PERRIS RESERVOIR ARCHEOLOGY: LATE PREHISTORIC DEMOGRAPHIC CHANGE IN SOUTHEASTERN CALIFORNIA

Edited By:

James F. O'Connell
Philip J. Wilke
Thomas F. King
Carol L. Mix

Prepared by the

Archaeological Research Unit
Department of Anthropology
University of California
Riverside, California

Submitted to the

State of California
Department of Parks and Recreation

February 20, 1973

STATE OF CALIFORNIA
Resources Agency
Department of Water Resources
Division of Right of Way Acquisition

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Preface

This publication exemplifies the best in a cooperative program of archeology within a public works project area. The cooperative program of archeological service for the State Department of Water Resources by the State Department of Parks and Recreation has now been in operation for almost 15 years. During this time legislation has been enacted that has benefited archeological programs and research for state agencies. Much of this improvement can be attributed to a greater environmental concern now evident throughout the country.

There is an increasing awareness that the archeological sites of the native Californians are a nonrenewable resource — that these sites are equivalent in a sense to endangered species. It is sad that this new awareness was not fully operative in the early construction phases of the great California State Water Project. However, despite the fact that not until nearly the end of this great construction program did archeology begin to come into its own, archeological projects supported by the Department of Water Resources in northern and central California contributed greatly to the knowledge of prehistoric and protohistoric native societies in these areas of the state.

In retrospect those of us who managed the Water Resources Archeological Program over the years realize that under present conditions a far better program could have been executed. Nevertheless, the archeological program that was carried out served as a pioneer effort in the gaining of public support and recognition for archeological research. Whereas the concept of archeology generally received favorable support, in practice we often operated under stringent financial limitations, especially early in the program. Had the present concern for environmental values existed at that time, the broader program originally proposed would certainly have received more favorable consideration.

Fellow professionals have occasionally questioned the earlier limited scope of our program of archeology for the California State Water Project. The foregoing information may help them understand the limitations that faced us in the 15-year program that is now drawing to a close. And, as noted earlier, despite these limitations extensive and useful data have been gathered, and a series of publications on the work done have appeared.

The present report on Perris Reservoir, now Perris State Recreation Area, is a result of the cooperative efforts of the Department of Water Resources, the Department of Parks and Recreation, and the Department of Anthropology, University of California at Riverside. We feel that this report, though based on a pioneer effort, can be viewed as a substantial contribution to the prehistory of inland southern California. Certainly it should prove of value to future students of the prehistory in this relatively unknown region of the state.

We are therefore pleased to be able to bring out for public and professional use this report on the archeological work that was done before the construction of one of the final links in the most ambitious water development and distribution project in the history of mankind.

Francis A. Riddell
Supervisor, Cultural Resources Section

ACKNOWLEDGMENTS

The Perris Reservoir Archeological Salvage Project was administered by the California State Department of Parks and Recreation, Cultural Resources Section. We are grateful to Francis Riddell, William Olsen, and Stella Luttig for their skillful administrative supervision. We are also grateful to the Department of Anthropology, University of California at Riverside (Professor Alan Beals, Chairman), for continual assistance and provision of storage and work space.

The California State Department of Water Resources, represented by Ted Rowe, and Perris Dam Constructors, represented by Bob Belter and Eliot Lane, were unfailingly cooperative with the archeological operations and provided many forms of assistance. We are indebted to the Department of Water Resources, Palmdale Office, for permission to use Plate 1. We also received much assistance from the Wolfskill Ranch, the owners of which also own much of the land surrounding Perris Reservoir; from the United States Air Force at March AFB; from the Riverside County Department of Roads and Survey; and from the Riverside County Parks Department, especially Pete Dangermond, Jr., Emily Palmer, and Robert Kerdraon. We received technical assistance from the UCR Departments of Buildings and Grounds, Geography, Geology, Chemistry, and Botany. Oscar Clarke of the UCR Herbarium gave unstintingly of his time to assist in the identification of seeds, as did George Jefferson, then affiliated with the UCR Geology Museum, in the identification of faunal remains. Charmion McKusick of Globe, Arizona provided professional analysis of avifauna. David Weide of the Department of Geology, UCLA, identified certain ground stone artifacts, and Chester King of San Jose and Jack Mount of the Geology Museum, UCR, assisted in the identification and analysis of shell artifacts. Radiocarbon age determinations were provided concurrently by the Radiocarbon Dating Laboratory, Department of Anthropology, UCR, and the Isotope Laboratory, Institute of Geophysics and Planetary Physics, UCLA. Norah van Kleeck of the California State Department of Agriculture assisted with the identification of carbonized floral remains.

Jane Penn and Katherine Saubel of Malki Museum, Larry Bowles of the Riverside Municipal Museum, and Gerald A. Smith and Robert Reynolds of the San Bernardino County Museum gave us a great deal of background data and advice, as did Makoto Kowta of California State University at Chico. Arda Haenszel, Harley Garbani, Eugene Shepard, and Charles Mott all generously shared with us their extensive knowledge of local archeology. The Kirst-MacDonald Construction Company assisted with the backfilling of trenches.

The professional field staff on the project consisted of Dennis O'Neil, Philip Wilke, Thomas King, Norman Weber, Thomas O'Brien, Stephen Hammond, Carol Mix, Marilynn Eckland, Jeffrey Thelan, Kris Thomas, Margie Kleiger, Christopher Henley, Kenneth Decroo, and James Kelly. Regular nonsalaried personnel included Robert Bettinger, Mary O'Neil, Chrostopher Chaloupka, Charles Eiser, Timothy White, Edward Plummer, Lynn Thomas, Jim Stuart, Pete Jacobs, and Mary Brown, and many other UCR students contributed their assistance in one way or another. James O'Connell's archeological field class, which excavated the Charles Mott site, included Wilbur Wong, Suzanne Hendricks, Michael Gardner, Bettina Goth, Stephen Brown, Shari Gilevich, Ernest Sanders, Becky Brooks, Clayton Robarchek, Sue Waller, Stephen Hammond, Deborah Moore, Margo Crabtree, Alan Corbin, Joan Smith, Terry Ambrose, Linda Joseph, Nikki Carter, Amanda Marsh, Michael McGrath, Tim White, Rick Heller, Diddy McBride, and Cynthia Nowers. Anthony Galt served as assistant field director.

Eugene Anderson, Sylvia Broadbent, Michael Kearney, and R.E. Taylor of the UCR Department of Anthropology faculty also provided valuable assistance and advice. Louis Payen prepared most of the maps and line drawings in this publication except those in Figures 10 through 12, which were drawn by Linda Joseph. Stephen Brown prepared the photographic plates except for those of bone, shell, and flaked stone artifacts, which were kindly done by Bettina Goth. Jack Lambie provided the negative for Plate 13; Anthony Galt provided those for Plates 2 and 4. Carol Mix typed several drafts of the entire manuscript and also served as assistant editor. Steve Napoli and Mary Brown were of great help in resolving many last-minute crises. Harry Lawton of the College of Bio-Agricultural Sciences, UCR, provided many valuable criticisms and suggestions. Finally, Laurie O'Connell helped compile the bibliography, and Mary King and Lolly Wilke proofread the final draft of the manuscript.

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Abstract

Surveys and excavations at Perris Reservoir were designed to gain an understanding of the nature of prehistoric human adaptation within a discrete region of southeastern California, and the changes in that adaptation over time. Data indicate a period of low but gradually increasing population intensity from at least 300 BC to about AD 1500. Within this span, subsistence was based on the gathering of small seeds which were processed on deep basin milling stones, supplemented to some degree by hunting. Use of the region by human populations significantly intensified after AD 1500, the period from which the vast majority of the data are derived. After this time, use of deep basin milling stones seems to have been replaced by processing at numerous isolated bedrock milling stations. A broader pattern of resource exploitation is indicated, involving use of additional environmental zones, and additional resources within them, but probably still only on a seasonal basis. The settlement pattern in the later period is reconstructed as involving a single base camp, several outlying occupation sites utilized by small groups, and many scattered processing sites. The pattern of increased land use is atypical of hunter-gatherer populations existing in equilibrium with their environments. Since increased resource availability can seemingly be ruled out, and there is no significant evidence of technological innovation, intensified use of the region must reflect significant changes in population distributions. Such a demographic shift is most likely a result of restructured settlement patterns which accompanied the abrupt disappearance of freshwater Lake LeConte from the Salton Basin roughly coeval with the changes noted at Perris Reservoir.

Introduction

Perris Reservoir, when completed, will be one of the southern termini and dispersal nodes of the California Water Project. It will be one of interior southern California's major high-density recreation facilities. In accordance with its policy of providing for archeological salvage in advance of construction that threatens to damage or destroy historic and prehistoric resources, the California State Department of Water Resources contracted in 1970 with the State Department of Parks and Recreation to conduct archeological research in the reservoir area.

Recognizing that a cooperative approach to the necessary research would enhance efficiency, the Department of Parks and Recreation's Cultural Resources Section consulted with the California Desert Archeological Committee, a multi-institutional cooperative organization sponsored by the Society for California Archeology. The result was an informal cooperative arrangement with the Archeological Research Unit of the University of California at Riverside. This arrangement, under which UCR students and faculty have developed and implemented the salvage program as an integral part of the university's developing local research program, has had the fruitful results that are detailed in this publication.

The general area of Perris Reservoir has been the scene of sporadic archeological fieldwork for many years. Surveys in the area have been conducted since the 1930s by G. A. Smith, C. E. Smith, E. W. Shepard, and others. The Bernasconi site (4-Riv-395) just outside the reservoir area near Lakeview was excavated in 1961 by Goodman and Raskoff (1964). Until the present project began, the Bernasconi site was the only intensively investigated site on the Perris Plain. In 1960 Eugene Shepard and Paul Chace, then affiliated with the San Bernardino County Museum in Bloomington, conducted a detailed though subjective survey of parts of the Bernasconi Hills-Mt. Russell complex. Shepard also excavated at the Charles Mott and Dead Dog sites in and around the reservoir area. Unfortunately, collections from these sites were segregated neither from one another nor from other collections from the area and were, therefore, not used in our analysis.

Arda Haenszel of the San Bernardino County Museum has collected miscellaneous data on rock art in the reservoir area, which she has kindly made available to us.

In 1964 the spring field class in archeological field methods from UCR, under the direction of Makoto Kowta, conducted excavations at the Ford site (4-Riv-265), just south of the Dead Dog site. The small collection resulting from this excavation duplicates that from the other five excavated sites in the Perris Basin, but original field notes were obtained too late to permit analysis of the Ford site in this volume. In 1967 Dennis and Mary O'Neil of UCR conducted a partial survey of the Mt. Russell area.

As detailed in the site reports in this publication, the Perris Reservoir area has suffered considerably from the depredations of relic hunters, who in this region seem to be particularly partial to the ambitious task of stealing bedrock mortars. One extant mortar boulder at the Peppertree site only narrowly escaped removal. (See Wilke, "The Peppertree Site", in this publication.) In addition, an indeterminate but apparently large number of mortars have been removed from the Charles Mott site. Other evidence of vandalism includes the near destruction of the Moreno Maze pictograph (4-Riv-21) through its use as a target by "sportsmen" with firearms and miscellaneous minor artifact digging. Other damage to archeological resources in the area includes dislocation of the Bernasconi Pass petroglyph (4-Riv-62) by road construction, apparent complete destruction of 4-Riv-11, and miscellaneous grading at the Dead Dog site, apparently to channelize runoff. Finally, the Oleander Tank site was badly damaged during construction of the tank itself in about 1965.

Under the general administration of William Olsen of the Department of Parks and Recreation in Sacramento, the Perris Reservoir Archeological Project began in December, 1970, with excavations at the Dead Dog site (4-Riv-202), which lay in the right-of-way of a proposed haul road. Dennis O'Neil directed these excavations, which are described by Robert L. Bettinger in this publication. The haul road was subsequently relocated, and the site was only slightly damaged.

Philip Wilke succeeded O'Neil as project leader after the excavation of the Dead Dog site. Wilke first undertook a complete survey of the state property, which comprised the interior basin of the Mt. Russell-Bernasconi Hills. (See Ambrose and King in this publication.) He then directed excavations at the Peppertree site (4-Riv-463, Wilke, this publication), the Oleander Tank site (4-Riv-331, O'Brien, this publication), and the Pictograph site (4-Riv-452, Hammond, this publication). James O'Connel's field class in archeology excavated the Charles Mott site (4-Riv-464, Robarchek, this publication) during the spring of 1971, and Terrence Ambrose conducted a survey of the outer rim of the Mt. Russell-Bernasconi chain to complete reconnaissance of the reservoir area both within and adjacent to the actual reservoir properties. Jeffrey Thelan conducted geographic studies of the area and made preliminary drafts of several of the site maps. Linda Joseph began the task of recording pictographs and petroglyphs in the area.

The 1972 spring field class from UCR returned to the Dead Dog site for a much expanded excavation and controlled surface sampling. Aside from their use to correct some generalizations derived from the 1970 work, data from this project have not been incorporated in this publication.

This publication is divided into two parts. Part I is synoptic, providing an overview of theoretical problems pertinent to the project, predictions about the way of life of prehistoric Perris populations, and a summary of the research results. Part II presents primary data on all aspects of the project, including site reports, assemblage descriptions, and discussions of ecofacts, rock art, and other pertinent elements of the recovered data.

In the following pages reference is sometimes made to catalog numbers of particular specimens; for example, 16-207. The "16" in this case is the accession number for the collection from the Dead Dog site (4-Riv-202), and the "207" is the catalog entry of the particular specimen in that collection. Other accession numbers and respective collections discussed in this report are as follows: 17 – the Peppertree site (4-Riv-463); 18 – the Pictograph site (4-Riv-452); 19 – all sites located in survey and not assigned individual numbers; 20 – the Oleander Tank site (4-Riv-331); and 21 – the Charles Mott site (4-Riv-464).

PART I - PLAN AND SUMMARY OF THE RESEARCH

An earlier version of the ideas exprèssed in this section was presented in a symposium entitled "Man and Environment in the Late Prehistory of Southeast California" (J. F. O'Connell, Chairman) at the 1972 Annual Meeting of the Society for California Archeology, Long Beach.

Plate 1. Aerial view of the study area. View is to the northeast with the dam axis across the lower portion of the photo. The Bernasconi Hills are on the right, and Mt. Russell is just left of center. In the background are San Jacinto Valley, the Badlands, and the San Bernardino Mountains. (Photo courtesy of the State Department of Water Resources.)

A RESEARCH STRATEGY FOR INTERIOR SOUTHERN CALIFORNIA ARCHEOLOGY

G.T. Jefferson

Introduction

Interior southern California is characterized by physiographic and environmental diversity and a broad spectrum of natural resources. Substantial environmental change has taken place in the area during the last 10,000 years: major lake and river systems have formed and drained, and biotic communities have shifted their boundaries dramatically (Antevs, 1948, 1955, 1962; but see also Aschmann, 1958, 1959; Martin and Mehringer, 1965). During this time the area has been occupied by human populations that hunted and gathered wild crops for subsistence. In late prehistoric times, interior southern California was a region of relatively light population between the settled coastal hunter-gatherers to the west and the floodplain agriculturalists along the Colorado River, an area of highly variable resources bounded by the rich riverine and coastal environments (Bean, 1972:12).

This diversity and instability of environment and culture make interior southern California well suited for archeological studies of human adaptation. Human culture change can be studied here as a response to changes in both the natural and cultural environments, as an adaptation to changing natural and human ecology. Given this potential, an appropriate general research goal for interior southern California is an increased understanding of the evolution of cultural diversity. It is the purpose of this paper to point out some tentative steps that can be taken toward this goal.

Present knowledge of interior southern California prehistory is very sketchy. Ideas about such early complexes as Pinto and Lake Mojave are based on relatively limited fieldwork and analysis, usually done without benefit of modern research tools and concepts (Harrington, 1957; Campbell and Campbell, 1935, 1937; Rogers, 1939; Wallace, 1958), and our understanding of later events is grounded on a similar paucity of solid data and explicit theory. The nature of prehistoric man/land relationships has not been examined regionally, and little effort has been directed toward modelling prehistoric cultural continuity and change.

Archeological syntheses in this area are frequently based on apparently unrelated assemblages of data from locations isolated both temporally and spatially from one another. Such syntheses provide no means for dealing with currently important anthropological issues. Questions about the causative mechanisms of cultural change, adaptation to changing environmental conditions, and the spread of agricultural practices have been left largely unasked and unanswered due to a lack of pertinent data.

A step toward correcting this situation will be to define major research objectives explicitly, recognize pertinent specific problems, and pose appropriate questions; research can then be structured so as to yield the information required to answer such questions. The research strategy presented below is directed to the question: *What are the mechanisms of adaptive change among hunter-gatherer populations in arid lands?* In order to generate specific hypotheses with archeologically testable implications, a general model of adaptive change will be constructed on the basis of current theory in population dynamics and demography. On the basis of a general view of culture change as the adaptive response of a population to changing social or biophysical conditions, reasonable and archeologically testable statements may be proposed.

Definitions

For purposes of the following discussion, "carrying capacity" is defined as the maximum obtainable produce from a spectrum of relatively stable resources given the efficiency of a particular exploitative technology. "Subsistence practices" are defined as those activities that effect an energy transfer from natural resources to human populations. "Crucial effective resources" are those resources that act as limiting factors to population growth in the sense of Liebig's "law," which states that population size is dependent on the availability of the least abundant essential resource.

General Model

A hunter-gatherer population functions within and articulates with its biophysical environment. Normally this ecological relationship is a balanced condition. Birdsell (1968) has argued that the size and areal distribution of aboriginal populations form parts of an equilibrium system in which population size and density are balanced against the relative carrying capacity of the environment. The two independent variables of the equilibrium system are (1) population size and/or density; and (2) resource availability. (Technology is not considered an independent variable for purposes of this model.) Any disruption of the balance between a culture and its environment should result from changes in one or both of these variables.

In this light, culture change is viewed as an adaptive response to changes in either the social (population dynamic) or biophysical (resource dynamic) aspects of the culture's equilibrium condition. These adaptive responses are recognized in the form of shifts in subsistence practices and/or settlement patterns; that is, by the appearance of shifts in the culture/environment energy relationship. The following discussion will examine the archeologically testable implications of changes in these two ecological variables.

Population Variable

Ethnographic hunter-gatherers maintain population size by applying internal controls such as infanticide, abortion, and spacing of births through social taboos. Population levels are generally stabilized well below the carrying capacity of local resources (Birdsell, 1968). Given a relatively stable resource base (a constant biophysical environment), a disruption of population/resource equilibrium is unlikely. Binford (1968) and Sussman (1972), however, have described an exception to this expectation, pointing out that among *sedentary* hunter-gatherers, local population/resource equilibrium is maintained through the mechanism of fission or "budding" of excess numbers into adjacent regions. Of course, this means of maintaining local equilibrium is ultimately ineffective both locally and on a wider regional level since, as the area fills with "budded" populations, daughter populations will increasingly be "budded" into zones of marginal productivity. This mechanism can result in a situation in which the control of local population/resource equilibrium leads to population/resource instability in outlying areas. Such instability, often occurring in the "tension zone" between settled populations, requires readaptation in the form of new subsistence strategies, economic systems, and/or social controls.

Applying this model to interior southern California, we can imagine that initially both the coast and the interior were occupied by small numbers of wandering bands. As populations became settled along the coast, however, they would begin to grow and would bud daughter populations into the interior. Since the interior is a region of varied but limited resources, such a population influx would result in disruption of local equilibrium systems with concomitant shifts in settlement and subsistence patterns on the part of both indigenous and migrant populations. Archeologically visible results might include local microenvironmental adaptations: shifts or expansions in the number or types of exploited resources, changes in the character and distribution of settlements, and adjustments in scheduling of exploitative activities to conform to the seasonal availability of resources newly exploited or more efficiently utilized. Demographic changes such as consolidation or fragmentation of local populations might be expected.

Resource Variable

If hunter-gatherers operate at a level well below the carrying capacity of the environment given their technological efficiency, we would expect that minor fluctuations in resource availability could be easily accommodated. However, an environmental change that significantly enhances or degrades the productivity of crucial effective resources would result in disequilibrium.

An environmental change that enhances the productivity of a crucial resource will modify the population/resource balance by making previously scarce resources available for exploitation, permitting an increase in population size and/or density. On the other hand, an environmental change that degrades one or more effective resources will require a downward adjustment of the population/resource ratio. It is likely that hunter-gatherer groups would normally adjust population/resource balance as the productivity of effective resources declined by supplementing their subsistence base with resource complexes not previously intensively exploited. However, where environmental changes are catastrophic or otherwise permanently alter the productivity of effective resources, such that the reestablishment of population/resource equilibrium through local shifts in subsistence and/or settlement patterns is not feasible, relocation or population reduction must occur.

In general, under conditions of declining effective resource yield, one or more of the following archeologically recognizable mechanisms may be iniated by a hunter-gatherer group in an attempt to stabilize population/resource balance: (1) an intensified exploitation of remaining viable resource complexes; (2) a diversification of the resource base involving the exploitation of more and/or different microenvironments; (3) the acceptance and use of new procurement or processing techniques, including plant cultivation or agricultural practices; (4) relocation in a new region effected through fission or wholesale migration; or (5) the establishment of trade systems and the exchange of produce with other groups.

The above changes in subsistence and settlement patterns may be reflected in the prehistoric record of interior southern California. For example, those populations that were adapted to the lacustrine and related resources of extinct Lake LeConte in the Coachella and Imperial Valleys must have witnessed a relatively rapid disintegration of their resource base. Lake LeConte is known to have fluctuated dramatically in size during the last 2,000 years, and it eventually dried up completely prior to AD 1774. Although the exact timing of this event and its immediate effect on extinct local populations remain to be documented, it is likely that major demographic changes took place. When relocation occurs, as Binford (1968) has argued with reference to budding, a tension zone of demographic stress is produced between indigenous and migrant groups. It is probable that an analogous zone of population/resource imbalance would form about a region in which the productivity of effective resources has undergone a relatively rapid decline with results equivalent to those discussed under "Population Variable."

Necessary Data

In order to explore the archeological implications of the hypothetical situations generated for interior southern California from the general model presented above, specific kinds of data are required. In a broad sense, it is necessary to conduct research that is geared to the recognition of changes in population/resource equilibrium. This requires information reflecting the prehistoric biophysical and cultural conditions throughout the region at given points or during restricted periods in time as well as data that reveal sequential changes in such conditions. Specifically, it is necessary to be able to reconstruct changes in climate, physiography, and the distribution of biotic communities through time. Furthermore, information is required on prehistoric population size and distribution and settlement patterns, as well as data reflecting shifts in subsistence systems through time.

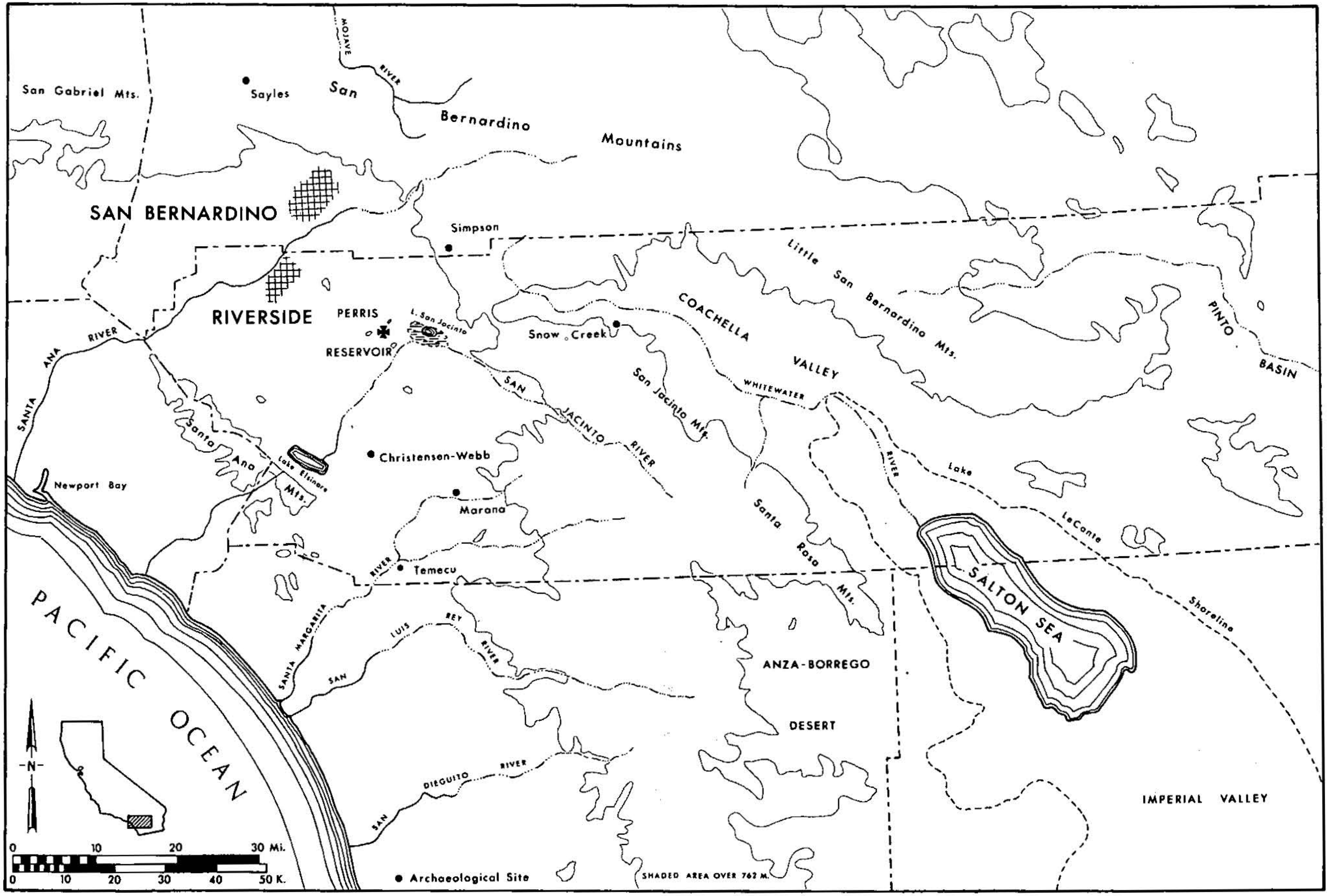
Methods of Obtaining Data

The sample universe of this research design includes the arid and semi-arid lands south of the Mojave River, north of Mexico, east of the Santa Ana Mountains and west of the Colorado River (Figure 1). The period of time under study encompasses the total duration of aboriginal occupation of the region (currently not known). Ideally, the data gathering system involves the construction of a set of sampling strata for each recognizable time segment. These strata are based on extant or reconstructed extinct zonations in the biophysical environment, such as the distribution of biotic communities. A unique set of strata is presumably associated with each time segment. For example, the strata defined in the study of late prehistoric land use of a dry lake basin are distinctly different from those that might be recognized in the same area during terminal Pleistocene times, when the basin contained a lake and asosciated lacustrine resources. Time segments should be sequential, as short in duration as possible, and based on any recognizable changes in the biophysical environment of sufficient magnitude to be reflected by concomitant shifts in a cultural system.

Each stratum within a time segment is to be randomly sampled for potential archeological remains. Numbers, sizes, and distribution of sites are recorded for each set of strata. A sample of sites in each set suitable for excavation is to be studied in detail. Recovered faunal and floral remains will be used to reconstruct extinct environmental conditions as well as subsistence practices, including exploited resources, season of exploitation or occupation, and procurement methods. Artifacts and their distributions are to be examined in order to determine what activities are represented at each site, including resource processing, tool maintenance and manfacture, and trade and other forms of social contact. Critical horizons in particular sites will be dated radiometrically. In short, the age and nature of subsistence practices and settlement patterns of aboriginal populations are described for each set of strata. Biophysical environmental conditions extant during each time segment provide the basis for an examination of human paleoecological systems.

Interpretive Aspects

As was previously stated, the immediate objective of this research program is the historical reconstruction of an extinct hunter-gatherer cul-


San Gabriel Mts.
Sayles
San Bernardino Mountains
MOJAVE RIVER
SAN BERNARDINO
Simpson
RIVERSIDE
PERRIS RESERVOIR
L. San Jacinto
Snow Creek
COACHELLA VALLEY
Little San Bernardino Mts.
PINTO BASIN
SANTA ANA RIVER
Santa Ana Mts.
Lake Elsinore
SAN JACINTO RIVER
San Jacinto Mts.
WHITEWATER RIVER
Christensen-Webb
Newport Bay
Marana
Santa Rosa Mts.
Lake LeConte Shoreline
SALTON SEA
Temecu
SANTA MARGARITA RIVER
SAN LUIS REY RIVER
ANZA-BORREGO DESERT
PACIFIC OCEAN
N
SAN DIEGUITO RIVER
IMPERIAL VALLEY
0 10 20 30 Mi.
0 10 20 30 40 50 K.
Archaeological Site
SHADED AREA OVER 762 M.

tural system, particularly those aspects of the system that directly articulate with the biophysical environment, namely subsistence and settlement patterns. The nature of this ecological interaction is then described in terms of an equilibrium system involving populations and resources for each segment of time sampled.

If the general model presented above is correct, it should be possible to identify nearly synchronous shifts in the subsistence and settlement aspects of a cultural system with changes in the biophysical or regional social environment. In order to delimit the nature and magnitude of adaptive change with reference to the culture it is necessary to note, qualify, and quantify any correlative shifts in the subsistence and settlement patterns of extinct populations with changes in the biophysical environment. Furthermore, attention should be directed to the correlation of changes in one cultural system with changes in neighboring systems; for example, with reference to the previously mentioned effects of budding or migrating groups from peripheral regions.

Under current conditions in southern California archeology, however, the ideal method of data collection presented above cannot be systematically approached. Although the essentials of the above design also appear in the general research plan of the California Desert Archeological Committee (1970), neither the current funding situation nor the structures of the archeological institutions of the California Desert are presently compatible with such an approach. As Struever (1968b) has argued, regional research programs of the kind advocated here will require considerable reorganization of the archeological research system, which has not yet happened in interior southern California.

At the moment, however, we maintain a responsibility to fit our salvage and other research programs as closely as possible into the overall program. The Perris Reservoir region can be regarded as a sample area in which questions can be asked about settlement and subsistence systematics for eventual articulation with the results of other studies conducted in a compatible fashion. Research at Perris Reservoir, therefore, was directed toward the reconstruction of the local settlement and subsistence system through analysis of extant and extinct biotic communities, observation of site distributions, and analysis of artifacts and ecofacts and their distributions. Furthermore, research was aimed at detecting change in this system, with the intent of eventually bringing this data to bear on the alternative trajectories of culture change articulated above. The following paper will treat the research objectives of the Perris Reservoir Project in greater detail.

Figure 1. Regional map of southern California.

ENVIRONMENT AND ETHNOGRAPHY AT PERRIS RESERVOIR

Robert L. Bettinger

The Perris study area is situated on the Perris Peneplain, a broad valley bounded on three sides by mountain ranges (Figure 1). The San Jacinto Mountains, which border the plain on the east, are an exposed portion of the Southern California Batholith, a massive intrusion formed in the late Cretaceous and subsequently uplifted in the early Tertiary. To the north are the San Bernardino Mountains, a complex unit of Peleozoic and Mesozoic meta-sediments and igneous intrusives that were raised along the San Andreas Fault during the Pleistocene. The Santa Ana Mountains on the southwest are composed of volcanics, Cretaceous marine, and early Tertiary sediments. Both the San Bernardino and San Jacinto Mountains reach elevations over 3,000 m, while the Santa Anas are much lower, nowhere exceeding 1,800 m.

The northwestern margin of the area is marked by the Santa Ana River. The peneplain itself is a large depositional basin composed primarily of materials eroded during the exposure of granitic bedrock surfaces of the Southern California Batholith, which occur as erosional remnants on the plain itself. Several faults are presently active in the area including the San Andreas, the Elsinore, and the San Jacinto.

The topography of the Perris locality (Figure 2) is dominated by two northeast-southwest trending granitic ridges: Mt. Russell to the north and the Bernasconi Hills to the south. Together these constitute the Mt. Russell-Bernasconi Hills complex, a U-shaped feature that opens to the southwest (Plate 1). The peaks of these ridges reach elevations of 775 m, while the floor of the valley enclosed between them is no lower than 460 m. Those portions of the Perris Peneplain immediately surrounding the Mt. Russell-Bernasconi Hills complex are a minimum of 435 m in elevation. Gently inclined pediments intersect exposed granite bedrock at elevations of 530 to 610 m on the interior slopes and of 460 to 530 m on the exterior slopes.

East of the Mt. Russell-Bernasconi Hills complex is the San Jacinto lakebed. This body of water, also known as Mystic Lake, was both fed and drained by the San Jacinto River, which rises in the western San Jacinto Mountains. Below the lake, the river formerly ran along the southern margin of the Bernasconi Hills, then turned southwest toward the Santa Ana River. In recent years the river was diverted into a flood channel, and the dry lakebed converted to agricultural land.

The local area receives 30 to 50 cm of rainfall annually, most of which falls during the period from January through April. Average annual temperature is 16°C, the average high of 36°C coming in August, and the low of an average 3°C in January (U.S. Weather Bureau, 1930, 1952).

The principal sources of surface water in the Perris area are small scattered springs, generally located along fault lines at the base of mountain slopes. Many of these springs are now dry and none supports more than a small standing pool. This condition is evidently a recent phenomenon due largely to well drilling operations, which lower the water table, and to overgrazing by domestic sheep and cattle, which reduces the native plant cover and increases the rate of runoff. The situation has no doubt been aggravated by the recent drought that has plagued the area and by the long-term changes in the rainfall cycle that have affected the Southwest as a whole during the past century (Fritts, 1965).

Biotic Communities

The vegetation of the Perris locality can be divided into five major biotic communities (Munz and Keck, 1959:13-17): range grassland, coastal sage scrub, chaparral, marsh, and alkali flats (Figure 2). A minor community characterized as riparian may occur in the range grassland, coastal sage scrub, or chaparral zones near springs or in places where the water table is close to the ground surface. This reconstruction is based in part on Garces' abbreviated account of the area as it appeared in 1774 (Bolton, 1930:II,345-346).

The range grassland community is reconstructed rather than observed since severe grazing by domestic livestock has largely eliminated its native plant cover. Relict growths and undisturbed communities in similar circumstances nearby indicate that the dominant species in this zone probably included rye grass (*Elymus condensatus*), blue grass (*Poa scabrella*), bent grass (*Agrostis* spp.), filaree (*Erodium texanum, E. macrophyllum*), needlegrass (*Stipa pulchra, S. cernua, S.*

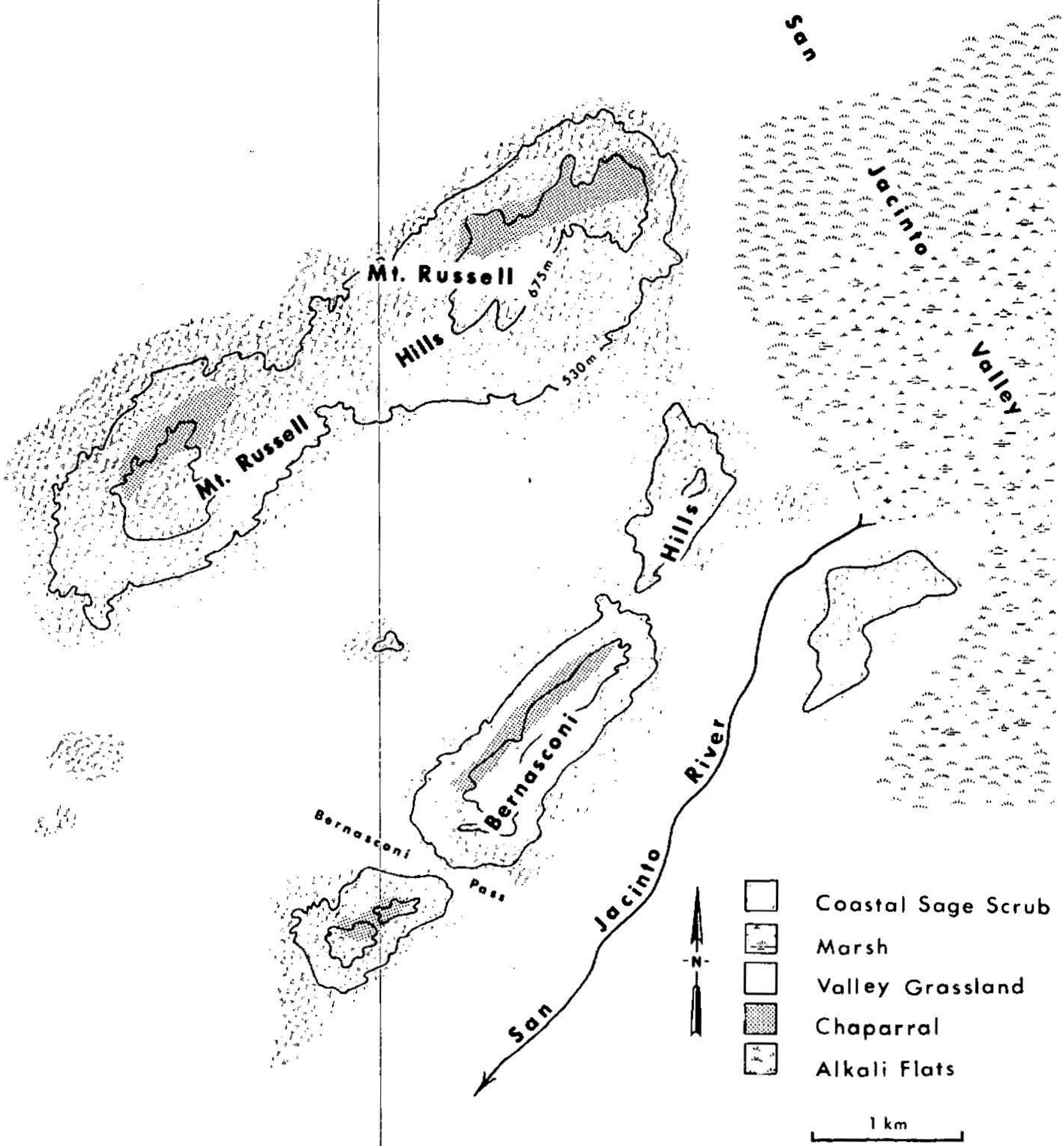


Figure 2. Geographic features of the study area. The biotic communities are those present in aboriginal times. Today they are greatly modified.

lepida), and triple-awned grass (*Aristida divaricata*). At present, the community is dominated by exotic species, especially tansy mustard (*Descurainia pinnata*), redtop (*Agrostis alba*), and cheat grass (*Bromus* spp.). At the Perris locality the range grassland appears on dry flatlands and the lower portions of pediments below 530 m (Plate 2).

Coastal sage scrub communities occur on the south-facing slopes and upper margins of pediments in the Mt. Russell-Bernasconi Hills complex (Plate 2). The combination of relatively steep slopes and southern exposure are the critical factors controlling their distribution. Under these circumstances, rapid rainfall runoff and direct exposure to sunlight maintain effective moisture at marginal levels and preclude the invasion of the zone by less tolerant plants.

The dominant flora in this community are buckwheat (*Eriogonum fasciculatum*), coastal sage (*Artemisia californica*), encelia (*Encelia farinosa*), and yellow pentstemon (*Pentstemon antirrhinoides*). Other common forms include mule fat (*Baccharis viminea*), bebbia (*Bebbia juncea*), bee plant (*Scrophularia californica*), and wedgeleaf goldenbush (*Haplopappus cuneatus*). Two cacti — beaver-tail (*Opuntia basilaris*) and deerhorn (*Opuntia acanthocarpa*) — are also found within this zone.

Plate 2. Coastal sage scrub and valley grassland communities. The coastal sage scrub community in the foreground is dominated by brittle bush (*Encelia farinosa*). Prior to the inception of agriculture, a valley grassland community occupied the valley floor in the near background. The view is to the southwest from the Charles Mott site (4-Riv-464), where excavation is in progress. (Photo courtesy of Anthony Galt.)

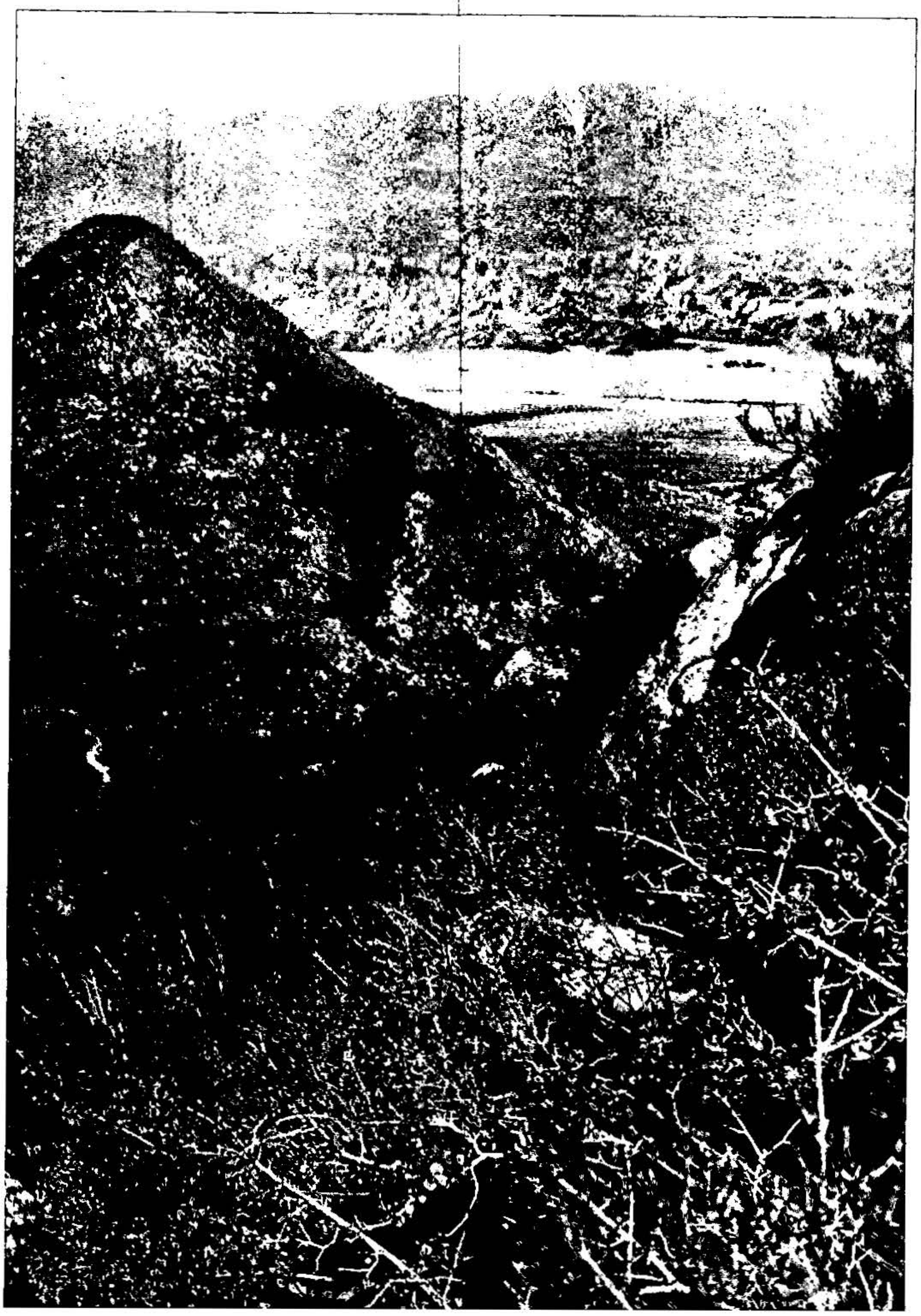
Monkey flower (*Mimulus longiflorus*) occurs infrequently in the relatively damp soil at the bases of large granitic boulders. On exceptionally steep slopes, so little moisture is retained in the soil that the variety of flora is further reduced, so that coastal sage and encelia are represented to the virtual exclusion of other plants.

Chaparral communities are found on north-facing slopes, which are somewhat sheltered from direct sunlight and hence retain greater amounts of soil moisture (Plate 3). As a result, plant growth in these zones is quite dense. Dominant shrubs are chamise (*Adenostoma fasciculatum*), sugar bush (*Rhus ovata*), yellow pentstemon, mountain mahogany (*Cercocarpus ledifolius*), and redberry (*Rhamnus crocea*). Clumped stands of scrub oak (*Quercus dumosa*), interior live oak (*Q. wislizenii*), hollyleaf cherry (*Prunus ilicifolia*), and laurel sumac (*Rhus laurina*) occur sporadically within this community. Interspersed among these shrubs and trees are a wide variety of herbs including: sacapellote (*Perezia microcephala*), chia (*Salvia Columbariae*), night shade (*Solanum xanti*), silver buckwheat (*Eriogonum elongatum*), cup weed (*Gnaphalium bicolor*), and snapdragon (*Antirrhinum nuttallianum*). Other common plants are onion (*Allium* spp.) and black and white sages (*Salvia mellifera, S. apiana*).

Plant diversity within this zone is reduced where gentle slopes slow the rate of runoff and increase the amount of effective moisture. Chamise is the dominant shrub in these areas. However, chamise is entirely absent in the chaparral communities of the Bernasconi Hills. This phenomenon is not clearly understood, but it may reflect a selective consequence of brush fires.

As noted earlier, a riparian community occurs at springs and in washes where the water table lies close to the ground surface. The dominant species in this community are trees, including elderberry (*Sambucus mexicana*), arroyo willow (*Salix lasio-*

Plate 3. Chaparral community. This view shows the chaparral community high on the northwest slope of the Bernasconi Hills. In the background are San Jacinto Valley, the Badlands, and the San Bernardino Mountains.



lepis), red willow (*S. laevigata*), and western sycamore (*Plantanus racemosa*). The dense shrub and herb understory is principally composed of Cleveland sage (*Salvia clevelandii*), sunflower (*Helianthus californicus*), ragweed (*Franseria acanthicarpa*), and nettle (*Urtica gracilis*). In general, this zone also contains crowded stands of the same plant species that are present in immediately adjacent plant communities. For example, springs within the coastal sage scrub are surrounded by dense thickets of buckwheat, coastal sage, and encelia in addition to the typical riparian phreatophytes.

Before the recent disruption of the San Jacinto River drainage system, freshwater marsh communities were distributed around the margin of San Jacinto Lake and along the backwaters of the San Jacinto River (Plate 4). Plants typically found in these areas probably include tule (*Scirpus* spp.), cattail (*Typha latifolia*), tule-potato (*Sagittaria latifolia*), spike-rush (*Heleocharis* spp.), wild hyacinth (*Brodiaea* spp.),and wire grass (*Juncus* spp.).

These marshes were bordered by alkali flat communities that dominated poorly drained areas subject to periodic overflow from either the river or the lake (Plate 4). The species characteristic of this zone were saltbush (*Atriplex* spp.), salt grass (*Distichilis spicata*), and pulsey (*Heliotropium curassavicum*). Today these plants cover extensive areas of the dry lakebed southeast of the Bernasconi Hills.

Plate 4. Natural environment at Perris Reservoir. This view is to the southeast from the Charles Mott site (4-Riv-464) toward the Lakeview Mountains and upper San Jacinto Valley, which is on the left. Lake San Jacinto (Mystic Lake) and extensive marshes formerly occupied the valley floor. (Photo courtesy of Anthony Galt.)

The relative extent of these two communities probably varied substantially during prehistoric times, largely as a function of fluctuation in lake level, which in turn was controlled by the amount of water in the San Jacinto River. Variation in stream flow reflected the seasonal pattern of precipitation and snow melt, as well as both short- and long-term regional climatic cycles. This variation may also have been governed in part by changes in base level that resulted from activity along any of the several local fault lines.

Several plants that occur in the Perris area do not exhibit restricted distributions but are found in several plant communities. Notable among these are golden yarrow (*Eriophyllum confertiflorum*), phacelia (*Phacelia* spp.), white pigweed (*Chenopodium album*), and tumbleweed (*Amaranthus graecians*).

Fauna

According to Bean (1972), six species or groups of similar species found in the Perris area were important in the diet of interior southern California aborigines. These included mule deer (*Odocoileus hemionus*), mountain sheep (*Ovis canadensis*), pronghorn antelope (*Antilocapra americana*), jackrabbits (*Lepus californicus*), small rodents, and marsh and upland avifauna. Some of these animals are not found locally today because of hunting pressure and agricultural practices, but their former presence can be inferred.

In prehistoric times, the distribution of these animals varied as a function of topography and the character of local flora. Pronghorn antelope prefer flat or rolling open plains and feed primarily on grasses and sagebrush (Martin, Zim, and Nelson, 1951:273-274). Although no longer found near Perris, they were particularly common in the grassland community. Jackrabbits exhibit choices of diet and habitat that are similar to those of the antelope, and, as a result, their distribution corresponded closely to that of the antelope.

Mountain sheep and deer may inhabit a variety of local biotic communities depending on the character of those communities and the seasonal variation they sustain (Geist, 1971; Linsdale and Tomien, 1953). We suspect that at Perris these animals were found throughout the grassland, coastal sage, and chaparral zones, but were most often encountered in the narrow canyons and on the rocky slopes of the Mt. Russell-Bernasconi Hills complex.

The category of small mammals includes cottontails (*Sylvilagus auduboni*), mice (*Peromyscus spp.*), ground squirrels (*Citellus* spp.), wood rats (*Neotoma* spp.), kangaroo rats (*Dipodomys* spp.), pocket gophers (*Thomomys bottae*), and voles (*Microtus* spp.). These animals are found throughout the Perris area, although some genera are more abundant in certain communities than in others. Specifically, wood rats and cottontails are common in the chaparral and coastal sage scrub communities, while voles, ground squirrels, and pocket gophers are most often found in the range grassland zone.

Avifauna is divided into two groups. Marsh-dwelling waterfowl include ducks (Anatinae) and geese (Anserinae). Range grassland, coastal sage scrub, and chaparral communities are occupied by upland birds such as quail (*Lophortyx* sp.).

Ethnography

Southern California aboriginal populations have been systematically studied by ethnographers since the late nineteenth century. The principal contributions include works by Barrows (1900), Sparkman (1908), Kroeber (1908, 1925), Hooper (1920), Strong (1929), Drucker (1937), Bean (1972), and White (1963), among others. The following section outlines a model of prehistoric settlement and subsistence at the Perris locality based on this ethnographic information. The model was developed primarily on material from Bean (1972) and Bean and Saubel (1972), which comprehensively summarizes all the earlier sources and incorporates important new data, all in an ecological perspective.

The Perris locality falls within an area of unclear political affiliation bounded by four distinct ethnic territories: Serrano to the north, Gabrielino to the west, Luiseño to the south, and Cahuilla to the east (Bean, 1972: 1). It is the closest to the known territories of the Luiseño and the Cahuilla. Although these two are distinct social units, they shared a similar subsistence and settlement adaptation that has been described by Bean.

According to this pattern, the settlement of a particular geographic unit — for example, a drainage system — is centered around a landholding patrilineage, numbering an average of 70 to 80 individuals. While the Perris locality might support such a group seasonally, as a discrete territory it lacks certain critical resources, such as large oak groves, which are essential to the full seasonal pattern of exploitation. If Bean is correct, and if this pattern can be assumed to pertain to recent prehistoric contexts, then the study area represents only one part of the annual subsistence and settlement system.

Based on data collected ethnographically, we can observe eight food procurement systems that would have been operating in the Perris area. Each of these systems carries with it the constraints of technology, location (environmental zone), and seasonality. Where these constraints crosscut two or more genera, they have been merged into a single system.

Mule Deer and Mountain Sheep Procurement

Both mule deer and mountain sheep were taken individually by hunters working alone or in small groups (Bean, 1972:57-58). In contrast to the situation in some areas of the Great Basin, deer and mountain sheep were locally available year-round at Perris and therefore could have been hunted in all seasons. Although these species ranged through most of the biotic communities at Perris, they were most easily stalked or ambushed in the upland communities; i.e., in coastal sage and chaparral zones. Since mountain sheep must drink water frequently during the summer months (Ryan, 1968), they could easily have been shot by hunters concealed in blinds located near springs.

Antelope and Jackrabbit Procurement

Antelope and jackrabbits are exceptionally swift range grassland dwellers. Both their speed and their tendency to run rather than hide when threatened make them poor targets for the bow and arrow. Although Bean (1972:58) states that individual antelope were taken by means of a relay chase, the more common pattern over the entire Great Basin was the communal drive (Steward, 1938:34-35). Successful use of this technique required a substantial antelope population and the organized efforts of a relatively large number of people, both in the construction of the brush enclosures or wing traps and in the drive itself.

The jackrabbit drive often served as an alternative to antelope hunting when the local herds were too small, or the human population was not large enough to carry out a full-scale drive. In southern California rabbit hunts involved the combined efforts of men, women, and children who spread out over a wide area and forced the large hares into a semicircle of cordage nets (Bean, 1972:59). Since both jackrabbit and antelope drives required a large number of participants, these activities usually took place in the fall prior to or following the acorn harvests.

Cottontail and Small Rodent Procurement

Cottontails and small rodents avoid predators by camouflage or by seeking refuge in dens or burrows. Thus, their procurement did not require pursuit over long distances. Although they were taken individually by hunters with the use of clubs or bow and arrow, the most economic means of capture was by trapping. Cottontails forage within 100 m of their burrows and wood rats within 300 m, so that snares placed near burrows or nests known to be in use were often effective (Ryan, 1968; Wells and Berger, 1967). Traps need not be constantly tended, and for this reason small rodents provided the largest portion of the meat diet during seasons when certain plant resources demanded the attention of all members of a local band (Bean, 1972:58).

Avifauna Procurement

Both waterfowl and upland birds can be taken by a number of means, including nets, snares, and throwing sticks (Bean, 1972:61). Quail and doves are year-round residents, but ducks and geese are found locally only during the period from late fall through early spring. The biotic associations of these faunal groups have been noted above.

Root and Shoot Procurement

Shoots and roots include the corms and tubers of tule potato, wild onion, Mariposa lily (*Calochortus* spp.), wild hyacinth, tule, and cattail and the green herbage of such plants as buckwheat, sage, and amaranth. Most tubers are found in the marsh and riparian zones, while the shoot-producing species occur in the upland coastal sage and chaparral communities. The root stocks were collected with the aid of a digging stick and were either eaten or were dried for future use (Bean, 1972). Greens were hand-picked and eaten but not stored.

Most roots and shoots are available from April to September, but they were particularly important to the local diet in the early spring when other food stores had been exhausted (Bean, 1972). (Spike rush, which occurs in local marshes, was exploited for its roots in other parts of California [Steward, 1933]. Although not specifically mentioned by Bean [1972], it may have been utilized aboriginally.)

Seed Procurement

A wide variety of plants produced edible seeds, among them chia, buckwheat, pigweed, goosefoot, saltbush, salt grass, tule, cattail, bentgrass, sunflower, and coastal sage. Taken as a group, seeds can be gathered between late spring and early fall. However, each individual species is usually available only for a short period between the times the seeds ripen and fall to the ground. Although some plants (e.g., saltbush) may retain their seeds for periods of several months, they cannot be relied upon as potential resources long after they ripen because of consumption by seed-eating birds and animals. For example, during certain seasons, *Atriplex* seeds constitute from 2 to 15 percent of the diets of pocket mice, kangaroo rats, pocket gophers, ground squirrels, quail and geese (Martin, Zim, and Nelson, 1951:315).

The following is a list of seed plants described by Bean (1972) as important to local aboriginal populations. Species are grouped under the biotic community in which they are most commonly found. The months in which the plant may be collected are also shown. Unless otherwise indicated by ethnographic sources, this period is thought to occur about one month after flowering. In general the cited interval is greater than might be expected in any given year. Rather, it represents the seasonal limits over the long run. Throughout the area variation in factors such as annual and seasonal rainfall or edaphic conditions certainly restrict the timing of seed harvest to a narrower interval from year to year and place to place.

CHAPARRAL	
Salvia Columbariae	June – September
SAGE SCRUB	
Eriogonum	June – October
Artemisia	August – October
GRASSLAND	
Agrostis diegoensis	May – September
Stipa pulchra	April – June
S. cernua	May – June
Poa scabrella	March – July
Aristida divaricata	June – August
MARSH	
Typha latifolia	July – August
Scirpus spp.	June – September
ALKALI FLATS	
Distichilis spicata	May – July
Atriplex canescens	July – September
A. lentiformis	August – November
RIPARIAN	
Helianthus californicus	July – November
MIXED ASSOCIATIONS	
Chenopodium californicum	April – July
Amaranthus graecizans	August – December
A. californicus	August – November

Seed gathering was done by women working alone or in small groups. The common method of collection was with a seed-beater and conical basket.

Nut Procurement

The large seeds of the oak and hollyleaf cherry were the principle food resources in interior southern California (Bean and Saubel, 1961:238). All able-bodied members of families generally participated in their collection. Hollyleaf cherries were processed by removing the flesh coat, parching and cracking the pit hull, and grinding the enclosed nut into a storable flour. Acorns were dried, husked, ground in a mortar, leached to remove the tannic acids, and then either eaten or dried in cakes and stored. Whole acorns were stored in cylindrical brush granaries (Bean and Saubel, 1961:240).

Hollyleaf cherries were harvested in the late summer and early fall, just prior to the acorn-gathering operations in October and November. Since both cherries and acorns are eaten by many animals including deer and mountain sheep as well as innumerable birds and rodents, rapid harvest was a necessary prerequisite to the successful exploitation of these staple food crops. Small stands of hollyleaf cherry and scrub oak are located in chaparral communities in the Perris locality. However, the nearest large groves of oak occur some 16 km to the east in the foothills of the San Jacinto Mountains.

Berry Procurement

Certain plants produced fruits and berries that were occasionally eaten or used as beverage stock. This exploitation was opportunistic rather than critically calculated or planned. The species available for use at Perris included redberry, sumac, and elderberry.

Seasonal Round

The eight procurement systems discussed above can be articulated in the following pattern of seasonal exploitation (Figure 3). In the early spring, when the winter food stores were exhausted, tubers and greens provided nearly all of the vegetal diet. In some parts of the Great Basin men as well as women participated in their collection (Steward, 1933:244), although Bean (1972) does not mention this practice for southern California. Cottontails and other small rodents taken in traps probably accounted for most of the meat consumed, although deer and mountain sheep may have been hunted occasionally. As the season progressed, collecting activities gradually shifted from greens and tubers to seeds.

This procurement system involved the short-term occupation of small camps in especially productive locations away from the main village. The camp unit usually consisted of one or two families. Rabbits and rodents continued to provide most of the meat protein, but the pursuit of large mammals gradually became more important. Like the small family groups involved in seed collection, hunters may have established temporary camps as bases for their operations. Seed procurement was most important in the late summer, less so in the early fall. At this time large numbers of people gathered at village locations in anticipation of the acorn harvest. The major collecting activity centered on the gathering and processing of hollyleaf cherry.

These large population aggregates also permitted communal jackrabbit and antelope drives, provided that appropriate habitat and sufficiently large numbers of these animals were found nearby. During this period, the acorn crop was frequently checked by hunters (Bean and Saubel, 1961:239). When these nuts were ripe, most family groups moved to oak groves to harvest this essential resource. The entire acorn yield, both in processed and raw form, was then transported back to the main camp. Since men were involved in harvest activities through this period, the hunting of large game was precluded, and rabbits and rodents taken by snares or traps constituted the bulk of the animal diet.

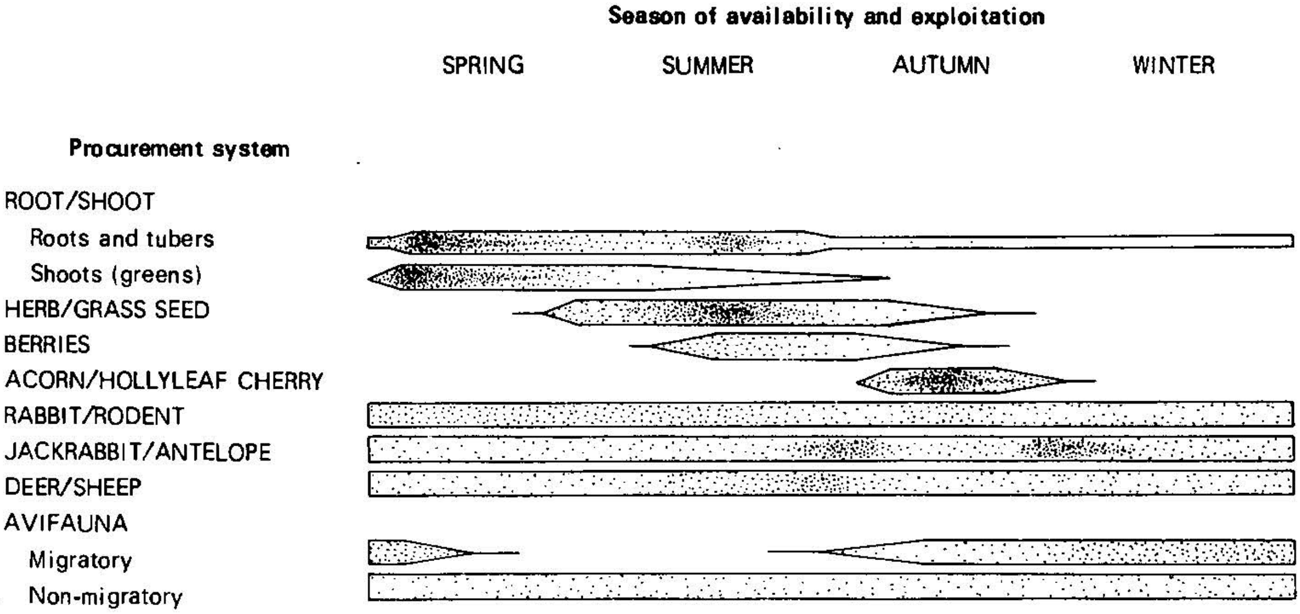
The winter months were marked by a reduction in the variety of available resources. Subsistence was based on stored food and the hunting of waterfowl. The tasks performed during this season were primarily related to such maintenance chores as the processing of skins and the production of baskets, pottery, bows, and arrow shafts.

This settlement and subsistence pattern has two important aspects. First, nearly all procurement systems were generalized rather than specialized. In other words, it was a range of plants or animals that were exploited, rather than a single species. Within this framework, the schedule of day-to-day activities was flexible. For example, during the late summer months women might have collected and processed seeds from a stand of bentgrass in the range grassland zone on one day, while on the next they might well move to the marsh community to harvest cattail pollen. In turn this pattern favored the development of generalized tool kits and procurement and processing techniques that were applicable to a given spectrum of food resources. One "feedback" result of this system is that there was a conscious effort to exploit only those plants or animals that are susceptible to the generalized means of procurement.

Second, village location reflected this same nonspecialized adaptation. While we have noted the occurrence of temporary camps established near areas particularly rich in one or two resources, most villages were situated so that in the long run nearly 80 percent of the edible plant foods were available within a radius of 5 miles (Bean, 1972).

To summarize, aboriginal populations in eastern California followed an unspecialized subsistence and settlement pattern that drew upon eight distinct resource procurement systems. The limited seasonality exhibited by most of these systems prevented an emphasis on any one at the expense of the others. At the same time the variety of species included within a single procurement system constituted a sort of "fail-safe" device, since the failure of one resource could be countered by the exploitation of another. In fact, this approximates a mini-max strategy in which a possible maximum return is ignored in favor of an assured minimum return. While such economic behaviors are eminently "safe," as Flannery (1968) and others (Clarke, 1969:95) have noted, in the long run their conservatism prevents the development of more effective means of adaptation.

Figure 3. Hypothetical subsistence pattern at Perris Reservoir. This figure portrays food procurement systems discussed in the text. Polygons indicate the relative availability of given resources by season, and shading indicates the relative importance of a given system at any time of the year. Thus the importance of an individual system at any time depends on both the seasonality of the resource and on the scheduling of exploitative tasks among the various procurement systems. (Compiled from various sources, including Bean, 1972; Bean and Saubel, 1972; Steward, 1938; Flannery, 1968; Martin, Zim, and Nelson, 1951; Pyle, 1953; Munz and Keck, 1959; Sparkman, 1908; and Barrows, 1900.)



SETTLEMENT AND SUBSISTENCE AT PERRIS RESERVOIR: A SUMMARY OF ARCHEOLOGICAL INVESTIGATIONS

Philip J. Wilke

The purpose of this paper is twofold. It will first present a synthesis of the papers that comprise Part II of this publication with respect to the ethnographic model of historic aboriginal land use in interior southern California presented by Bettinger ("Environment and Ethnography," this publication). It will then explore possible explanations for the pattern of aboriginal land use at Perris Reservoir with respect to the review of mechanisms of adaptive change offered by Jefferson ("Research Strategy," this publication).

To attempt a synthesis of the pattern of aboriginal land use at Perris Reservoir, it is first necessary to draw certain inferences from reconnaissance data, excavation data, and chronological studies.

Summary and Inferences

Reconnaissance within the Perris Reservoir locality was designed to gather data on the past distribution of subsistence resources that would have been important to aboriginal populations in the area and to determine the location and character of archeological sites there. Although significantly modified today by such factors as agriculture, overgrazing, and eradication of the water resources of the San Jacinto Valley, the natural environment of the reserovir area has been reconstructed from field observations and historic records, with some assistance from excavation data.

In this reconstruction the concept of biotic community (i.e., a widespread and recurring complex of floral and associated faunal resources in a given topographic setting) has been used. We infer the former presence of a valley grassland community on the open, flat plains and valley floors; a coastal sage scrub community on the rocky slopes of the Mt. Russell Hills and Bernasconi Hills; small chaparral communities on the upper northwest slopes of these hills; and an aquatic community immediately to the east of the study area in San Jacinto Valley involving both lentic (freshwater marsh, open waters of Lake San Jacinto) and lotic (San Jacinto River) facies, and alkali flats, also in San Jacinto Valley (Figure 2).

Across this geographically varied landscape are distributed two general categories of archeological sites: occupation sites, which were seasonally used as campsites from which foraging activities were conducted, and processing sites, consisting merely of isolated loci where bedrock metates attest to the milling of herb and grass seeds. The former of these site categories most often occurs at the base of the hills where springs emerged in the past (some of which are still active) or along the edge of the marshes out of the immediate area under consideration and hence not investigated. In addition to water resources, these temporary campsites offered bedrock milling surfaces for the processing of vegetal foods.

Isolated processing sites are located almost everywhere suitable milling surfaces are afforded by outcrops of granitic bedrock, but never more than a short distance up the hill slopes. Since bedrock outcrops are not common in the zones inferred as former grasslands, processing sites are also largely confined to the base of the hills, a narrow zone that we infer was an ecotone between grassland and coastal sage scrub.

With the exception of a few isolated rock art sites in the same general topographic setting as occupation and processing sites, no other archeological sites were found. The upper slopes of the hills and the open valley floors were presumably exploited for food resources, but processing of vegetal foods and daily chores of living were not carried out there. The density and distribution of site categories across geographic features are shown in Figure 4.

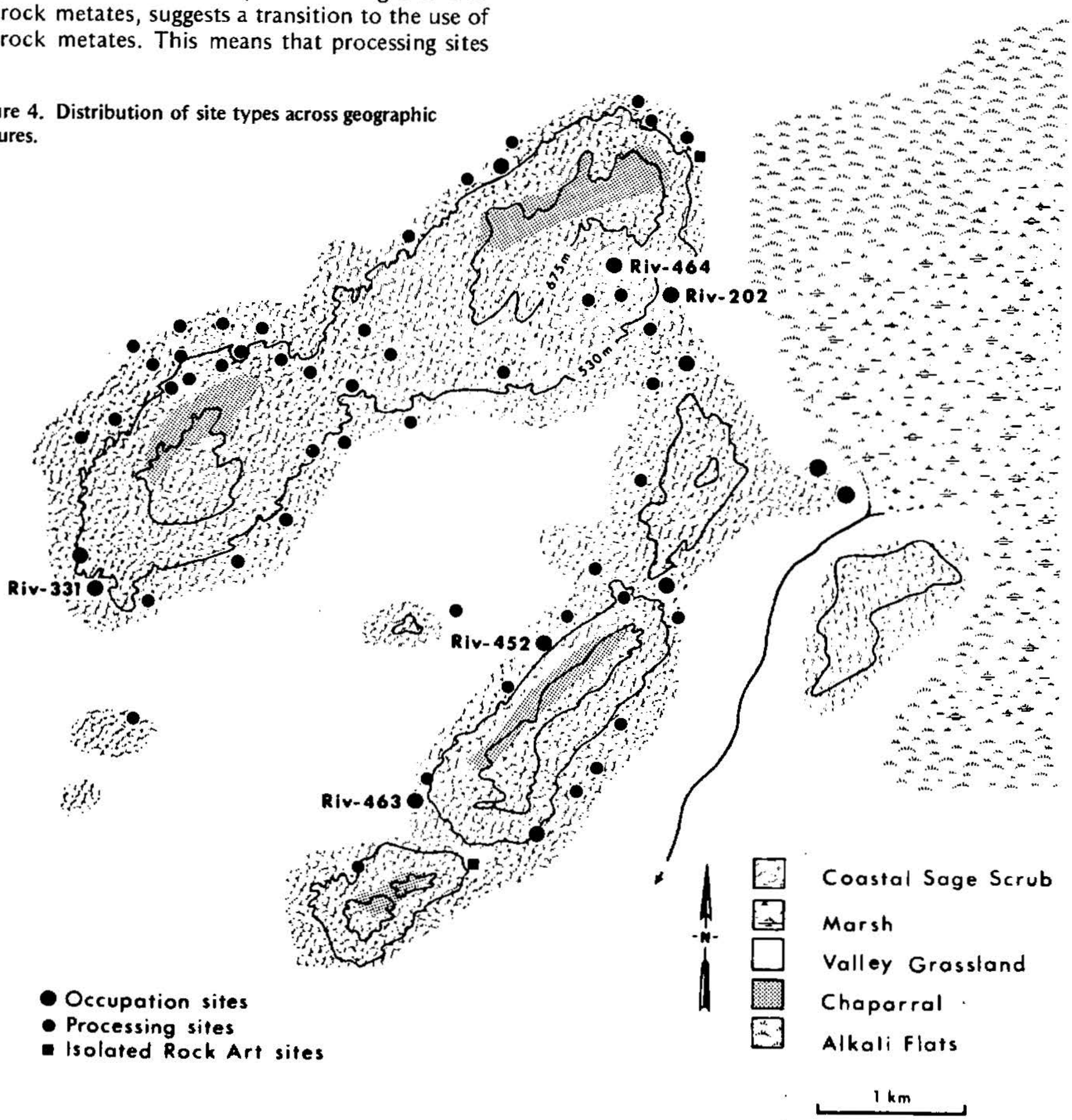
Nearly all the artifacts recovered at Perris Reservoir were surface collected or excavated at five occupation sites. The greatest number of these artifacts consist of ground stone seed milling implements and fragments thereof.

Manos comprise the most common category of seed milling implements. These were used in conjunction with portable or semiportable metates and bedrock metates for milling small herb and grass seeds. There is some evidence that basin-shaped metates were originally used instead of bedrock metates at the occupation sites but were replaced by the latter at some point in time.

Where basin metates were recovered in the course of excavation they generally underlay and hence predated small triangular projectile points of the Cottonwood series, which were in vogue only after about AD 1300. The recovered basin metates show considerable use, with milling basins from 1.7 to 8.5 cm deep. In contrast, the milling surfaces of bedrock metates, whether at occupation sites or processing sites, range from flat polished surfaces to shallow depressions that rarely attain a depth of 2 cm. The fact that where deep basin metates are datable, they are older than AD 1300 or so, together with the shallow depth of milling basins of bedrock metates, suggests a transition to the use of bedrock metates. This means that processing sites are probably a late phenomenon at Perris Reservoir, and use of them apparently coincides with all or part of the time in which Cottonwood series projectile points were used.

Mortars at Perris Reservoir are exclusively of the bedrock variety, and with one or two possible exceptions these were confined in occurrence to occupation sites. Use of the wooden pestle is inferred inasmuch as no cylindrical stone pestles were found, the only ones recovered being simple unshaped elongate cobbles that do not fit in most of the mortars. The mortar and pestle functioned ethnographically in the processing of acorns and

Figure 4. Distribution of site types across geographic features.



the seeds of hollyleaf cherry. Since both of these foods require leaching to remove the tannic acid and thus render the pulverized meal edible, mortars were apparently used at occupation sites where water for leaching was also readily available. The preponderance of various milling implements among the artifact collections attests to the importance of various plant resources in the aboriginal subsistence economy.

Seeds of herbs and grasses were rendered more edible or more readily preservable by parching, as is suggested by the occurrence of carbonized seeds of ethnographically important food plants in the fill of hearths uncovered in the excavations. We believe that the seed sample recovered by water separation represents foodstuffs lost in the fires in the process of parching with live coals. Hearths frequently also contained quantities of small rocks ranging from 5 to 8 cm in diameter. The consistent occurrence of such rocks suggests cooking in perishable containers by heat transfer. Broken milling implements were also commonly found in the hearths, presumably serving as cooking stones when no longer useful for seed processing, or, in the case of manos, when broken from overly enthusiastic use as hammerstones. Cooking facilities unearthed in the excavations included small and large hearths as well as earth ovens, pits up to a meter across and half that deep and filled with burned rocks, bone scraps, plant remains, and the like.

Ceramic vessel sherds are not abundantly represented in the collections from Perris, and were used there only late in time, after AD 1650 or so. Plain brown utility ware (Tizon Brown Ware) sherds are frequently burned on one or both surfaces, indicating cooking vessels used directly over fire rather than with cooking stones. Buff ware sherds are seldom burned and indicate storage rather than cooking.

Projectile points are quite commonly found in later deposits but are conspicuously absent from levels dating prior to 870±80 radiocarbon years ago (corrected to AD 1100-1220) at the Peppertree site and in early levels elsewhere in the reservoir locality. All but one of the 87 classifiable specimens belong to types made only after about AD 1300. The type Cottonwood Triangular and its associated variants comprise more than 90 percent of all classifiable examples from the study area. The presence of faunal remains in earlier deposits indicates that game was hunted and suggests that these small projectile points replaced untipped hardwood foreshafts of projectiles after about AD 1300.

Bone awls and notched bone implements, both apparently used in basket working, attest to some manufacturing and maintenance-oriented activity. Other categories of implements associated with such tasks, including drills, scrapers, knives, perforators, and the like are only minimally represented.

Items commonly associated with exchange systems, such as shell beads, were present in limited quantity. These are important in attempting to trace outside connections in addition to their value in cross dating assemblages. It was anticipated that shell beads would offer some insight into possible involvement of aboriginal groups at Perris Reservoir in the widespread interaction systems that characterized aboriginal California (King, 1971). Examples of Pacific Coast shell did occur in the deposits, but manufactured shell items that originated in the Gulf of California were also found and indicate that studies of interaction and exchange systems in the interior of southern California must also consider these additional elements.

Remains of food plants were occasionally collected directly from the deposits, but most of them were recovered by water separation of the fill of hearths and other cooking facilities. The data presented in Table 31 are limited although highly suggestive. We think it reasonable to infer that a rather consistent occurrence in the cooking facilities of carbonized seeds of goosefoot, amaranth, saltbush, chia, and certain unidentified grasses indicates exploitation of these plants as a resource complex and parching of the seeds with live coals. The seeds could be effectively collected during the summer months in the valley grassland, coastal sage scrub, alkali flat, and, to a lesser extent, chaparral communities and thus obtained within short distances from the occupation sites. Since ethnographic records indicate that parching of seeds preceeded grinding, the sample obtained by water separation may not be representative of the kinds of seeds milled at the many processing sites recorded in the study area. If fires were regularly kindled at these sites to provide parching coals, they should display at least some development of organic soils, which they apparently lack. This problem has not yet been worked out to our satisfaction, but it is possible that processing sites may have been used for hulling seed or otherwise freeing it from attached glumes and the like, with parching and milling carried out at the occupation sites. In this case, the recovered sample would be representative of the species treated at the processing sites.

Small fragments of either acorn hulls or hollyleaf cherry seeds were also found in a number of water separation samples. These probably indicate discarding of such refuse in the fires, but they also attest to use of such resources of the chaparral communities. Hollyleaf cherry becomes available for harvest in late summer and early autumn, and acorns are characteristically an autumn crop. Both of these foods would have been used after the season of small seed harvesting had passed.

A number of plant remains were recovered directly from the midden deposits during excavation (Table 32). Among these were seed fragments of California laurel (*Umbellularia californica*). Although popular sources on the use of native plant foods (e.g., Kirk, 1970: 220) indicate that the fruits of this tree can be roasted and eaten, we have been unable to locate references to the ethnographic practice of eating laurel, although the leaves reportedly have medicinal uses (Bean and Saubel, 1972: 143). We are unable to evaluate the significance of these remains or to account for their presence in the middens. The shallow depth at which they occur and the fact that they occur at sites displaying evidence of historic occupation, suggest that they may have been derived from introduced shade trees. No laurel was noted in the botanic survey of the study area.

Analysis of the nearly 22,000 bone scraps recovered in the course of excavation indicates that at least 34 separate vertebrate taxa were exploited for food by the aboriginal populations at Perris Reservoir. The lagomorphs — jackrabbits and cottontails — were unquestionably the most important on a day-to-day basis, although a greater bulk of meat is represented by the remains of the ungulates — deer and bighorn. Small rodents were also important in the diet.

Of particular interest is the occurrence of waterfowl, which could only have come from the aquatic communities of San Jacinto Valley. Waterfowl are not represented in the faunal samples from all sites tested. For example, no waterfowl are present in the sample from the Oleander Tank site, which yielded the largest collection among the excavated sites, comprising a minimum of 325 individual animals representing 15 taxa. This suggests that foraging activities from that site did not extend as far as the aquatic communities of San Jacinto Valley. Certain of the waterfowl species are only seasonally available, lending additional support to statements of seasonality of occupation.

Long bones of ungulates were split and crushed, presumably to obtain marrow; and the extremely fragmentary bones of small animals such as rabbits and rodents indicate that the animals were almost certainly crushed in mortars, a practice that is well documented ethnographically.

As in the case of the floral remains, there is little evidence for change in species exploited over time. Exceptions to this pattern include a general addition of species in later deposits at several sites; it is noteworthy that waterfowl are almost entirely restricted to very late deposits. Since there is no reason to postulate the late appearance of lacustrine conditions in San Jacinto Valley, and since most of the waterfowl species are not seasonally specific, the data clearly point to a broadened subsistence base very late in prehistoric time.

More significant is the quantitative change in individual animals taken over time, as illustrated at Area 2 of the Peppertree site (Table 29). Here levels *a* through *d*, which was dated at 215±60 radiocarbon years (corrected to AD 1570-1650), produced a total of 108 jackrabbits and cottontails. Levels *e* through *k*, which was dated at 2,200±80 radiocarbon years (corrected to 380-200 BC), span the previous 2,000 radiocarbon years, yet they yielded only 52 of these animals. Considered another way, twice as many total animals of all species (143 individuals) were taken in the last 215 radiocarbon years as in the entire previous 2,000 (72 individuals). This can only mean a significant change in hunting intensity, and may well serve as an index of increased land use intensity.

The oldest dated deposits investigated at Perris Reservoir were at the Peppertree site, where a hearth at the base of the cultural deposit in Area 2 was dated at 2,200±80 radiocarbon years BP (corrected to 380-200 BC). Basal dates are not available from the other occupation sites investigated, but are presumably more recent than the basal levels at the Peppertree site. For the sake of convenience, all cultural material dating earlier than the appearance of Cottonwood series projectile points has been assigned to an early period. The appearance of Cottonwood projectile points is usually set at AD 1300 (cf. Clewlow, 1967), a date that is supported by the stratigraphic evidence from Area 2 at the Peppertree site. Almost without exception, artifacts dating from the early period are seed milling implements. Basin-shaped metates were used during this period and attest to the significance of small seed exploitation in the aboriginal diet. The single projectile point that stylistically dates from the early period is an Elko Eared specimen from the Charles Mott site, but it occurred in association with artifacts of younger age, and was apparently redeposited.

The presence of a variety of faunal remains in early period deposits at Peppertree indicates that animals were also hunted, apparently with hardwood-tipped projectiles, a fact that makes difficult the cross dating of deposits by time-marker artifact styles. This restricted material culture inventory characterized the occupation of the reservoir locality from at least as early as 300 BC until about AD 1300. The data pertinent to early deposits indicate that population in the area was low and that occupation was probably sporadic.

Cottonwood series and Desert Side-notched projectile points and a few *Olivella* lipped beads characterize the late period, dating after AD 1300. During this period artifact inventories are much more diversified, but most items are still related to food procurement and processing. Associated time-sensitive projectile points link almost all the occupational refuse at Perris Reservoir with the late period.

Within the late period certain changes are evident. For example, there is a late addition of ceramics to the artifact inventory. Occupation surfaces at the Peppertree, Dead Dog, and Charles Mott sites yielded radiocarbon dates corrected to about AD 1650. In each case the living floors underlay and hence predated ceramic vessel sherds of Tizon Brown Ware and Lower Colorado Buff Ware, indicating a very late appearance of ceramics in the Perris locality. Exploitation of the waterfowl resources of San Jacinto Valley began about this time, as indicated by the late occurrence of aquatic bird bones at three of the five sites sampled. The apparent association of the processing sites with the late period has already been discussed. Artifact and debitage frequencies, subsurface features, and the frequency of faunal remains all point to a period of intense occupation beginning generally coincident with the dated living surfaces. A terminal date for the occupation of the Perris Reservoir locality has been set at AD 1800. The reason for abandonment is not understood, but it apparently occurred at about the time of initial Spanish contact. Artifacts associated with the Spanish settlement of California are completely lacking.

The Settlement Pattern

The evidence derived from survey and excavation in the Perris area is interpreted to represent a pattern of intensified land use late in prehistoric time. This pattern involved use of seasonal occupation sites from which a wide variety of both floral and faunal resources were collected. Plant exploitation involved two separate aspects: (1) harvesting of small herb and grass seeds and milling them at numerous scattered processing sites as well as at occupation sites, generally during the summer months; and (2) a late summer and autumn aspect involving exploitation of hollyleaf cherry and acorns in the chaparral communities. The latter aspect probably did not involve the isolated processing sites to a great degree since the resources involved were processed with bedrock mortars that are restricted in occurrence to the occupation sites. Occupation of the reservoir locality in the winter months seems to be ruled out by a lack of evidence of substantial structures, abundant maintenance and manufacturing implements, cemeteries, or other signs of permanent or winter villages.

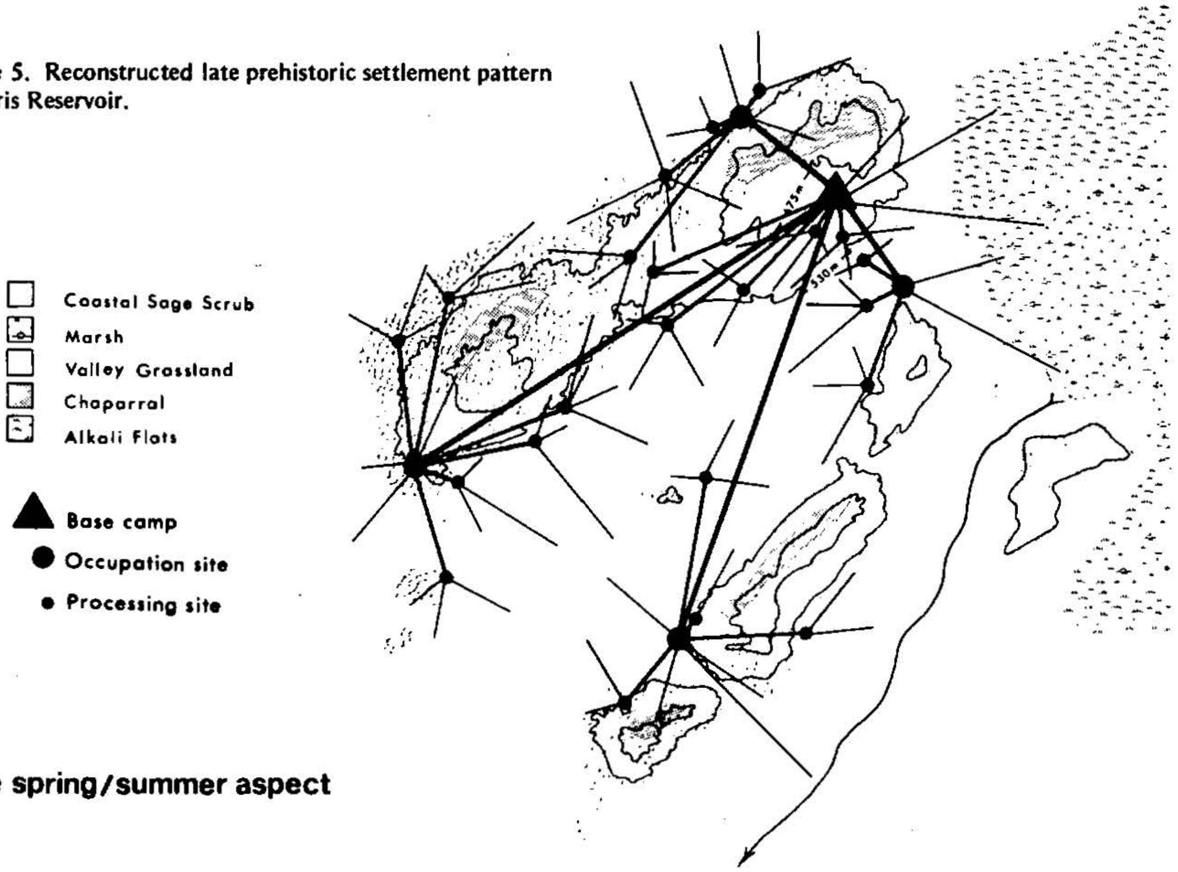
It is believed that this late settlement pattern involved small groups of people moving into the area in the spring as greens became available. Operation of a base camp and several other occupation sites, with nearby processing sites used by small groups engaged in seed collecting, hunting, and trapping seems the most satisfactory reconstruction. In view of its large size and abundant bedrock mortars and metates, as well as a permanent water supply and diversified artifact inventory, the Charles Mott site is the most likely candidate for the base of operations. It seems reasonable to suggest that as autumn approached subsistence activity intensified at the occupation sites, with the collecting and drying of acorns and hollyleaf cherry fruits, guarding against their consumption by birds and animals, and processing them into consumable food. Exploitation of the aquatic communities also occurred in the autumn, as indicated by the remains of seasonally available waterfowl in the bone refuse. Jackrabbit drives were probably conducted on the open plains.

This settlement pattern postulated for the last half of the late period, with its late spring/summer small seed harvesting aspect, and its late summer/autumn large seed harvesting aspect, is shown schematically in Figure 5. The selection of occupation sites in a given year was probably based on the productivity of nearby resources, availability of water, and other fluctuations in the natural environment. Likewise, it is also possible that the location of the base camp varied from year to year or even during the season. The size and social structure of the aboriginal population involved in such a pattern of exploitation is difficult to determine. Since the reservoir area is actually a somewhat isolated geographic territory, the group may have comprised a single lineage numbering from 50 to 100 individuals (Bean, 1972: 70-77).

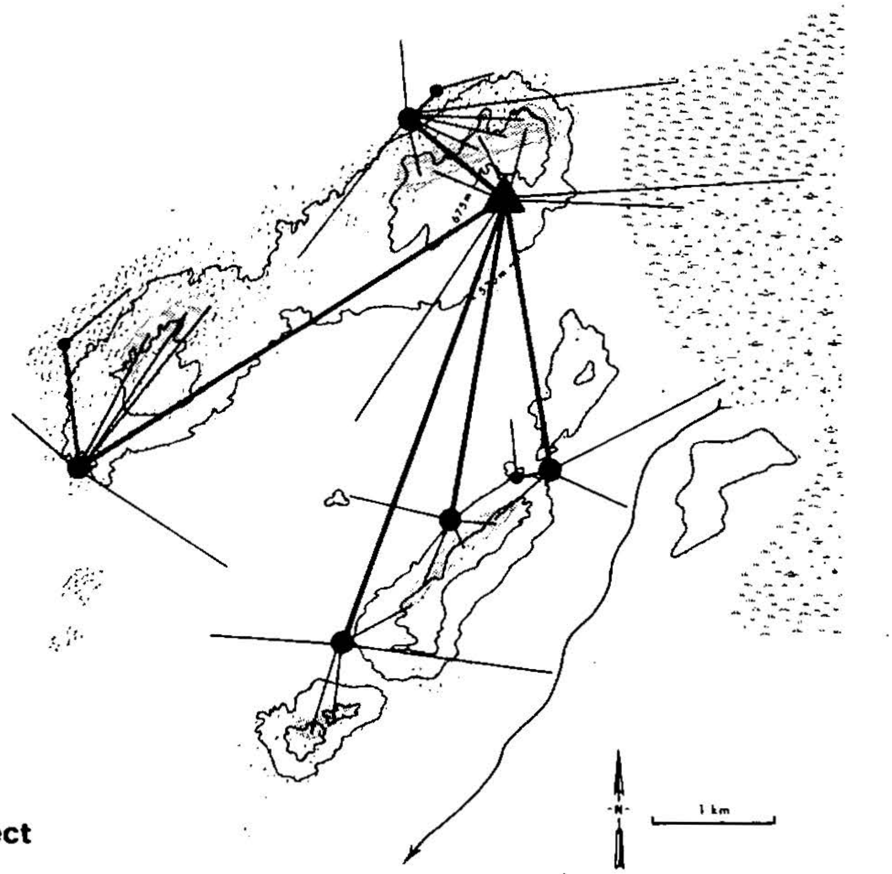
The Subsistence Pattern

In the preceding paper a tentative model of late prehistoric subsistence practices for the Perris

Figure 5. Reconstructed late prehistoric settlement pattern at Perris Reservoir.



Late spring/summer aspect



Late summer/autumn aspect

Reservoir locality was drawn from ethnographic literature. The subsistence data from Perris will be considered as it relates to the ethnographically derived model of individual food procurement systems.

Mule Deer and Mountain Sheep Procurement

These species are available at any season, and are sufficiently abundant in the faunal remains to indicate that this was in important procurement system at Perris Reservoir.

Antelope and Jackrabbit Procurement

These species were most profitably hunted by means of the communal drive, especially between autumn and spring, when aboriginal populations were drawn together for the autumn acorn harvest or at permanent villages. Jackrabbits may also have been taken in other seasons by smaller-scale drives or by individual hunters using bows and arrows, throwing sticks, and the like. The faunal sample includes the remains of only one pronghorn antelope, while jackrabbit was the most common single species, representing more than 41 percent of the 1,027 individual animals in the collection. The reason antelope were not more extensively used is unknown.

Cottontail and Small Rodent Procurement

Cottontails constitute a significant percentage (more than 31 percent) of the individual animals in the faunal assemblage and were thus of substantial dietary importance. Small rodents are represented by a variety of species, including woodrat, ground squirrel, and gopher. Although recovered in smaller number, they were perhaps as important as cottontails in view of the fact that a large portion of the individuals actually present may have been lost through the one-quarter-inch mesh screens used in the excavations.

Avifauna Procurement

The sample of birds is small but diversified, including 14 taxa. It includes the terrestrial California quail, several raptorial species, and a variety of waterfowl. Birds were probably not very important on a day-to-day basis, but migratory waterfowl would be expected to be more commonly used at a winter village in a setting like the head of San Jacinto Valley.

Root and Shoot Procurement

Constraints of data preservation preclude any assessment of this procurement system at present. There are no floral remains to suggest the exploitation of roots and shoots, but these are characteristically not preserved in open sites, such as those investigated at Perris. The procurement system may be represented by the scraper planes; these were primarily found at the Dead Dog site, which is located nearest the marsh community. Proximity to the marshes suggests that such plants as cattail and bulrush may have been used for their edible roots. Roots and greens would have been especially important if the seasonal occupation of the area began in the early spring.

Herb and Grass Seed Procurement

The heavy reliance on these resources is indicated by the large numbers of seed grinding implements in the artifact assemblages; by the repeated occurrence of amaranth, goosefoot, saltbush, chia, and grass seeds in the water separation samples from hearths at several sites; and by the widespread distribution of isolated milling sites throughout the study area. The particular taxa represented are generally available in the summer, and it is likely that during this season herb and grass seeds were the principal elements in the local diet.

Berry Procurement

While this procurement system may have been of considerable importance (Barrows, 1900: 63-64), evidence for its presence at Perris Reservoir is almost entirely lacking. The collecting of these foods does not require specialized implements, and representation of the plant remains in water separation samples from hearths seems unlikely. The few juniper berries recovered by water separation are about the only evidence at hand for the use of these resources.

Acorn and Hollyleaf Cherry Procurement

The abundance of bedrock mortars and the presence of carbonized seed remains indicate that these species were exploited locally and were of considerable importance in the diet. However, today oak and hollyleaf cherry have only limited distribution in the immidiate area, and it is not likely that such distribution was substantially different in the past. It is unlikely that a full winter's supply of this resource could have been obtained

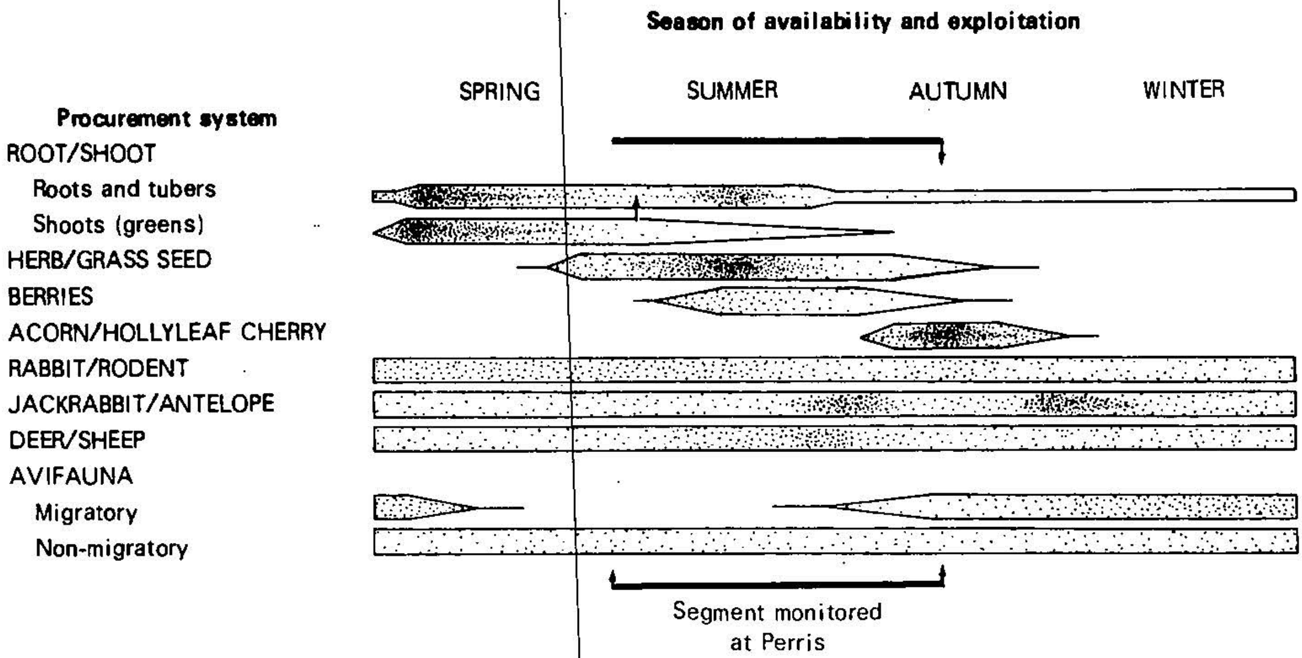


Figure 6. Segment of late prehistoric subsistence pattern monitored by data analysis. (Adapted from Figure 3.)

locally; instead, summer resident groups may have collected these items as they ripened and then moved to other areas for a larger acorn harvest later in the fall.

The seasonal ripening of these resources is of particular importance here. Hollyleaf cherry ripens in late summer and early fall; acorns are strictly a fall crop. Hollyleaf cherry may have been more heavily exploited at Perris, while the acorn harvest may have been scheduled to take place later and elsewhere. The apparent absence of winter camps in the reservoir vicinity is consistent with this interpretation.

The reconstructed subsistence pattern that has been discussed here is presented in Figure 6.

If the reservoir locality were only seasonally occupied, as the data indicate, the question arises as to where the seasonal occupants spent the winter. In view of Font's comments (Bolton, 1930, IV: 475) on the scarcity of trees and hence firewood in the immediate vicinity in 1774 and the possibility that sufficient winter stores were not locally obtainable, the winter village may have been located in a spot like the head of San Jacinto Valley, where access to oak groves was readily afforded, and timber and water were available in abundance.

Demographic Change

The pattern of intensified land use observed at Perris Reservoir appears to represent an increased population in the area on a more regular basis after about AD 1500 to 1600 – a population that exploited a broader range of food resources on a larger scale.

The apparent abruptness of this demographic shift argues against explanation in terms of local population growth. Moreover, the data suggest a settlement and subsistence system that should have resulted in an equilibrium state between local population and environment (Jefferson, in this publication). If, for the sake of argument, local population growth is ruled out as an explanation for the change, the only other viable alternative is a population influx from elsewhere. It was stated earlier that either an increase in population or a decrease in resource availability could lead to population/resource disequilibrium. It was also stated that such an unstable situation might be restored to a state of equilibrium by reduction of the population through out-migration, budding a portion of the population into an adjacent territory. The Perris Reservoir region may have been the recipient of such offshoot equilibrium-restoring population segments; and this may in fact be the explanation for the change seen there. However, it is known that hunter-gatherer populations were using the reservoir locality since at least as early as about 300 BC, presumably existing in equilibrium with their environment, given their subsistence economic adaptation. Any influx of population into such a setting would result in immediate and drastic disequilibrium there unless the local subsistence economy were restructured with rigorously scheduled and coordinated exploitative activities conforming to the seasonality of a broad spectrum of food resources (cf. Flannery, 1968).

This alternative, a population influx and a broadened and more highly integrated subsistence economy, is seen as a reasonable explanation of the data from Perris Reservoir. An integral aspect of the late prehistoric subsistence/settlement adaptation there may well have been an involvement in far-ranging reciprocal exchange systems. This is certainly suggested by the occurrence in the deposits of manufactured shell objects that originated in the Gulf of California and on the Pacific Coast or on the Channel Islands, of small ground stone objects made of schists common to the Santa Barbara Channel region, and of obsidian, the origin of which has not yet been determined but for which there is no local source.

If increased land use at Perris was an indirect result of population increase in an adjacent region, that region may well have been the coast. We know that the coast was both a densely populated (Brown, 1966; Kroeber, 1925: 880-891) and highly productive region. King (1971), however, has shown that the exceptionally dense population of the Chumash region (the vicinity of the Santa Barbara Channel) was not simply a result of a hunter-gatherer subsistence economy in a richly productive natural environment. Population density there was enhanced by a complex system of economic exchange based on shell money. The coastal region may thus have been the donor of excess population segments with interior regions, such as Perris Reservoir, the recipients.

On the other hand, increased use of the Perris region may have occurred as a response to reduction of the resource base of an adjacent region. Disruption of the coastal economic interaction sphere occurred after intense use of the Perris region began (cf. King, 1971). Such disruption can therefore be ruled out, and we must look to natural causes of reduction of the resource base in other areas.

Late prehistoric environmental change in southern California may have been either climatically or nonclimatically induced. Several investigators have presented evidence that they interpret as indicating recent climatic changes tending toward aridity (Hubbs, 1955, 1957; Hubbs, Bien, and Suess, 1960: 202). These data have been reviewed in some detail by O'Connell (n.d.). His comparison of these data with additional data from several sources, including tree-ring records from the nearby San Bernardino Mountains (Schulman, 1947, 1956), indicates that the reality and magnitude of late prehistoric climatic changes in southern California are equivocal. He views the data as possibly indicative of short-term secular variation rather than long-term climatic variation of considerable magnitude. Any short-term fluctuations would have been readily adjusted to by local hunter-gatherer populations, which tend to stabilize at levels well below the carrying capacities of their respective environments.

Nonclimatically induced environmental change was a significant factor in interior southern California in late prehistoric time. Throughout the late Quaternary, the Colorado River periodically discharged into the Salton Basin on the Colorado Desert forming Lake LeConte, a freshwater body of considerable proportions. This lake in turn overflowed into the Gulf of California. At other times the river discharged directly into the Gulf, and the lake receded. A series of radiocarbon age determinations (Hubbs, Bien, and Suess, 1965) suggest that a recent stage of this lake began shortly after the beginning of the Christian era and ended 400 to 500 years ago. Geological evidence offered by Stanley (Hubbs, Bien, and Suess, 1960: 215) and archeological evidence recently obtained (Wilke, unpublished field notes) show that a single 1,000 year stand is not indicated but that one or more recessions of unknown duration occurred within that time. Survey data indicate that a relatively dense and probably sedentary population exploited this lacustrine environment.

There is good reason to believe that a rerouting of the Colorado River, the only significant input into the lake, resulted in rapid disappearance of the lake by evaporation. Such a nonclimatically induced environmental change would have catastrophically altered the productivity of the Salton Basin. Certainly within a century – perhaps within half that time – resident populations would have undergone a transition from a lacustrine to a desert subsistence adaptation. It seems doubtful that such a transition could have been effected without an interim phase of population/resource disequilibrium; and Aschmann (1959: 45) is probably correct in inferring a significant out-migration coincident with the drying of the lake.

It cannot be definitely concluded that the increased use of the Perris Reservoir region is a response to environmental stress in the Salton Basin, but several lines of evidence do support such a notion. First of all, the timing is right. As nearly as can be determined, resource depletion in the

Salton Basin immediately preceded population influx at Perris Reservoir. Secondly, similar increases in land use are evident elsewhere in the interior of southern California. Wilke (n.d.) has reviewed this evidence and noted that published survey data point to significant population increases in such widely separated regions as the Anza-Borrego Desert (Meighan, 1959; Wallace and Taylor, 1958) and Joshua Tree National Monument (Wallace, 1964) late in prehistoric time. It is considered reasonable to suggest that these demographic changes were initiated by a common cause, the desiccation of Lake LeConte being a viable explanation. Research now in progress is directed at testing this hypothesis.

PART II - DATA REPORTS

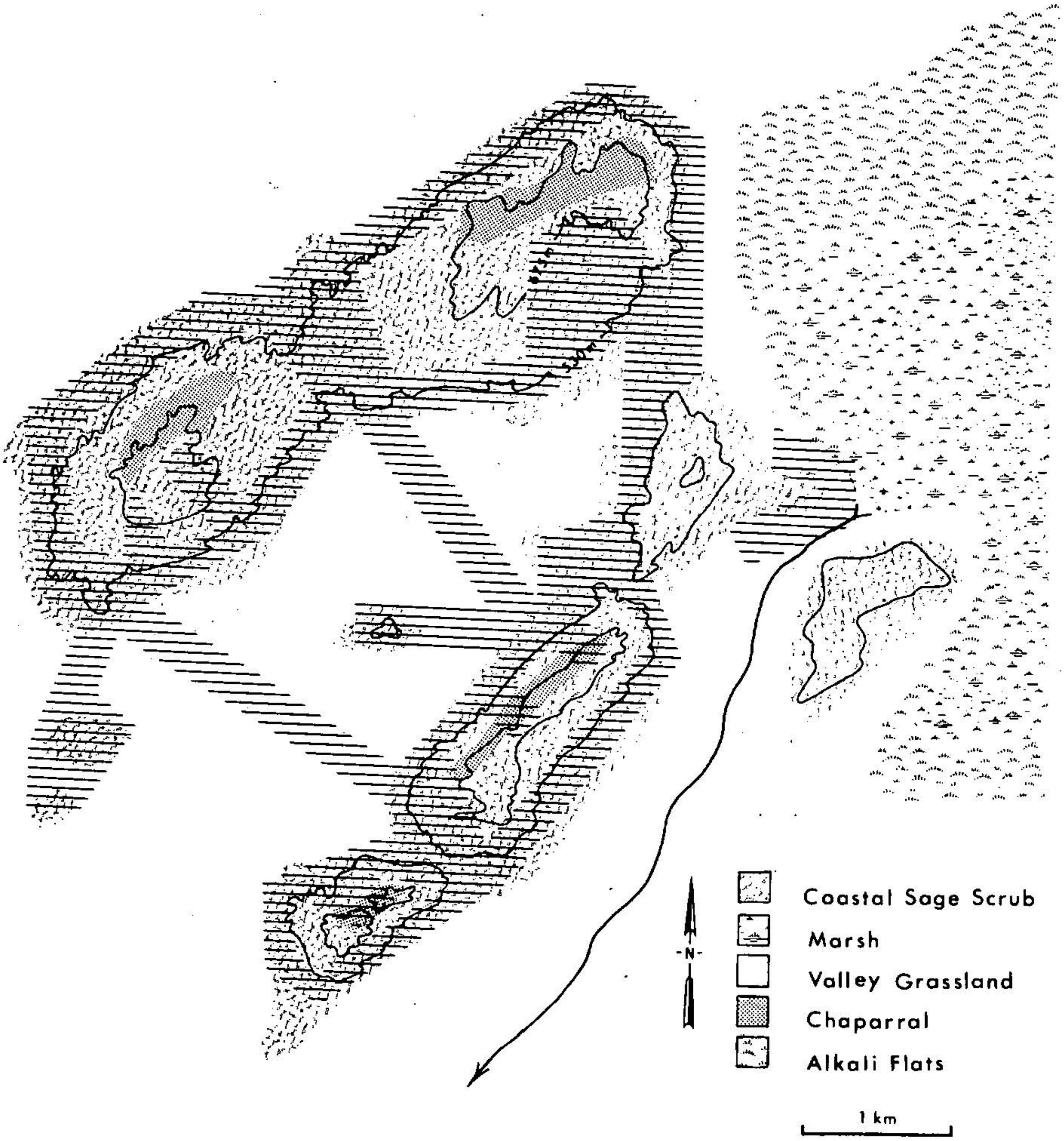


Figure 7. Survey areas. Hachure shows portions of the reservoir area that were subjected to intensive surface survey.

ARCHEOLOGICAL SURVEY AND SITE DISTRIBUTIONS

Terrence Ambrose
Thomas F. King

Although various partial site surveys of the Perris Reservoir locality had been conducted over the years before the beginning of the salvage project, it was necessary to resurvey the area to fill in gaps in previous data, obtain unrecorded information pertinent to current problems, and check the condition of known sites. Since the immediate research purpose of the project was to reconstruct the subsistence and settlement system that operated in the area and identify changes in it through time, it was clearly necessary to seek information on the kinds of sites present and their relationship to features of the natural environment. For purposes of the survey, "archeological site" is defined as any place at which evidence appears of aboriginal or early historic human contact with the environment, including not only middens but also bedrock milling facilities, trails, pictographs, and the like.

Procedure

Aside from a certain amount of overall subjective examination of the region, the first step in the survey was an aerial reconnaissance by light plane to obtain complete aerial color infrared photo coverage. This operation and subsequent botanic transect surveys, both supervised by Jeffrey Thelan of the UCR Geography Department, permitted construction of a detailed map of plant communities (Figure 2). Concurrent with the air survey a systematic archeological reconnaissance was undertaken on the ground.

Examination of extant site survey records indicated that nearly all previously recorded sites in the study area occurred near the base of the hills. The sites were thus located on or near the valley grassland/coastal sage scrub ecotone where springs, bedrock outcrops for milling facilities, and convenient access to two or more biotic communities were afforded. It was decided to sample systematically all biotic and geomorphic zones to determine if extant site location data reflected the actual range of site locations. Toward that end a sampling strategy was worked out whereby portions of all strata would first be sampled. A series of transects crosscutting biotic and geomorphic zones within the boundaries of the Perris Reservoir project was intensively examined by large teams on foot. This survey confirmed the locational implications of extant site data. Accordingly, the basal portions of the Bernasconi and Mt. Russell Hills were intensively surveyed — the interior reservoir sector in connection with the funded salvage program and the exterior sector by the senior author as a student research project. The small rocky outcrops on the floor of the proposed reservoir basin were also surveyed in their entirety. Surveyed portions of the study area are shown in Figure 7.

Site Taxonomy

Sixty-one archeological sites were located in the course of survey in the study area. Locations of all sites in relation to biotic communities are shown in Figure 4. Summary data on all sites are shown in Table 1.

Formal analysis of recorded sites on the basis of surface data only, ignoring biophysical environmental attributes, results in the isolation of two basic site types (Figure 8) plus isolated pictographs or petroglyphs. The first of these special cases is the Moreno Maze (4-Riv-21) (Plate 6), a large red-painted rectangular pictograph on a northeast-facing boulder at the northeast foot of Mt. Russell. The only other clear evidence of aboriginal use of the site (except for an enigmatic rock wall located just to the south) is a shallow bedrock metate located at the foot of the boulder on which the maze is painted.

The second isolated rock art site is the Bernasconi Pass petroglyph (4-Riv-62) (Plate 5). This large combination mortar-petroglyph occupies an isolated boulder in Bernasconi Pass. Actually, it is

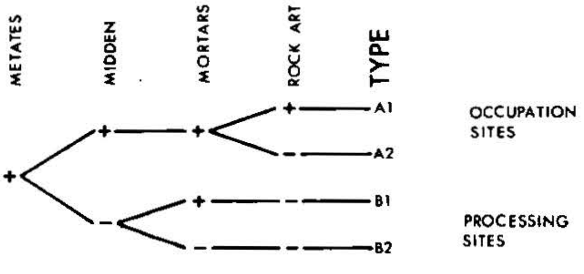


Figure 8. Classification of sites based on surface criteria.

TABLE 1
SITE CHARACTERISTICS OF ALL SITES LOCATED IN SURVEY

Desig. 4-Riv-	Type	Contour elev. (meters)	Water source	Mortars	Metates	Walls	Rock art	Comments
11	?	480	4 springs	39	--	--	--	Destroyed before 1971
12	A1	525	Spring	8	8	--	PI	
21	--	480	--	--	1	+	PI	Moreno Maze
62	--	495	--	--	--	--	PE	Bernasconi Petroglyph
202	A1	504	Spring	14	30	--	PE/PI	
205	A1	500	Spring, wash	3	2	--	--	Destroyed
331	A2?	480	Spring	12	28	+	PE?	
419	A1	504	Spring	12	8	--	PI	
420	A2	480	Spring	1	9	--	--	These three sites form a single cluster
421	A1	492	Spring	5	2	--	PI	
452	A1	492	2 washes	6	16	--	PI	Spring line adjacent
455	B2	492	Wash, spring	--	4	--	--	
463	A2	492	Wash, spring	11	18	+	--	
464	A1	576	Washes, springs	63	78	+	PE/PI	
465	B2?	445	--	--	3	--	--	Scattered debitage
468	B2?	470	??	--	2+?	--	--	Damaged by blasting
480	B2	504	Washes	--	7	--	--	
481	B2	504	--	--	13	--	--	
482	B2	540	Wash	--	Several	--	--	Eroded
483	B2	540	--	--	8	--	--	
484	B2	428	3 washes	--	15	--	--	
485	B2	540	--	--	15	--	--	
486	B2	540	Wash	--	Many	--	--	Eroded
487	--	464	--	--	--	--	--	Isolated mano
488	B2	521	Wash	--	2	--	--	
489	B2	510	Wash	--	4	--	--	
490	B2	474	Spring	--	1	--	--	
492	B2	516	Wash	--	Many	--	--	Eroded
524	B2	524-530	?	--	6	--	--	
525	B1	530	--	1	3	--	--	
526	B2	536	--	--	1	--	--	
527	B2	524-530	--	--	4	--	--	
528	A2	520-530	Spring	11	--	--	PI	
529	A2	530-565	Springs	3	30+	--	--	
530	B2	537	None	--	1	--	--	
531	B2	565	None	--	3	--	--	
532	B1	580	Wash	4	3	--	--	
533	B2	570	Wash	--	2	--	--	Eroded
534	B2	580-590	Wash	--	6	--	--	
535	B2	500	--	--	4	--	--	
536	B2	530	--	--	2	--	--	
537	B2	540	--	--	1	--	--	
538	B2	570	Wash	--	2	--	--	
539	B2	620	--	--	2	--	--	
540	B2	590	Wash	--	3	--	--	
541	B1	610	Wash	1	7	--	--	
542	B2	590	--	--	1	--	--	
543	B2	590	--	--	1	--	--	
602	A1	449	Adjacent marsh	9	7	--	PI	
603	A2	448	Adjacent marsh	5	12	+	--	
604	B2	492	Spring 500 m NE	--	3	--	--	
605	B2	503	Spring 500 m SW	--	2	--	--	
606	B2	515	Spring 500 m SE	--	4	--	--	
607	B2	540	--	--	2	--	--	
608	B2	484	Adjacent seeps	--	3	--	--	
609	B2	485	--	--	5	+	--	
610	B2	485	--	--	11	+	--	
611	B2	557	--	--	2	--	--	
612	B2	528	--	--	2	--	--	
613	B2	528	--	--	3	--	--	
614	B2	515	Spring 600 m W	--	2	--	--	

not entirely certain that the boulder was originally isolated since it has been moved from its original location somewhat higher in the pass. However, no information about the stone's former location or the conditions of its transport has indicated that it was associated with any kind of occupation site. Both these rock art sites are discussed in detail in the paper by Linda Joseph, "Rock Art of the Perris Reservoir," included in this publication.

We can now turn to the basic site types re-

Plate 5. Petroglyph at Site 4-Riv-62 in Bernasconi Pass. Scale has 10 cm increments.

corded by the archeological reconnaissance. Figure 8 diagrams the taxonomy based on surface descriptive variables only. This figure indicates that the archeological sites of Perris Reservoir can be grouped into two gross types on the basis of surface indications alone. One of these types, which we call *occupation sites* because the presence of middens and numerous bedrock mortars appears to suggest long-term or repeated use, may or may not have pictographs and/or petroglyphs, but the sample is too small to allow further breakdown of the taxonomy. The other gross type represents sites that consist only of bedrock grinding surfaces (metates or slicks). Metates, with an occasional mortar but no discernible midden deposit, may be found singly or in considerable numbers at a given site. As a group these sites are designated *processing sites,* and it is probable that the only activity regularly carried out at them was the milling of herb and grass seeds.

As Figure 4 indicates, occupation sites tend to occur at the bases of hills in the mouths of small canyons where spring water is available. Processing sites are found very frequently indeed along the bases of the hills and are most closely associated with the valley grassland and coastal sage scrub zones, where hard seeds requiring milling would have been available. These sites are not necessarily associated with water sources and seem to appear almost anywhere that suitable granitic outcrops occur. Current survey data indicate that processing sites outnumber occupation sites by a ratio of nearly 5 to 1. However, since in our taxonomy even a single bedrock metate slick is termed a processing site, extremely careful scrutiny of all suitable slabs and boulders might double this ratio.

It is suggested that the occupation sites are temporary village or campsites from which occupants ranged within circumscribed catchments to procure foodstuffs. One of the procurement strategies outlined in Part I of this publication involved the gathering and processing of herb and grass seeds. This procurement strategy explains the presence of the processing sites, and the sheer number of these sites tends to demonstrate the importance of this strategy in the range of activities carried out by the prehistoric inhabitants of Perris Reservoir.

Hudson (1971) has proposed a settlement model for the "proto-Gabrielino" area, which presumably includes Perris Reservoir since he uses the Bernasconi site (4-Riv-395) in his analysis. Hudson suggests a semisedentary pattern of settlement essentially compatible with the seasonal round proposed by Bettinger in Part I of this publication and divides "proto-Gabrielino" settlements into "primary subsistence villages" lying in places where "microenvironmental niches . . . occurred in close juxtaposition, and provided a broad base for exploitation throughout most of the seasons," and "secondary subsistence gathering camps" lying in areas of less stable and varied resources and "required [only] to supplement and insure a stable food supply during the period[s] of low or lean supplies."

Assuming the basic validity of Hudson's proposal, it seems most appropriate to us to propose, on the basis of surface evidence, that either (1) some Perris Reservoir occupation sites are primary subsistence villages, and others are secondary subsistence gathering camps; or (2) all Perris Reservoir occupation sites are secondary subsistence gathering camps, some being possibly more frequently used than others and/or used for a more diverse set of activities. In either case, seed grinding stations (processing sites) are not viewed as separate settlements but merely as spatially distinct facilities used by the residents of occupation sites in the course of their seed procurement activities.

ROCK WALLS

Terrence Ambrose
Thomas F. King

Unusual surface features occurring in some numbers at Perris Reservoir are dry-laid walls of unhewn boulders. Among the sites in the reservoir locality where these features occur are Charles Mott (4-Riv-464), Oleander Tank (4-Riv-331), Peppertree (4-Riv-463), and Moreno Maze (4-Riv-21). The wall at Charles Mott forms a rough double semicircle about 4 m in diameter on Locus 5. (See Robarchek, "Charles Mott Site," in this publication.) At Oleander Tank and Peppertree, the walls connect large boulders and tend to circumscribe the midden deposits located in canyon mouths. (See O'Brien, "Oleander Tank site," and Wilke, "Peppertree Site," in this publication.) At the Moreno Maze the wall stretches along the base of Mt. Russell for some 200 m, zig-zagging from boulder to boulder several meters above the base of the slope. One short, isolated rock wall segment is found on top of a large boulder adjacent to a game trail about one-quarter km up the canyon from the Peppertree site.

Attributes common to most of the rock walls observed in the course of surveying the reservoir area are that they tend to link up immovable bedrock outcrops and are themselves composed of local granitic fragments and boulders weighing up to 100 or more kilograms. A considerable amount of labor was thus expended in their construction. Except in one possibly recent construction at the Pictograph site (described by Hammond, this publication; see also Plate 10), the rocks comprising the walls are completely untrimmed.

Over the years several hypotheses have been advanced to explain the presence of stone walls in the general area of the Perris Plain. Each hypothesis will now be examined using tests based on present data derived from field observation and the excavations discussed in later sections of this report.

Walls of Pueblo-like Structures

It has been asserted to the authors that the rock walls of the Perris Plain area are the remnants of walled structures similar to southwestern pueblos (and in some versions, the products of southwestern architects). If this were the case, we would expect that (1) they would at least in most cases form rooms containing midden deposits, artifacts, and ecofacts; and (2) they would at least occasionally occur on more or less flat ground on which their occupants could walk about. Neither expectation is borne out by field observation, and we are forced to reject this hypothesis.

Antelope Traps

It is regarded as possible that the walls were used in antelope drives. Antelope would be driven into a canyon mouth ringed with walls. Unable to escape over the walls and with hunters blocking the mouth of the canyon, the antelope could easily be killed in quantity. This proposition is in accord with some ethnographic observations in the Great Basin, notably those of Steward (1938: 34-35). If this proposition were correct, we would expect that (1) walls would usually be found in the mouths of canyons; and (2) evidence of antelope kills would be found adjacent to the walls. Expectation (1) is supported by the evidence, but expectation (2) is not. Extensive excavations at Peppertree (4-Riv-463) and Oleander Tank (4-Riv-331), both of which lie in the mouths of canyons ringed by walls, have revealed only one identifiable antelope bone. The possibility that another animal could have been trapped between the walls seems relatively remote; deer and mountain sheep cannot be trapped in low-walled enclosures, and it is difficult to imagine the walls being effective for jackrabbit procurement. (Other than antelope, the jackrabbit was the only animal commonly hunted in southern California by means of the communal drive and some form of enclosure.)

Hunting Blinds

As opposed to their use as parts of antelope traps, the idea that the walls were used as hunting blinds suggests that a hunter or a small group of hunters would hide behind them waiting for game, such as deer, to wander within shooting range. If this proposition were correct, we would expect that (1) the walls would occur near game trails and/or water sources, where game would be expected to congregate; and (2) evidence of the procurement of game, such as deer, would be found in