest with cedar and black oak	1
MRP-78	BRM	1,207	Ponderosa pine forest with cedar and black oak	1

Appendix 2--Continued

Designation	Site Type	Elevation (m)	Vegetation Type	Drainage Class
MRP-142	LS, BRM	1,799	Lodgepole pine forest with red fir?	3
MRP-143	LS, BRM	1,335	Ponderosa pine forest with cedar and black oak	?
MRP-144	LS, BRS	1,335	Ponderosa pine forest with cedar and black oak	2
MRP-145	LS	1,324	Ponderosa pine forest with cedar and black oak	2
MRP-146	BRM, MID	1,323	Ponderosa pine forest with cedar and black oak	?
MRP-147	LS, BRM	1,317	Ponderosa pine forest with cedar and black oak; grass	?
MRP-148	MID, BRM	1,326	Ponderosa pine forest with cedar and black oak	M
MRP-149	LS, BRM	1,320	Ponderosa pine forest with cedar and black oak	?
MRP-150	LS, BRM	1,321	Ponderosa pine forest with cedar and black oak	?
MRP-151	LS, BRM, MID	1,320	Ponderosa pine forest with cedar and black oak	?
MRP-152	LS	1,301	Ponderosa pine forest with cedar and black oak	?
MRP-153	LS	2,500	Lodgepole pine forest with red fir	L
MRP-154	LS	2,515	Lodgepole pine forest with red fir	L
MRP-155	LS	2,500	Lodgepole pine forest with red fir	L
MRP-156	LS	3,079	Willow; pine	L
MRP-157	LS	3,110	Lodgepole pine forest with red fir; alpine meadow	L

Appendix 2--Continued

Designation	Site Type	Elevation (m)	Vegetation Type	Drainage Class
MRP-94	MID	1,982	Lodgepole pine forest with red fir	2
MRP-95	MID, BRM	1,921	Lodgepole pine forest with red fir?	2
MRP-96	MID	2,073	Conifer forest, species unknown	2
MRP-97	MID, BRM	2,088	Conifer forest, species unknown	2
MRP-98	MID	1,890	Conifer forest, species unknown	2
MRP-99	MID	1,829	Conifer forest, species unknown	2
MRP-100	LS, BRM	1,799	Jeffrey pine forest with cedar and red fir	?
MRP-101	BRM	1,890	Lodgepole pine forest with red fir	?
MRP-102	MID	1,921	Jeffrey pine forest with cedar and red fir	2
MRP-103	MID, BRM	1,896	Jeffrey pine forest with cedar and red fir	2
MRP-104	MID, BRM	1,878	Red fir forest with silver pine, sugar pine, jeffrey pine, lodgepole pine, and mountain hemlock	3
MRP-105	MID, BRM	1,878	Lodgepole pine forest with cedar and red fir	2
MRP-106	MID, BRM	1,884	Jeffrey pine forest with cedar and red fir	2
MRP-107	BRM	1,890	Ponderosa pine forest with cedar and black oak	3
MRP-108	MID	2,104	Lodgepole pine forest with red fir	2

Appendix 2--Continued

Designation	Site Type	Elevation (m)	Vegetation Type	Drainage Class
MRP-109	LS	2,470	Lodgepole pine forest with red fir	2
MRP-110	MID?, LS	2,470	Conifer forest, species unknown	2
MRP-111	MID?, LS	2,470	Conifer forest, species unknown	2
MRP-112	MID, LS?	2,470	Conifer forest, species unknown	2
MRP-113	MID?	2,470	Conifer forest, species unknown	2
MRP-114	MID? LS	2,470	Conifer forest, species unknown	2
MRP-115	MID, LS	2,073	Conifer forest, species unknown	2
MRP-116	MID, LS	2,073	Conifer forest, species unknown	2
MRP-117	MID, BRS	2,104	Conifer forest, species unknown	2
MRP-118	MID?, LS	2,134	Conifer forest, species unknown	2
MRP-119	MID?, LS	2,134	Conifer forest, species unknown	2
MRP-120	MID, BRM	2,378	Conifer forest, species unknown	2
MRP-121	LS, BRM	2,189	Lodgepole pine forest with red fir	2
MRP-122	LS	2,195	Lodgepole pine forest with red fir	2
MRP-123	MID, BRM	2,197		2
MRP-124	MID, BRM	2,287	Conifer forest, species unknown	2

Appendix 2--Continued

Designation	Site Type	Elevation (m)	Vegetation Type	Drainage Class
MRP-125	LS	2,378	Conifer forest, species unknown	2
MRP-126	BRM	488	Chaparral	1
MRP-127	LS	2,287	Lodgepole pine forest with red fir	2
MRP-128	LS	2,287	Lodgepole pine forest with red fir	2
MRP-129	MID?, LS	2,439	Lodgepole pine forest with red fir	2
MRP-130	LS	2,470	Lodgepole pine forest with red fir?	2
MRP-131	LS	2,470	Lodgepole pine forest with red fir?	2
MRP-132	LS	2,500	Lodgepole pine forest with red fir?	2
MRP-133	LS	2,561	Lodgepole pine forest with red fir; alpine meadow	2
MRP-134	LS	2,591	Lodgepole; sagebrush	2
MRP-135	MID, LS	1,878	Lodgepole pine forest with red fir	2
MRP-136	RS, LS	2,192	Lodgepole pine forest with red fir	2
MRP-137	LS	2,287	Conifer forest, species unknown	2
MRP-138	LS	2,287	Conifer forest, species unknown	2
MRP-139	LS	2,363	Lodgepole pine forest with red fir	2
MRP-140	LS	2,348	Lodgepole pine forest with red fir	2
MRP-141	LS	1,921	Lodgepole pine forest with red fir?	2

Appendix 2--Continued

Designation	Site Type	Elevation (m)	Vegetation Type	Drainage Class
MRP-79	LS, MID, BRM	1,210	Ponderosa pine forest with cedar and black oak	1
MRP-80	MID, BRM	1,210	Ponderosa pine forest with cedar and black oak	1
MRP-81	BRM	1,244	Oak woodland (mixed species)	?
MRP-82	BRM	1,213	Ponderosa pine forest with cedar and black oak	1
MRP-83	RS, MID, BRM	1,220	Ponderosa pine forest with cedar and black oak	1
MRP-84	"Camp"		Meadow; orchard	1
MRP-85	RS, "site"	1,341	Conifer forest, species unknown	1
MRP-86	BRM	1,814	Ponderosa pine forest with cedar and black oak	?
MRP-87	LS, MID, BRM	1,854	Jeffrey pine forest with cedar and red fir	1
MRP-88	MID	1,855	Lodgepole pine forest with red fir	1
MRP-89	MID, BRM	1,855	Lodgepole pine forest with red fir	1
MRP-90	MID, BRM	1,872	Jeffrey pine forest with cedar and red fir	2
MRP-91	MID?	1,860	Lodgepole pine forest with red fir	1
MRP-92	LS	1,210	Ponderosa pine forest with cedar and black oak; grass	1
MRP-93	MID?	2,134	Conifer forest, species unknown	1

Appendix 2--Continued

Designation	Site Type	Elevation (m)	Vegetation Type	Drainage Class
MRP-158	MID, PIC, RS	1,207	Ponderosa pine forest with cedar and black oak	1
MRP-159	BRM	1,216	Ponderosa pine forest with cedar and black oak	1
MRP-160	BRM	1,220	Ponderosa pine forest with cedar and black oak	1
MRP-161	RS, BRM	1,226	Ponderosa pine forest with cedar and black oak	1
MRP-162	BRM	1,213	Ponderosa pine forest with cedar and black oak	1
MRP-163	RS, BRM	1,210	Oak woodland (mixed species)	3
MRP-164	LS	2,134	Conifer forest, species unknown	?
MRP-165	LS	2,134	Conifer forest, species unknown	2
MRP-166	MID, BRM	2,134	Conifer forest, species unknown	2
MRP-167	LS	2,134	Lodgepole pine forest with red fir	2
MRP-168	BRM	1,189	Conifer forest, species unknown	1
MRP-169	BRM	1,197	Ponderosa pine forest with cedar and red fir	1
MRP-170	MID?, LS	1,206	Ponderosa pine forest with cedar and red fir	1
MRP-171	LS	1,207	Ponderosa pine forest with cedar and red fir; grass	1
MRP-172	BRM, LS	1,207	Ponderosa pine forest with cedar and red fir; grass	1
MRP-173	LS, MID	1,213	Ponderosa pine forest with cedar and red fir; grass	1

Appendix 2--Continued

Designation	Site Type	Elevation (m)	Vegetation Type	Drainage Class
MRP-174	BRM	1,248	Ponderosa pine forest with cedar and black oak	3
MRP-175	LS, MID, BRM	1,280	Ponderosa pine forest with cedar and black oak	2
MRP-176	LS, MID, BRM	1,250	Ponderosa pine forest with cedar and black oak	3
MRP-177	BRM	1,244	Ponderosa pine forest with cedar and black oak	3
MRP-178	BRM	602	Oak woodland (mixed species)	1
MRP-179	MID, BRM	563	Ponderosa pine forest with cedar and black oak	1
MRP-180	MID, BRM, LS	567	Ponderosa pine forest with cedar and black oak	1
MRP-181	MID, BRM	548	Oak woodland (mixed species)	1
MRP-182	MID, BRM	556	Oak woodland (mixed species)	1
MRP-183	LS, MID, BRM	518	Digger pine-blue oak woodland	1
MRP-184	MID, BRM	518	Oak woodland (mixed species)	2
MRP-186	LS, BRM	1,213	Ponderosa pine forest with cedar and black oak	1
MRP-187	BRM	1,204	Ponderosa pine forest with cedar and black oak	1
MRP-188	BRM	1,216	Ponderosa pine forest with cedar and black oak	2

Appendix 2--Continued

Designation	Site Type	Elevation (m)	Vegetation Type	Drainage Class
MRP-189	BRM	1,192	Ponderosa pine forest with cedar and black oak; grass	S
MRP-190	BRM	1,213	Ponderosa pine forest with cedar and black oak	2
MRP-191	BRM	1,212	Ponderosa pine forest with cedar and black oak	2
MRP-192	IA	2,287	Lodgepole pine forest with red fir	2
MRP-196	LS	1,213	Ponderosa pine forest with cedar and black oak; grass	2
MRP-197	BRM	1,585	Ponderosa pine forest with cedar and black oak	?
MRP-198	BRM	1,720	Ponderosa pine forest with cedar and black oak	?
MRP-199	LS, MID, BRM		Ponderosa pine forest with cedar and black oak	?
MRP-200	SC		None	?
MRP-201	LS, BRM	1,463	Pine, open	?
MRP-202	LS, BRM	1,372	Ponderosa pine forest with cedar and black oak	?
MRP-203	LS, BRM	1,251	Ponderosa pine forest with cedar and black oak	2
MRP-204	BRM	1,274	Ponderosa pine forest with cedar and black oak	2
MRP-205	BRM	1,223	Ponderosa pine forest with cedar and black oak	1
MRP-206	LS	1,311	Ponderosa pine forest with cedar and black oak	1
MRP-207	LS	1,341	Cedar	1

Appendix 2--Continued

Designation	Site Type	Elevation (m)	Vegetation Type	Drainage Class
MRP-208	BRM	1,287	Ponderosa pine forest with cedar and black oak	1
MRP-209	LS, BRM	?	Conifer forest, species unknown	?
MRP-210	LS, BRM	?	Deciduous and conifers	?
MRP-211	LS	1,181	Ponderosa pine forest with cedar and black oak	2
MRP-212	LS, BRM	1,188	Ponderosa pine forest with cedar and black oak	2
MRP-213	LS, BRM	1,220	Ponderosa pine forest with cedar and black oak	1
MRP-214	BRM	1,195	Ponderosa pine forest with cedar and black oak	1
MRP-215	BRM	1,372	Ponderosa pine forest with cedar and black oak	?
MRP-216	LS, BRM	1,195	Ponderosa pine forest with cedar and black oak	1
MRP-217	LS	1,226	Ponderosa pine forest with cedar and black oak	3
MRP-218	LS, MID, BRM	1,317	Ponderosa pine forest with cedar and black oak	1
MRP-219	MID, BRM	1,287	Ponderosa pine forest with cedar and black oak	1
MRP-220	LS, BRM	2,195	Lodgepole pine forest with red fir	2
MRP-221	LS	2,226	Lodgepole pine forest with red fir	2
MRP-222	LS, BRM	2,195	Lodgepole pine forest with red fir	2
MRP-223	BRM	2,134	Lodgepole pine forest with red fir	2

Appendix 2--Continued

Designation	Site Type	Elevation (m)	Vegetation Type	Drainage Class
MRP-224	MID, BRM	2,134	Lodgepole pine forest with red fir	2
MRP-225	BRM	2,134	Lodgepole pine forest with red fir	3
MRP-226	LS, BRM	2,195	Red fir forest with silver pine, sugar pine, jeffrey pine, lodgepole pine, and mountain hemlock	2
MRP-227	MID, BRM	1,951	Red fir forest with silver pine, sugar pine, jeffrey pine, lodgepole pine, and mountain hemlock	2
MRP-228	BRM	1,860	Conifer forest, species unknown	2
MRP-229	MID	2,134	Jeffrey pine forest with cedar and red fir	2
MRP-230	LS	2,043	Red fir forest with silver pine, sugar pine, jeffrey pine, lodgepole pine, and mountain hemlock	?
MRP-231	LS, BRM	1,829	Ponderosa pine forest with cedar and black oak	2
MRP-232	LS	2,409	Lodgepole pine forest with red fir	?
MRP-233	LS	2,195	Lodgepole pine forest with red fir	2
MRP-234	LS	2,104	Lodgepole pine forest with red fir	2
MRP-235	LS, MID, BRM	1,982	Lodgepole pine forest with red fir?	2
MRP-236	MID, BRM	1,409	Ponderosa pine forest with cedar and black oak	?
MRP-237	MID, BRM	2,409	Lodgepole pine forest with red fir; Alpine meadow	2

Appendix 2--Continued

Designation	Site Type	Elevation (m)	Vegetation Type	Drainage Class
MRP-238	LS, MID, BRM	2,088	Jeffrey pine forest with cedar and red fir?	?
MRP-239	IA	2,165	Lodgepole pine forest with red fir	
MRP-240	LS, BRM	1,212	Ponderosa pine forest with cedar and black oak	2
MRP-241	RS, BRM	1,048	Ponderosa pine forest with cedar and black oak	2
MRP-242	BRM	1,055	Ponderosa pine forest with cedar and black oak	1
MRP-250	LS, MID, BRM	610	Ponderosa pine forest with cedar and black oak	1
MRP-251	LS, BRM	579	Chaparral; Ponderosa pine forest with cedar and black oak	1
MRP-252				
MRP-253				
MRP-254	PIC, BRM	1,220		1
MRP-277	MID, LS	1,976	Chaparral	?
MRP-285	LS	1,213	Ponderosa pine forest with cedar and black oak	2
MRP-286	LS, RS, BRM	1,220	Ponderosa pine forest with cedar and black oak	2
MRP-287	RS, BRM	1,220	Ponderosa pine forest with cedar and black oak	2
MRP-288	RS, BRM	1,216	Ponderosa pine forest with cedar and black oak	2

Designation	Site Type	Elevation (m)	Vegetation Type	Drainage Class
MRP-289	BRM	1,216	Ponderosa pine forest with cedar and black oak	2
MRP-290	BRM	1,213	Ponderosa pine forest with cedar and black oak	1
MRP-291	LS, BRM	1,220	Oak woodland (mixed species)	2
MRP-292	RS, MID, BRM	1,220	Ponderosa pine forest with cedar and black oak	2
MRP-293	RS, BRM	1,226	Ponderosa pine forest with cedar and black oak	?
MRP-294	RS, BRM	1,220	Ponderosa pine forest with cedar and black oak	2
MRP-295	BRM	1,220	Ponderosa pine forest with cedar and black oak	2
MRP-296	RS, BRM	1,241	Oak woodland (mixed species)	2
MRP-297	BRM	1,247	Oak woodland (mixed species)	2
MRP-298	BRM	1,226	Ponderosa pine forest with cedar and black oak	?
MRP-299	BRM	1,213	Oak woodland (mixed species)	?
MRP-300	MID?, LS	1,210	Cedar, bracken	?
MRP-301	BRM	1,220	Ponderosa pine forest with cedar and black oak	2
MRP-302	BRM	1,220	Oak woodland (mixed species)	2
MRP-303	BRM	1,213	Ponderosa pine forest with cedar and black oak	2
MRP-304	RS, BRM	1,220	Ponderosa pine forest with cedar and black oak	1
MRP-305	MID, BRM	1,213	Ponderosa pine forest with cedar and black oak	1

Appendix 2--Continued

Designation	Site Type	Elevation (m)	Vegetation Type	Drainage Class
MRP-306	BRM	1,216	Ponderosa pine forest with cedar and black oak	2
MRP-307	BRM	1,213	Ponderosa pine forest with cedar and black oak	2
MRP-308	LS	1,207	Ponderosa pine forest with cedar and black oak	1
MRP-309	RS, BRM	1,207	Ponderosa pine forest with cedar and black oak	1
MRP-310	RS, BRM	1,209	Ponderosa pine forest with cedar and black oak	1
MRP-311	BRM	1,210	Ponderosa pine forest with cedar and black oak	1
MRP-312	RS, BRM	1,195	Ponderosa pine forest with cedar and black oak	1
MRP-313	RS, BRM	1,192	Ponderosa pine forest with cedar and black oak	1
MRP-314	BRM	1,195	Ponderosa pine forest with cedar and black oak	S
MRP-315	RS, BRM	1,189	Oak woodland (mixed species)	1
MRP-316	LS, BRM	1,195	Oak woodland (mixed species)	1
MRP-317	RS, LS, BRM	1,232	Oak woodland (mixed species)	2
MRP-318	BRM	1,201	Cedar, laurel, blue oak	2
MRP-319	BRM	1,207	Cedar, laurel, willow	2
MRP-320	RS, BRM	1,212	Ponderosa pine forest with cedar and black oak	S
MRP-321	BRM	1,215	Ponderosa pine forest with cedar and black oak	1

Appendix 2--Continued

Designation	Site Type	Elevation (m)	Vegetation Type	Drainage Class
MRP-322	LS	1,211	Ponderosa pine forest with cedar and black oak	1
MRP-323	BRM	1,213	Ponderosa pine forest with cedar and black oak	2
MRP-324	BRM	1,210	Ponderosa pine forest with cedar and black oak	1
MRP-325	BRM	1,213	Ponderosa pine forest with cedar and black oak	1
MRP-326	BRM	1,218	Ponderosa pine forest with cedar and black oak	1
MRP-327	LS, MID?,	1,213	Ponderosa pine forest with cedar and black oak	1
MRP-328	BRM	1,220	Ponderosa pine forest with cedar and black oak	1
MRP-329	LS, BRM	1,180	Ponderosa pine forest with cedar and black oak	1
MRP-330	MID, BRM	1,197	Willow, grasses	1
MRP-331	BRM	1,201	Ponderosa pine forest with cedar and black oak	1
MRP-332	BRM	1,252	Ponderosa pine forest with cedar and black oak	2
MRP-333	BRM	1,248	Ponderosa pine forest with cedar and black oak	3
MRP-334	BRM	1,232	Ponderosa pine forest with cedar and black oak	1
MRP-335	BRM	1,239	Ponderosa pine forest with cedar and black oak	1
MRP-336	LS, BRM	1,223	Ponderosa pine forest with cedar and black oak	1
MRP-337	LS, BRM	1,226	Ponderosa pine forest with cedar and black oak	1

Appendix 2--Continued

Designation	Site Type	Elevation (m)	Vegetation Type	Drainage Class
MRP-338	BRM	1,230	Ponderosa pine forest with cedar and black oak	1
MRP-339	BRM	1,242	Ponderosa pine forest with cedar and black oak	3
MRP-340	BRM	1,274	White fir forest with sugar pine, red fir, jeffrey pine, and Douglas fir?	3
MRP-341	LS, BRM	1,293	Ponderosa pine forest with cedar and black oak	3
MRP-342	BRM	1,239	Ponderosa pine forest with cedar and black oak	3
MRP-343	MID, BRM, LS	1,235	Ponderosa pine forest with cedar and black oak	1
MRP-344	LS, M, BRM	1,585	Ponderosa pine forest with cedar and black oak	2
MRP-345	LS	1,616	White fir forest with sugar pine, red fir, jeffrey pine, and Douglas fir	2
MRP-346	LS, BRM	1,305	Ponderosa pine forest with cedar and black oak	2
MRP-347	BRM	1,355	Ponderosa pine forest with cedar and black oak	2
MRP-348	BRM	1,335	Ponderosa pine forest with cedar and black oak	3
MRP-349	LS, MID, BRM	1,317	Ponderosa pine forest with cedar and black oak	2
MRP-350	MID, LS, BRM	1,302	Ponderosa pine forest with cedar and black oak	2
MRP-351	MID, BRM	1,355	Ponderosa pine forest with cedar and black oak	3

Appendix 2--Continued

Designation	Site Type	Elevation (m)	Vegetation Type	Drainage Class
MRP-352	LS	1,351	Ponderosa pine forest with cedar and black oak	3
MRP-353	LS, MID, BRM	1,323	Ponderosa pine forest with cedar and black oak	M
MRP-354	MID?, BRM	1,341	Ponderosa pine forest with cedar and black oak	3
MRP-355	BRM	518	Digger pine-blue oak woodland	1
MRP-358	LS, BRM	559	Digger pine-blue oak woodland	1
MRP-360	BRM	552	Oak woodland (mixed species)	1
MRP-361	LS, BRM	570	Digger pine-blue oak woodland?	1
MRP-362	MID, BRM	595	Oak woodland (mixed species)	1
MRP-363	C	625	Ponderosa pine forest with cedar and black oak	1
MRP-364	BRM	2,195	Lodgepole pine forest with red fir	2
MRP-365	BRM, MID	1,872	Red fir forest with silver pine, sugar pine, jeffrey pine, lodgepole pine, and mountain hemlock	3
MRP-366	LS	2,195	Lodgepole pine forest with red fir	2
MRP-367	LS	2,134	Lodgepole pine forest with red fir	2
MRP-368	LS	2,146	Lodgepole pine forest with red fir	2
MRP-369	RS, MID, BRM	1,049	Ponderosa pine forest with cedar and black oak	1

Appendix 2--Continued

Designation	Site Type	Elevation (m)	Vegetation Type	Drainage Class
MRP-370	LS	2,183	Lodgepole pine forest with red fir	2
MRP-371	LS	2,305	Red fir forest with silver pine, sugar pine, jeffrey pine, lodgepole pine, and mountain hemlock	?
MRP-372	MID, LS, BRM	1,774	Ponderosa pine forest with cedar and black oak?	?
MRP-373	LS	1,280	Ponderosa pine forest with cedar and black oak	1
MRP-374	LS, BRM	1,287	Ponderosa pine forest with cedar and black oak	1
MRP-375	LS, BRM	1,287	Ponderosa pine forest with cedar and black oak	1
MRP-376	LS, BRM	2,402	Red fir forest with silver pine, sugar pine, jeffrey pine, lodgepole pine, and mountain hemlock	S
MRP-377	LS	2,387	Red fir forest with silver pine, sugar pine, jeffrey pine, lodgepole pine, and mountain hemlock	?
MRP-378	LS, MID, BRM	2,384	Red fir forest with silver pine, sugar pine, jeffrey pine, lodgepole pine, and mountain hemlock	S
MRP-379	LS, BRM	1,354	Ponderosa pine forest with cedar and black oak	3
MRP-380	BRM, LS	1,329	Ponderosa pine forest with cedar and black oak	3
MRP-381	LS, BRM	1,280	Ponderosa pine forest with cedar and black oak	3
MRP-382	RS, BRM	625	Chaparral	1

Appendix 2--Continued

Designation	Site Type	Elevation (m)	Vegetation Type	Drainage Class
MRP-440	LS	2,997	Lodgepole pine forest with red fir	2
MRP-441	LS	2,899	Lodgepole pine forest with red fir	2
MRP-442	LS, BRM	2512	Lodgepole pine forest with red fir	2
MRP-443	LS	2,564	Lodgepole pine forest with red fir	2
MRP-444	LS	2,622	Lodgepole pine forest with red fir	2
MRP-445	LS	2,835	Lodgepole pine forest with red fir	L
MRP-446	LS	2,924	Lodgepole pine forest with red fir	L
MRP-447	LS	2,924	Lodgepole pine forest with red fir	2
MRP-448	LS	2,561	Lodgepole pine forest with red fir	2
MRP-449	LS	2,774	Lodgepole pine forest with red fir	?
MRP-450	LS	2,134	Lodgepole pine forest with red fir	1
MRP-451	BRM	2,134	Lodgepole pine forest with red fir	2
MRP-452	LS	2,171	Jeffrey pine forest with cedar and red fir	1
MRP-453	LS, BRM	2,226	Red fir forest with silver pine, sugar pine, jeffrey pine, lodgepole pine, and mountain hemlock	1
MRP-454	LS	2,244	Red fir forest with silver pine, sugar pine, jeffrey pine, lodgepole pine, and mountain hemlock	2

Appendix 2--Continued

Designation	Site Type	Elevation (m)	Vegetation Type	Drainage Class
MRP-457	L	1,220	Sugar pine, buckbrush	
MRP-458	LS	1,220		
MRP-514	LS, BRM	1,273	Ponderosa pine forest with cedar and black oak	3
MRP-515	LS	1,448	Ponderosa pine forest with cedar and black oak	1
MRP-516	LS	1,213	Ponderosa pine forest with cedar and black oak	1
TUO-22	PIC, LS, MID, BRM, RS	1,338	Ponderosa pine forest with cedar and black oak	1
TUO-28	LS	2,287	White fir forest with sugar pine, red fir, jeffrey pine, and Douglas fir	L
TUO-29	"Camp site"	1,159		2
TUO-45	LS	3,079	Lodgepole pine forest with red fir	2
TUO-46	LS	2,866	Lodgepole pine forest with red fir	2
TUO-47	LS	2,988	Conifer forest, species unknown	L
TUO-48	LS, BRM		Oak woodland (mixed species)	?
TUO-49	MID, BRM	1,433		L
TUO-50	LS	1,433		?
TUO-51	?	1,433	Ponderosa pine forest with cedar and black oak	?
TUO-52	MID	1,433	Ponderosa pine forest with cedar and black oak	2

Appendix 2--Continued

Designation	Site Type	Elevation (m)	Vegetation Type	Drainage Class
TUO-53	LS	1,433	Conifer forest, species unknown	2
TUO-54	LS, BRM	1,433	Conifer forest, species unknown?	?
TUO-55	LS, MID, BRM	1,433		?
TUO-56	MID, BRM	1,433	Ponderosa pine forest with cedar and black oak	2
TUO-57	BRM	?		
TUO-58	?	?		
TUO-59	?	?		
TUO-61	?	?		
TUO-62	?	?		
TUO-63	?	?		
TUO-65	?	?		
TUO-66	MID?, LS	?		
TUO-67	?	?		
TUO-68	?	?		
TUO-69	?	?		
TUO-70	?	?		
TUO-71	?	?		
TUO-72	?	?		
TUO-73	?	?		
TUO-74	?	?		
TUO-75	?	?		

Appendix 2--Continued

Designation	Site Type	Elevation (m)	Vegetation Type	Drainage Class
TUO-76	?	?		
TUO-77	?	?		
TUO-78	?	?		
TUO-79	?	?		
TUO-80	BRM	?		
TUO-81	?	?		
TUO-82	?	?		
TUO-83	?	?		
TUO-84	?	?		
TUO-85	?	?		
TUO-86	?	?		
TUO-87	?	?		
TUO-88	?	?		
TUO-89	?	?		
TUO-90	?	?		
TUO-91	?	?		
TUO-92	?	?		
TUO-99	?, LS	3,171		
TUO-102	BRM	1,585		
TUO-103	LS	2,561	Conifer forest, species unknown	2
TUO-104	MID	2,561	Conifer forest, species unknown	2
TUO-105	LS	2,402	Lodgepole pine forest with red fir	2

Appendix 2--Continued

Designation	Site Type	Elevation (m)	Vegetation Type	Drainage Class
TUO-106	MID?, LS	2,500	Conifer forest, species unknown	3
TUO-107	MID?, LS	2,561	Conifer forest, species unknown	L
TUO-108	LS	2,612	Lodgepole pine forest with red fir	3
TUO-109	LS	2,613	Lodgepole pine forest with red fir	2
TUO-110	LS	2,613	Lodgepole pine forest with red fir	2
TUO-111	LS, BRM	2,607	Lodgepole pine forest with red fir	1
TUO-112	LS	2,613	Lodgepole pine forest with red fir; Alpine meadow	1
TUO-113	LS	2,611	Lodgepole pine forest with red fir; Alpine meadow	1
TUO-114	LS	2,613	Lodgepole pine forest with red fir; Alpine meadow	1
TUO-115	LS	2,613	Lodgepole pine forest with red fir; Alpine meadow	1
TUO-116	LS	2,614	Lodgepole pine forest with red fir	1
TUO-117	LS	2,614	Lodgepole pine forest with red fir	1
TUO-118	LS	2,614	Lodgepole pine forest with red fir; Alpine meadow	1
TUO-119	LS	2,619	Lodgepole pine forest with red fir; Alpine meadow	1
TUO-120	LS	2,626	Lodgepole pine forest with red fir; Alpine meadow	2
TUO-121	LS	2,616	Lodgepole pine forest with red fir; Alpine meadow	1

Appendix 2--Continued

Designation	Site Type	Elevation (m)	Vegetation Type	Drainage Class
TUO-122	LS, MID	2,591	Conifer forest, species unknown	1
TUO-123	LS	2,604	Lodgepole pine forest with red fir	1
TUO-124	BRM, LS	2,623	Lodgepole pine forest with red fir	1
TUO-125	LS	2,608	Lodgepole pine forest with red fir; Alpine meadow	1
TUO-126	LS, BRM	2,608	Lodgepole pine forest with red fir; Alpine meadow	1
TUO-127	LS	2,610	Lodgepole pine forest with red fir; Alpine meadow	1
TUO-128	LS, MID?	2,613	Lodgepole pine forest with red fir; Alpine meadow	1
TUO-129	LS	2,610	Lodgepole pine forest with red fir; Alpine meadow	P
TUO-130	LS	2,610	Lodgepole pine forest with red fir; Alpine meadow	2
TUO-131	LS	2,608	Lodgepole pine forest with red fir; Alpine meadow	2
TUO-132	LS	2,608	Lodgepole pine forest with red fir; Alpine meadow	1
TUO-133	MID	2,610	Lodgepole pine forest with red fir; Alpine meadow	1
TUO-134	MID	2,610	Lodgepole pine forest with red fir; Alpine meadow	1
TUO-135	MID	2,591	Lodgepole pine forest with red fir; Alpine meadow	2
TUO-145	MID	2,683	Lodgepole pine forest with red fir; Alpine meadow	2
TUO-146	MID	2,622	Lodgepole pine forest with red fir; Alpine meadow	2

Appendix 2--Continued

Designation	Site Type	Elevation (m)	Vegetation Type	Drainage Class
TUO-147	MID	2,652	Conifer forest, species unknown	2
TUO-148	BRM	1,555		2
TUO-149	MID	2,683	Conifer forest, species unknown	2
TUO-150	MID	2,683	Lodgepole pine forest with red fir; Alpine meadow	2
TUO-151	MID	2,683	Conifer forest, species unknown	2
TUO-152	LS	2,988	Lodgepole pine forest with red fir; Alpine meadow	2
TUO-153	LS	2,988	Lodgepole pine forest with red fir; Alpine meadow	2
TUO-154	LS	2,988	Lodgepole pine forest with red fir; Alpine meadow	2
TUO-155	LS	2,988	Lodgepole pine forest with red fir; Alpine meadow	2
TUO-156	LS	3,140	Alpine meadow	L
TUO-157	LS	3,140	Alpine meadow	L
TUO-158	LS	3,140	Lodgepole pine forest with red fir; Alpine meadow	L
TUO-159	MID	3,140	Alpine meadow	L
TUO-160	LS	3,140	Lodgepole pine forest with red fir; Alpine meadow	L
TUO-161	LS	3,171	Lodgepole pine forest with red fir; Alpine meadow	?
TUO-162	LS	2,988	Lodgepole pine forest with red fir	2
TUO-163	LS	2,902	Lodgepole pine forest with red fir	2

Appendix 2--Continued

Designation	Site Type	Elevation (m)	Vegetation Type	Drainage Class
TUO-164	LS	2,908	Lodgepole pine forest with red fir; Alpine meadow	L
TUO-165	LS	2,902	Lodgepole pine forest with red fir	L
TUO-166	BRM?, LS	2,625	Lodgepole pine forest with red fir; Alpine meadow	1
TUO-167	BRM, LS	2,625	Lodgepole pine forest with red fir; Alpine meadow	1
TUO-168	LS	2,798	Lodgepole pine forest with red fir; Alpine meadow	L
TUO-169	LS	2,791	Lodgepole pine forest with red fir; Alpine meadow	L
TUO-170	LS	2,800	Lodgepole pine forest with red fir; Alpine meadow	L
TUO-171	LS	2,835	Alpine meadow	?
TUO-172	LS	2,866	Lodgepole pine forest with red fir; Alpine meadow	2
TUO-173	LS	2,898	Lodgepole pine forest with red fir; Alpine meadow	2
TUO-174	LS	2,921	Lodgepole pine forest with red fir; Alpine meadow	2
TUO-175	LS	2,890	Lodgepole pine forest with red fir; Alpine meadow	2
TUO-176	LS	2,896	Alpine meadow	2
TUO-177	LS	3,018	Lodgepole pine forest with red fir; Alpine meadow	2
TUO-178	LS	3,034	Lodgepole pine forest with red fir; Alpine meadow	2
TUO-179	LS	2,881	Conifer forest, species unknown	2
TUO-180	LS	2,866	Conifer forest, species unknown; Alpine meadow	2

Appendix 2--Continued

Designation	Site Type	Elevation (m)	Vegetation Type	Drainage Class
TUO-181	LS	2,866	Conifer forest, species unknown; Alpine meadow	2
TUO-182	LS	2,881	Conifer forest, species unknown	2
TUO-183	LS	2,866	Conifer forest, species unknown	2
TUO-184	LS	2,896	Conifer forest, species unknown	2
TUO-185	LS	2,912	Conifer forest, species unknown	2
TUO-186	LS	2,896	Conifer forest, species unknown	2
TUO-187	LS	2,896	Conifer forest, species unknown	2
TUO-188	LS	2,957	Conifer forest, species unknown	2
TUO-189	LS	2,957	Conifer forest, species unknown	2
TUO-190	LS	2,957	Conifer forest, species unknown	2
TUO-191	LS	2,973	Conifer forest, species unknown	2
TUO-192	LS	3,018	Conifer forest, species unknown	2
TUO-193	LS	3,018	Alpine meadow	2
TUO-194	LS	3,018	Conifer forest, species unknown	2
TUO-195	LS	3,018	Conifer forest, species unknown; Alpine meadow	2
TUO-196	LS	3,018	Alpine meadow	2
TUO-197	LS	3,079	Conifer forest, species unknown	2

Appendix 2--Continued

Designation	Site Type	Elevation (m)	Vegetation Type	Drainage Class
TUO-198	LS	3,171	Conifer forest, species unknown	2
TUO-199	LS, MID?	3,171	Conifer forest, species unknown	2
TUO-200	LS	3,201	Conifer forest, species unknown; Alpine meadow	2
TUO-201	LS	2,988	Conifer forest, species unknown	L
TUO-202	MID	2,988	Alpine meadow	L
TUO-203	LS, MID	2,988	Conifer forest, species unknown; Alpine meadow	2
TUO-204	LS	3,262	Lodgepole pine forest with red fir; Alpine meadow	2
TUO-205	LS, BRM	2,037	Jeffrey pine forest with cedar and red fir?	2
TUO-206	LS, BRM	1,494	Sagebrush, mixed conifer, oaks	2
TUO-207	LS, BRM	2,287	Lodgepole pine forest with red fir	L
TUO-208	LS	2,290	Lodgepole pine forest with red fir	L
TUO-209	LS, BRM	2,274	Red fir forest with silver pine, sugar pine, jeffrey pine, lodgepole pine, and mountain hemlock?	L
TUO-210	LS, BRM	2,271	Lodgepole pine forest with red fir	L
TUO-211	MID, BRM	1,433	Jeffrey pine forest with cedar and red fir	2
TUO-212	MID, BRM	1,433	Conifer forest, species unknown	2
TUO-213	MID?, BRM	1,433	Conifer forest, species unknown	?

Appendix 2--Continued

Designation	Site Type	Elevation (m)	Vegetation Type	Drainage Class
TUO-214	MID, BRM	1,433	Ponderosa pine forest with cedar and black oak?	3
TUO-215	MID?, BRM	1,433	Ponderosa pine forest with cedar and black oak?	3
TUO-216	MID?, BRM	1,433	Jeffrey pine forest with cedar and red fir?	3
TUO-217	MID, BRM	1,433	Jeffrey pine forest with cedar and red fir	3
TUO-218	MID, BRM	1,433	Black oak woodland	3
TUO-219	MID, BRM	1,433	Oak, fir, pine	M
TUO-220	LS, BRM	1,433	Conifer forest, species unknown	?
TUO-221	BRM	1,433	Jeffrey pine forest with cedar and red fir?	?
TUO-222	BRM	1,372	Jeffrey pine forest with cedar and red fir	2
TUO-223	MID, BRM	1,402	Ponderosa pine forest with cedar and black oak	2
TUO-224	LS	1,402	Ponderosa pine forest with cedar and black oak	2
TUO-225	LS	1,402	Ponderosa pine forest with cedar and black oak	2
TUO-226	MID, BRM	1,799	Conifer forest, species unknown	2
TUO-227	LS	1,799	Conifer forest, species unknown	2
TUO-228	LS	1,799	Conifer forest, species unknown	2
TUO-229	LS	1,799	Conifer forest, species unknown	2

Appendix 2--Continued

Designation	Site Type	Elevation (m)	Vegetation Type	Drainage Class
TUO-230	MID, LS, BRM	1,799	White fir forest with sugar pine, red fir, jeffrey pine, and Douglas fir	2
TUO-231	MID, BRM	1,799	White fir forest with sugar pine, red fir, jeffrey pine, and Douglas fir	2
TUO-232	LS	1,799	White fir forest with sugar pine, red fir, jeffrey pine, and Douglas fir	2
TUO-233	LS	1,829	White fir forest with sugar pine, red fir, jeffrey pine, and Douglas fir	2
TUO-234	BRM	1,982	White fir forest with sugar pine, red fir, jeffrey pine, and Douglas fir	3
TUO-235	BRM	1,433	Oak, fir, pines	?
TUO-236	LS, BRM	1,418	White fir forest with sugar pine, red fir, jeffrey pine, and Douglas fir?	2
TUO-237	LS, BRM	1,418	White fir forest with sugar pine, red fir, jeffrey pine, and Douglas fir?	2
TUO-238	LS	1,409	Ponderosa pine forest with cedar and black oak	2
TUO-239	MID, BRM	1,402	White fir forest with sugar pine, red fir, jeffrey pine, and Douglas fir	2
TUO-240	IA	?	Alpine meadow	2
TUO-241	IA	3,201	Lodgepole pine forest with red fir	?
TUO-245	LS	3,280	Alpine meadow	L
TUO-246	LS	3,216	Alpine meadow	L

Appendix 2--Continued

Designation	Site Type	Elevation (m)	Vegetation Type	Drainage Class
TUO-258	LS, MID, BRM	1,707	Ponderosa pine forest with cedar and black oak?	?
TUO-259	MID	1,707	Ponderosa pine forest with cedar and black oak?	?
TUO-260	MID, BRM	1,707	Ponderosa pine forest with cedar and black oak?	?
TUO-261	LS	1,683	Conifer forest, species unknown	?
TUO-262	LS	1,534	Ponderosa pine forest with cedar and black oak?	?
TUO-263	LS	1,707	Ponderosa pine forest with cedar and black oak?	?
TUO-264	MID	1,390	Conifer forest, species unknown	?
TUO-490	LS, MID	2,628	Lodgepole pine forest with red fir; Alpine meadow	2
TUO-491	LS	2,637	Lodgepole pine forest with red fir	2
TUO-492	LS	2,639	Lodgepole pine forest with red fir; Alpine meadow	2
TUO-493	LS	2,616	Lodgepole pine forest with red fir	?
TUO-494	LS	2,615	Lodgepole, sagebrush	1
TUO-495	LS	2,636	Lodgepole pine forest with red fir; Alpine meadow	1
TUO-496	LS	2,626	Lodgepole pine forest with red fir; Alpine meadow	1
TUO-497	LS	2,616	Sagebrush	1
TUO-498	LS	2,637	Lodgepole pine forest with red fir; Alpine meadow	2

Appendix 2--Continued

Designation	Site Type	Elevation (m)	Vegetation Type	Drainage Class
TUO-499	BRM	2,610	Lodgepole pine forest with red fir; Alpine meadow	1
TUO-500	LS	2,634	Lodgepole pine forest with red fir; Alpine meadow	3
TUO-501	LS	2,627	Lodgepole pine forest with red fir; Alpine meadow	3
TUO-502	LS	2,630	Lodgepole pine forest with red fir; Alpine meadow	1
TUO-503	MID	2,640	Lodgepole pine forest with red fir; Alpine meadow	2
TUO-504	LS	2,610	Lodgepole pine forest with red fir; Alpine meadow	2
TUO-505	LS	2,634	Lodgepole pine forest with red fir; Alpine meadow	2
TUO-506	LS	2,631	Lodgepole pine forest with red fir; Alpine meadow	2
TUO-507	LS, BRM	2,609	Lodgepole pine forest with red fir; Alpine meadow	3
TUO-508	LS	2,649	Lodgepole pine forest with red fir; Alpine meadow	2
TUO-509	LS	2,616	Lodgepole pine forest with red fir; Alpine meadow	2
TUO-510	LS	2,625	Lodgepole pine forest with red fir; Alpine meadow	2
TUO-511	LS	2,631	Lodgepole pine forest with red fir; Alpine meadow	2
TUO-512	LS	2,396	Lodgepole pine forest with red fir	2
TUO-513	LS	2,402	Lodgepole pine forest with red fir	2

Appendix 2--Continued

Designation	Site Type	Elevation (m)	Vegetation Type	Drainage Class
TUO-514	LS, MID, BRM, RS	2,387	Lodgepole pine forest with red fir;Alpine meadow	2
TUO-515	LS, BRM	1,201	Black oak woodland	M
TUO-516	LS, BRM	1,073	Ponderosa pine forest with cedar and black oak	3
TUO-517	LS, MID, BRM	1,927	White fir forest with sugar pine, red fir, jeffrey pine, and Douglas fir	2
TUO-518	MID?, BRM	1,878	White fir forest with sugar pine, red fir, jeffrey pine, and Douglas fir	2
TUO-519	MID?, BRM	1,878	White fir forest with sugar pine, red fir, jeffrey pine, and Douglas fir	2
TUO-520	MID, BRS	1,892	Ponderosa pine forest with cedar and black oak	2
TUO-521	LS	1,836	White fir forest with sugar pine, red fir, jeffrey pine, and Douglas fir	2
TUO-522	LS,	1,488	Ponderosa pine forest with cedar and black oak	2
TUO-523	LS, BRM	1,335	Ponderosa pine forest with cedar and black oak	2
TUO-524	BRM, MID	1,366	White fir forest with sugar pine, red fir, jeffrey pine, and Douglas fir?	3
TUO-525	MID, BRM	1,384	White fir forest with sugar pine, red fir, jeffrey pine, and Douglas fir	2
TUO-526	LS	1,409	Black oak woodland	2

Appendix 2--Continued

Designation	Site Type	Elevation (m)	Vegetation Type	Drainage Class
TUO-527	LS	2,628	Lodgepole pine forest with red fir; Alpine meadow	2
TUO-528	LS	2,631	Lodgepole pine forest with red fir	2
TUO-529	LS	2,634	Lodgepole pine forest with red fir; Alpine meadow	2
TUO-530	LS	2,652	Lodgepole pine forest with red fir; Alpine meadow	2
TUO-531	LS	2,628	Lodgepole pine forest with red fir; Alpine meadow	2
TUO-532	LS	2,634	Lodgepole pine forest with red fir; Alpine meadow	2
TUO-733	LS	2,573	Lodgepole pine forest with red fir; Alpine meadow	1
TUO-734	LS	2,598	Lodgepole pine forest with red fir; Alpine meadow	1
TUO-735	LS	2,549	Lodgepole pine forest with red fir; Alpine meadow	1
TUO-736	LS	2,537	Lodgepole pine forest with red fir; Alpine meadow	1
TUO-737	LS	2.384	Lodgepole pine forest with red fir; Alpine meadow	1
TUO-738	LS	2,389	Lodgepole pine forest with red fir	1
TUO-739	LS	2,390	Lodgepole pine forest with red fir	1
TUO-740	LS	2,463	Lodgepole pine forest with red fir	P
TUO-741	LS, RS, MID	2,655	Lodgepole pine forest with red fir	?

Appendix 2--Continued

Designation	Site Type	Elevation (m)	Vegetation Type	Drainage Class
TUO-742	LS	2,652	Lodgepole pine forest with red fir	?
TUO-743	LS	2,646	Lodgepole pine forest with red fir; Alpine meadow	2
TUO-744	LS	2,652	Lodgepole pine forest with red fir; Alpine meadow	2
TUO-745	LS	2,677	Lodgepole pine forest with red fir; Alpine meadow	2
TUO-746	LS	2,716	Lodgepole pine forest with red fir; Alpine meadow	2
TUO-747	LS	2,744	Lodgepole pine forest with red fir; Alpine meadow	?
TUO-748	LS	2,756	Lodgepole pine forest with red fir; Alpine meadow	2
TUO-749	LS	2,817	Lodgepole pine forest with red fir; Alpine meadow	2
TUO-750	LS, BRM	2,851	Lodgepole pine forest with red fir	2
TUO-751	LS	3,119	Lodgepole pine forest with red fir; Alpine meadow?	L
TUO-752	LS	3,012	Lodgepole pine forest with red fir; Alpine meadow	2
TUO-753	LS	3,003	Lodgepole pine forest with red fir	L
TUO-754	LS	2,829	Lodgepole pine forest with red fir; Alpine meadow	2
TUO-755	LS	3,064	Lodgepole pine forest with red fir; Alpine meadow	2/P
TUO-756	LS	3,152	Lodgepole pine forest with red fir; Alpine meadow	L
TUO-757	LS	3,171	Lodgepole pine forest with red fir	L

Appendix 2--Continued

Designation	Site Type	Elevation (m)	Vegetation Type	Drainage Class
TUO-758	LS	2,927	Lodgepole pine forest with red fir; Alpine meadow	2
TUO-759	BRM, LS	3,233	Whitebark pine forest	L
TUO-760	LS	2,793	Lodgepole pine forest with red fir; Alpine meadow	2
TUO-761	LS	2,811	Lodgepole pine forest with red fir; Alpine meadow	2
TUO-762	LS	2,877	Lodgepole pine forest with red fir; Alpine meadow	2
TUO-763	LS, BRM	2,165	Jeffrey pine forest with cedar and red fir; Alpine meadow?	?
TUO-764	MID, RS, BRM	1,354	Oak woodland (mixed species)	P
TUO-765	LS, BRM	1,299	Ponderosa pine forest with cedar and black oak	1
TUO-766	RS, LS	1,338	Ponderosa pine forest with cedar and black oak	1
TUO-925	LS, BRM	1,509	Ponderosa pine forest with cedar and black oak	2
TUO-926	LS	1,512	Ponderosa pine forest with cedar and black oak	L
TUO-927	LS	3,018	Lodgepole pine forest with red fir; Alpine meadow	L
TUO-928	LS	?	Lodgepole pine forest with red fir; Alpine meadow	1
TUO-929	MID	1,448	Conifer forest, species unknown	2

APPENDIX 3

ARCHEOLOGICAL RECORD FORMS

File #: ______

CULTURAL SITE RECORD

FIELD # (optional): ______________ STATE #: ______________

MAP: ______________, ___', 19___ AERIAL PHOTO: ______________

COUNTY: ______________ CONTOUR: > ___; < ___; $\tilde{x}$ ___ feet + Msl

MERIDIAN: ______________ T___ ___, R___ ___, ___1/4 of ___1/4, Sec.___

U.T.M.G.: Zone ______; ______________ mE/ ______________ mN

LAT./LONG. (optional): ___° ___' ___" W Long/ ___° ___' ___" N Lat.

SITE LOCATION (give bearings and distances wherever possible): ______________

ACCESS: ______________

SITE DESCRIPTION (Be thorough, explicit and concise; this may be the only record ever made of this resource.): ______________

SITE TYPE: ______________

DIMENSIONS: ______ meters ___-___ x ______ meters ___-___ (cf. plan)

ESTIMATED AREA: ______________ square meters. DESCRIBE THE METHOD USED TO DETERMINE SITE EXTENT AND BOUNDARIES: ______

DEPTH OF CULTURAL DEPOSIT: Maximum ___ cm; Mean ___ cm.

DESCRIBE METHOD USED TO DETERMINE DEPTH: ______________

BIOTIC SETTING (Life zones, communities and habitats): ______________

mjm 1978

Site #: ________ (2)
Field #: ________

ON-SITE VEGETATION TYPE(S): ____________________

____

Species: ____________ ___% ____________ ___%
____________ ___% ____________ ___%
____________ ___% ____________ ___%

SURROUNDING VEGETATION TYPE(S): ____________________

____

Species: ____________ ___% ____________ ___%
____________ ___% ____________ ___%
____________ ___% ____________ ___%

LOCAL FAUNA: ____________________

____

____

SOIL OF SITE: ____________________

____

____

ADJACENT SOIL(S): ____________________

____

____

GEOLOGY: ____________________

____

____

LANDFORM: ____________________

____

SLOPE: ______% Aspect: ____________________

INSOLATION: ____________________

____

EXPOSURE TO WIND AND PRECIPITATION: ____________________

____

NEARBY WATER: Distance __________ meters; Direction __________

Nature of water source/name ____________________

Flow direction ____________________ Amount of water ____________

SITE MODIFICATIONS (cultural or natural, including erosion, grading, illicit digging, etc.): ____________________

____

____

PREVIOUS STUDY (nature of work, date, investigator, reference): ______

____

____

____

ARTIFACTS: Collected ___ Left <u>in situ</u> ___ Describe types, numbers, materials, distribution: ____________________

____

____

____

Site #: ______________
Field #: ______________

FEATURES (Describe briefly; attach supplemental data as needed): ______

CULTURE HISTORICAL INFERENCES: ______

APPARENT SIGNIFICANCE OF SITE: ______

NATIONAL REGISTER STATUS: ______
POTENTIAL IMPACTS TO SITE AND/OR ITS INTEGRITY: ______

COMMENTS: ______

OWNER (Name and address): ______

TENANT: ______

PHOTOGRAPHS (Number b/w, color, chrome; subjects): ______

PHOTO REPOSITORY: ______
PHOTO CATALOGUE Nos.: ______
SITE RECORDER(S): ______
DATE: ______
APPENDED DOCUMENTS: ______

PORTION OF U.S.G.S. ______

MAP SHOWING SITE LOCATION→

Site #: ______________

Field #: ______________

(4)

SKETCH MAP OF SITE

(1) Indicate magnetic north. (2) Show scale, if appropriate. (3) Use conventional U.S.G.S. map symbols to the extent possible. (4) Clearly identify all special symbols. COMMENTS: ______________

____

DRAWN BY: ______________ DATE: ______________

CULTURAL SITE RECORD

Field #: ____________ State #: ____________

Item #	CONTINUED DATA

RECORDER(S) ____________ DATE: ____________

Page (5)

BEDROCK MILLING STATION DATA

State No. ______________________

Field No. ______________________

BRM Outcrops ______________________

Mortars ______________________

Milling slicks ______________________

Other features ______________________

____

____

Number	Length cm	Width cm	Depth cm	Shape

Number	Length	Width	Depth	Shape

mjm 1975-03
1980 rev

p. (6)

BEDROCK MILLING STATION PLAN(S)

Site____________________

Outcrop No(s).__________

(All measurements in cm unless noted)

(7)

APPENDIX 3: File No. ____

ARTIFACT COLLECTION RECORD

Catalogue #: ____________

☐ Isolated Artifact ☐ Artifact Found on Site

Site Field #: ____________ State #: ____________

UTMG Coordinates: Zone ____ ____________ mE/ ____________ mN

Bearing: ________ ° ☐ mag ☐ True / Distance: ________ m

to Datum (describe): ____________

Description of Discovery Site and Specimen Context: ____________

____

____

Description of Specimen: ____________

____

____

____

____

____

____

____

Sketch of Specimen

Photo of Discovery Site, Roll #: ______ / Frame #: ______

Map Reference: ____________

Description of Collection Technique: ____________

____

Name(s) of Collector(s): ____________ Date: ________

PHOTOGRAPHIC RECORD

Film Type:	Roll #:	Camera: w lens

Date	Frame	Site #	Subject	Facing

(9)

AUGER LOG

Site ____________________ Datum ____________________

Bore #	Bearing	Distance	Depth	Observations

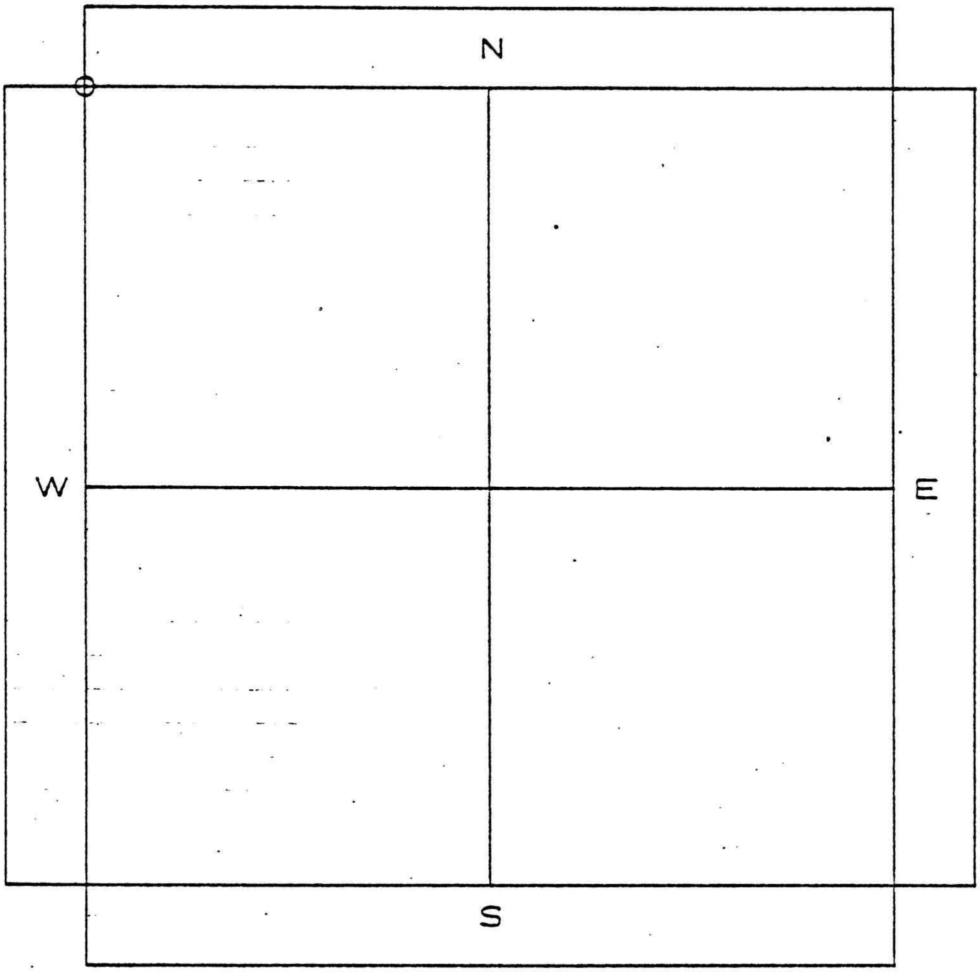
LMR '80

UNIT LEVEL RECORD

Site ______________________
Unit ______________________
Depth ________ to ________ cm

Soil type ______________________
Soil color (Munsell) ______________________
Soil texture ______________________
Zonation ______________________

Surface elevations (NW = 0):
NE ______ SW ______ SE ______
Estimated level vol. ______ m^3



Artifact Key

1. ______________________
2. ______________________
3. ______________________
4. ______________________
5. ______________________
6. ______________________
7. ______________________
8. ______________________
9. ______________________
10. ______________________
11. ______________________
12. ______________________
13. ______________________
14. ______________________
15. ______________________

Feature Key

(squares represent 1x1-m areas in plan;
elongate rectangles represent sidewall profiles.)

Fire-broken rock: Type(s) of rock ______________________; weight ________ kg
Carbon: description ______________________; ^{14}C sample taken? ______
Faunal remains: gross types, condition ______________________

Floral remains: gross types, condition: ______________________

Description of features: ______________________

Human remains (give burial #): ______________________
Stratification: ______________________
Photos: ______________________
Screen size: ________; Excavation methods: ______________________
Excavators: ______________________ Date: ______________________

Site ______________ Unit ______________ Level ______ - ______ cm

Item

Continuation from p. 1

______ ______________________

______ ______________________

______ ______________________

______ ______________________

______ ______________________

Comments: ______________________

____

____

Lithic Constituents

	Number	Weight
Asphaltum	/	g
Basalt	/	g
Chert	/	g
Milky quartz	/	g
Obsidian	/	g
Ochre	/	g
Phyllite	/	g
Porphyry	/	g
Quartz crystal	/	g
Quartzite	/	g
Slate	/	g
Steatite	/	g
	/	g
	/	g
	/	g
	/	g
	/	g

Clay/ceramics

____

____

____

Floral Remains

____

____

____

Other Constituents

____

Faunal Remains

Condition of bones ______________

Large mammal bone	/	g
Small mammal bone	/	g
Bird bone	/	g
Fish bone	/	g
Reptile bone	/	g

Identified species:

	/	g
	/	g
	/	g
	/	g
	/	g
	/	g
	/	g
	/	g
	/	g
	/	g

Shell preservation ______________

Identified molluscan species:

	/	g
	/	g
	/	g
	/	g
	/	g
	/	g
	/	g
	/	g
	/	g
	/	g
	/	g

Laboratory analyst ______________________ Date ______________

RADIOCARBON DATA

Field

1. Field Number ______________ 2. Sample Title ______________

3. Site Number ______________ 4. UTM (Z__) ______________ mE/ ______________ mN

5. Unit ______________ 6. Location ______________

7. Depth _____ cm below ______________ 8. Matrix ______________

9. Stratigraphic Position ______________

10. Associated Features ______________

11. Sample Substance ______________

12. Collection Technique ______________

13. Collection Date ______________ 14. Collector(s) ______________

Lab

15. Submitted __/__/ __/__/__/ 16. Submitted by ______________

17. Dry Weight ______________ g 18. Comments ______________

^{14}C Lab

19. Laboratory No. [ ] 20. Half-Life Used ______________

21. Laboratory Comments ______________

22. Age ______ ± ______ ^{14}C yr 23. Correction/Calibration ______________

23. Date ______________

Interpretations

24. Associated Artifacts ______________

25. Other Associations ______________

26. Significance of Age/Date ______________

27. Validating Data ______________

28. Comments/Reference(s) ______________

MT '81

ARCHAEOLOGICAL SPECIMEN CATALOGUE

Cat. #	Description	Site	Unit	Depth	Horiz. Locat.		Association / Comments

CATALOGUE	UNIT	DEPTH cm	MATERIAL*	LENGTH mm	WIDTH mm	THICKNESS mm	WEIGHT g	DECORATION*	WEAR*	TYPE*	ASSOCIATION*	DATE*	COMMENTS*

* refer to key

APPENDIX 4

HISTORICAL ARCHEOLOGY

Appendix 4

HISTORICAL ARCHEOLOGY

by

Scott Carpenter

Introduction

To date, no archeological studies of historic sites have been conducted within Yosemite National Park. During archeological investigations of prehistoric sites, historic material has been retrieved and documented along with the greater amounts of prehistoric artifacts and features (Whittaker 1981). Although the historic record for the park and its environs is relatively well documented (Russell 1931; Hall 1921; Hubbard 1958; Paden and Schlichtmann 1959; Huntington 1966), few data from the recent past have been recovered archeologically.

Historic sites have been identified in Yosemite Valley, El Portal, Glacier Point/Hennes Ridge, Wawona, Mariposa Grove, Tuolumne Meadows, Hodgdon Meadow, Hetch Hetchy, Foresta/Big Meadow, and the Yosemite backcountry. The following list gives types and numbers of historic sites listed in the Cultural Resource Management Plan.

TYPES AND NUMBERS OF RECORDED HISTORIC PROPERTIES IN YOSEMITE NATIONAL PARK

Residential Structures	
Residences	54
Related Structures (garages, sheds, etc.)	17
Cabins	5
Cabin Sites	2
Tourism Activities	
Hotels	2
Guest Cottages	8
Hotel Related Structures	5
Bullfrog Pond	1
Lodges	2
Flower Garden	1
Hotel Parking Areas	2
Tourist Campground Facility	1
Registration Office	1
Sign	1

Park Operations

Administration Building	1
Museums	2
Fire Lookout Station	1
Acting Superintendent's Headquarters	1
Ranger Stations	3
Civilian Conservation Corps Buildings	11
Comfort Station	1
Ranger Cabins	2
Miscellaneous Structure	1

Public Buildings and Facilities

Post Office	1
Chapel	1
Cemetery	1

Roads

Roads	2
Tunnel	1
Bridges (open)	8
Covered Bridge	1

Utilities

Utility Structure	1
Power House	1
Diversion Dam and Pentstock	1
Ditch	1
Ice Reservoir	1

Commerce

Bakery	1
Storage Structure	1
Transportation Company Office	1
Studios (Photography/Art)	5

Railroad

Railroad Grades and Camp	1
Water Tank	1
Stationhouse	1
Turntable	1
Turntable Pit	1

Farming and Ranching

Orchards	2
Barns	4

Military

Army Tack Room	1

Lumbering

Sawmill Site	1

Mining

Mine Equipment	1
Mine Cabins	5
Mine Shafts/Shaft Houses	4
Mine Structures	5

This list was compiled from a literature search and a casual reconnaissance by park staff and historians. It is not a total inventory because the park has not been thoroughly surveyed for historic sites. Past archeological surveys have recorded only American Indian sites, and most of these have been prehistoric.

The various structures and sites included on the List of Classified Structures and the National Register of Historic Places nomination program are documented with historical data concerning each structure or property. However, none of them has been researched to the extent of requiring archeological investigations, and their archeological potential is unknown. Historical resources studies within Yosemite National Park include the study now completed for the Wawona Pioneer History Center and the study of the Wawona Hotel complex, currently underway.

Current park programs for documenting historic properties include maintaining the List of Classified Structures and the nomination program for the National Register of Historic Places. The List of Classified Structures includes 144 structures, 135 of which remain at their original sites. There are 26 historic properties and three pieces of railroad equipment listed on the National Register of Historic Places. Additionally, there is one property that has been determined to be eligible for the Register, and eight properties that have been nominated for inclusion on the Register.

Historic activity in Yosemite can be subsumed under the following themes:

1. Mining
2. Ranching/Farming
3. Basque Sheepherders

4. Lumber Industry
5. Railroads/Transportation
6. Native American Settlements
7. Military Activities
8. Tourism/Mountaineering
9. Park Development and Operations

Beginning in the early 19th century, various groups of people explored California, including the central Sierra Nevada now defined as Yosemite National Park. The number of people who traveled through and made use of the Yosemite frontier increased during the remainder of the 1800s.

Historic period travels through the area of were documented when in 1833 J. R. Walker crossed the area with a party of trappers. Other explorations of Yosemite by Anglo-Americans occurred when Joseph Screech discovered Hetch Hetchy Valley in 1850 and J. D. Savage and his Mariposa Battalion advanced on a group of Indians near Yosemite Valley in 1851 (Russell 1968).

Explorers and trappers also crossed the many mountains and valleys of the Sierra. With the discovery of gold and other ores during the 1850s, miners prospected throughout the western foothills. During the remainder of the 19th century, larger-scale mining operations and camps developed in the Yosemite area.

Other resources in Yosemite began to be utilized by various groups at about the same time. Basque sheepherders and other ranchers found the Sierran meadows suitable for grazing stock. Local stands of timber were valued in the development of the neighboring San Joaquin Valley as well as in local settlements of El Portal and Wawona.

The birth of tourism in Yosemite occurred in 1856 when the first permanent structure, the Lower Hotel, was built by Walworth and G. A. Hite near the base of Sentinel Rock in Yosemite Valley (Russell 1968). Construction of the Upper Hotel followed in 1858 and set the pace for the development of scores of other hotels, lodges, cabins, and related tourist facilities over the following 120 years.

Yosemite Valley and the Mariposa Grove of Big Trees were granted to the state of California by the U.S. Congress as public trust in 1864. Yosemite National Park was established October 1, 1890.

Mining, lumbering, sheep ranching, tourism, mountaineering, park development and management, plus the daily activities of the resident Native American peoples are documented through existing records and oral histories. Many of these activities can also be traced through the remains of historic archeological sites.

Assessment and Future Directions

Although only minimal archeological research has been conducted for historic sites in Yosemite, the data compiled for the List of Classified Structures and the National Register of Historic Places nomination program provides a base for planning historic site research and management programs. The Scope of Research for these two lists deals predominantly with extant structures and the sites of significant, nonextant structures. It could be estimated that the total number of historic archeological sites in Yosemite is at least double the number of historic sites listed in the 1979 Yosemite Cultural Resource Management Plan. For example, the Cultural Resource Management Plan lists 18 historic structures or features in Wawona, whereas an historic base map being compiled for the Wawona Hotel complex and vicinity identifies more than 50 structures. Although no surface remains of these structures exist today, significant archeological remains exist belowground.

The archeological remains of the recorded historic properties in Yosemite (as well as the presently unrecorded sites) provides a potentially rich resource of material culture. Archeological research into historic sites of the area would allow us to obtain more specific data about the configuration, content, and periods of use of each structure or site. More importantly, research could yield information helpful in understanding the socioeconomic development and occupation of Yosemite and the Sierra Nevada.

A primary management goal of historic sites in Yosemite is to obtain a reliable inventory of the sites and their archeological resources. This will require surveys of new areas in addition to a close and systematic examination of properties already recorded.

A secondary goal is to develop an archeological research design, which specifically addresses historic sites and their archeological components.

Recently, plans have been made to produce regional research designs for historic archeology in central and northern California. The U.S. Forest Service and the Bureau of Land Management are currently combining efforts to compile a research design and predictive model known as the Interagency Cooperative Cultural Resources Overview of the Southern Sierra Nevada (Moffitt 1981: personal communication; Johnson 1981: personal communication). A similar project dealing with historic properties within a small subregion was conducted for the Mendocino National Forest in northern California (Johnson 1981: personal communication). Thus far, however, no adequate regional research design exists for the Yosemite area.

An adequate historic archeological research design for Yosemite National Park should accomplish the following:

1. Local and regional history would be put in perspective and a chronology and settlement plan of past activity would be provided. Social and cultural groups, known to have operated in the area, would be identified and described in detail.

2. Theoretical direction for historical and anthropological spheres of interest would be specified. The bias and interests of the researcher and the National Park Service would be made explicit.

3. An account of previous research in areas or regions relating to research problems at Yosemite would be given.

4. Questions of historical, architectural, sociological, anthropological, and ecological significance which are appropriate to Yosemite's resources, and their apparent research potential would be listed.

5. The archeological techniques and methods which could be used to address questions in the research design would be described. Attention would be paid to the sampling strategy and levels of redundancy in data recovery.

6. Directions and approaches for protecting resources would be specified, providing research proposals for those sites that could not be preserved in place.

REFERENCES

Hall, A. F.
1921 Handbook of Yosemite National Park. New York: G. P. Putnam's Sons.

Hubbard, D.
1958 Ghost Mines of Yosemite. Fresno, California: The Awani Press.

Huntington, H. E.
1966 The Yosemite Story. New York: Doubleday and Co., Inc.

Paden, I., and M. Schlichtmann
1959 The Big Oak Flat Road to Yosemite. Yosemite: Yosemite Natural History Association.

Russell, C. P.
1968 One Hundred Years in Yosemite: The Story of a Great National Park and Its Friends. Yosemite: Yosemite Natural History Association.

Whittaker, J. C.
1981 Archeology in Yosemite National Park: The Wawona Testing Project. Tucson: Western Archeological and Conservation Center, National Park Service Publications in Archeology No. 18.