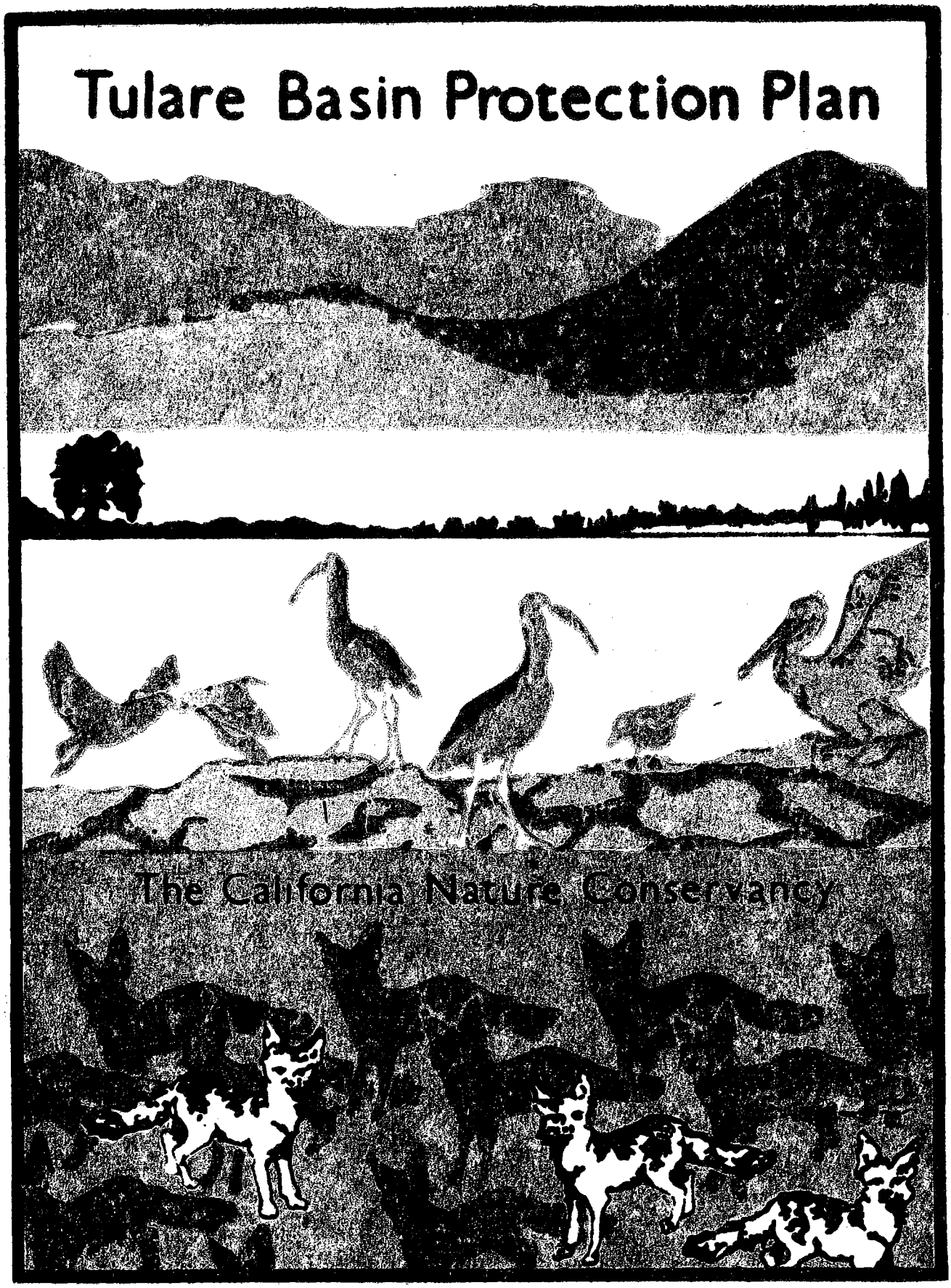
Tulare Basin Protection Plan



The California Nature Conservancy

T U L A R E B A S I N

P R O T E C T I O N P L A N

THE CALIFORNIA NATURE CONSERVANCY

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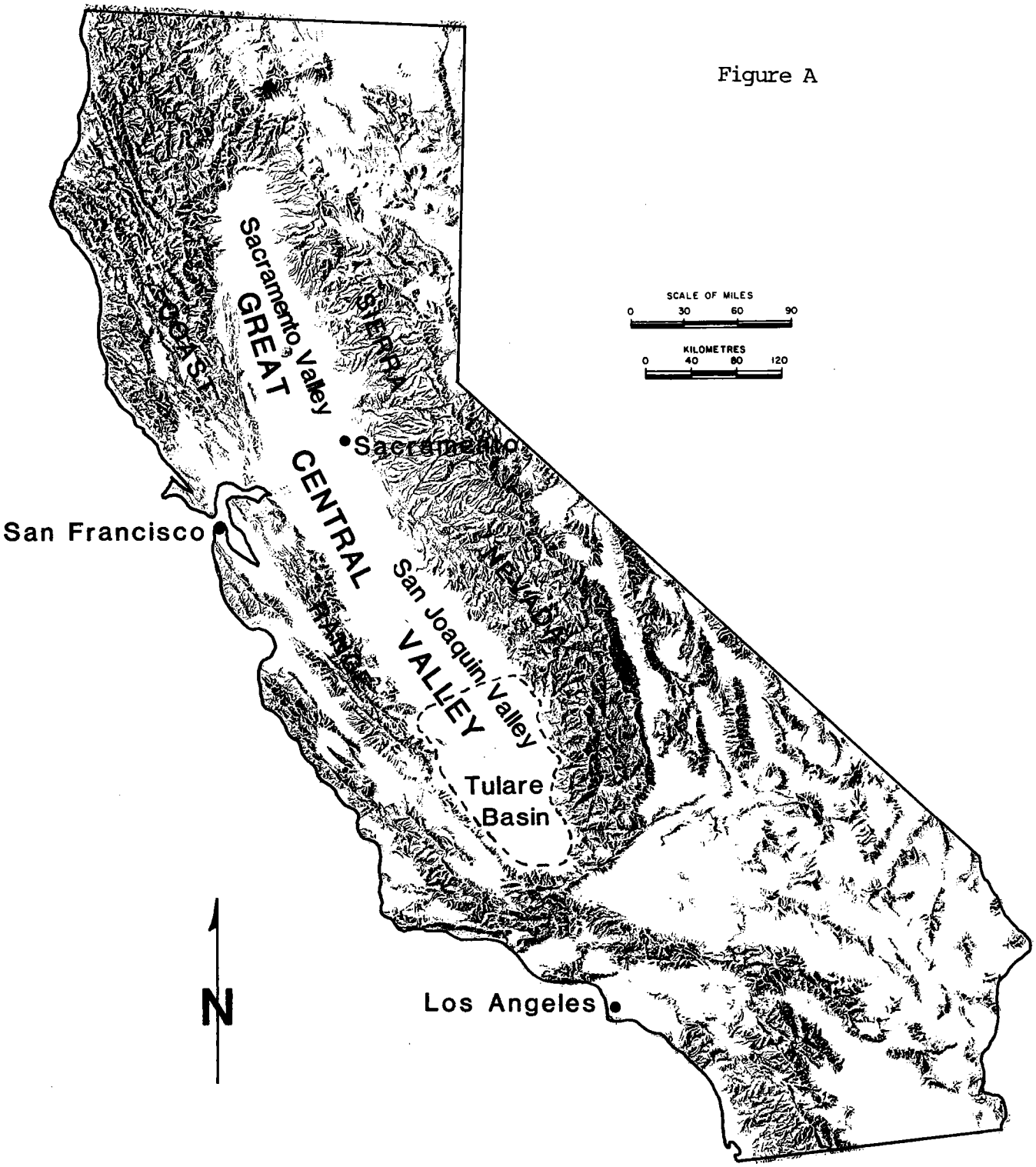
DEFINITIONS	ABBREVIATIONS
Tulare Basin	For the purposes of this study is defined as the area south of the merging alluvial fans from the Kings River (of the Sierra) and Los Gatos Creek (of the Coast Range). The Tulare Basin is bordered on the south by the Tehachapi Mountains, the Sierra on the east and the Coast Range to the west. While waters entering the Tulare Basin drain from substantial elevations in these surrounding mountains, this study focused on lands below 1000 feet elevation. This includes Kings County and portions of Tulare and Kern Counties.
Central Valley	See Great Central Valley
Great Central Valley also Central Valley	The vast contiguous valley in California reaching from near Redding south to the Tehachapis and bordered by the Coast Range to the west and the Sierra to the east.
Sacramento Valley	The northern portion of the Central Valley which is drained by the Sacramento River system.
San Joaquin Valley	The southern portion of the Central Valley from approximately Stockton to the Tehachapis. This includes the Tulare Basin.
CNDDB	California Natural Diversity Data Base
TNC	The Nature Conservancy

DEFINITIONS ABBREVIATIONS

BLM	Bureau of Land Management
BNLL	Blunt-nosed Leopard Lizard
CDFG	California Department of Fish and Game
DWR	Department of Water Resources
EIR	Environmental Impact Report
EO	Element Occurrence
ER	Ecological Reserve
NWR	National Wildlife Refuge
RNA	Research Natural Area
SJKF	San Joaquin Kit Fox
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VOA	Voice of America

Figure A



TOPOGRAPHIC MAP OF CALIFORNIA

INTRODUCTION

The Tulare Basin in the southern end of the San Joaquin Valley is a region which is presently the focus of considerable biological interest. Rapid agricultural and urban development in this area has led to widespread alteration of native lands. With these alterations of native lands has been the concomitant reduction and loss of "natural diversity," i.e., the native animals, plants, birds, and plant communities that comprise the natural environment.

The Tulare Basin Protection Plan has been initiated by The Nature Conservancy to elucidate the problems and opportunities of natural diversity protection. Specifically, the objectives and methods of this study are:

1. To clearly define the former extent of biological diversity in the Tulare Basin.

   Authors' familiarity with the project area coupled with both historical and current mapping of vegetation and review of literature allowed for delineation of former and current extent of natural diversity. (Sections 2 and 3.)

2. To delineate the current preservation activities in the Basin.

   TNC involvement in the Tulare Basin and documentation of preservation activities through other agencies provided the basis for delineation of preservation activities in the Basin. (Brief delineation, Table 4.1; detailed discussion of preservation and management activities, Section 4.2.)

3. To update and expand element abstract and "element"* occurrence information as part of the California Natural Diversity Data Base (CNDDB).

Extensive field verification and land use mapping provided for the update of plant communities and rare plants. ("CNDDB" in Section 4.2.)

4. To recognize element protection opportunities.

Definition of the current extent of natural diversity coupled with evaluation of agencies' and entities' management programs provided the focus for recognizing element protection opportunities. (Section 4.1 identifies element protection opportunities. Section 4.2 highlights problems and opportunities with managing agencies in the Tulare Basin.)

5. To propose element protection measures.

Protection measures are defined here as specific recommendations which the authors of this study singled out from a larger list of protection opportunities. Information and data from the above methods and findings comprising the Tulare Basin Protection Plan coupled with the authors' familiarity with the Tulare Basin provided the basis for the proposed or recommended element protection measures. (Table 5.1 lists the protection measure, managing agency, and respective elements at locations in the Kings, Tulare and Kern Counties. Section 5.2 discusses and defines cooperative management, a recurring protection measure. Section 5.3 provides specific comments and measures for Tulare Basin birds.)

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*An element as defined by CNDDB is a rare, endangered, threatened or otherwise unique plant species, animal species or natural community (including both terrestrial and aquatic communities). A further description of CNNDB is provided in Appendix I.

1. REGIONAL SETTING

In high altitude aerial photographs, the area delineated as California appears as a very mountainous region. From the Oregon-California border in the northwestern coastal mountains to the southeastern arid reaches of the state, there is a nearly continuous rippling of mountains and mountain ranges. These mountains are evidence of the massive pressures and consequent movements through geologic time of the Pacific, or Oceanic, Plate against the Continental Plate of the Earth's crust.

Of discernable exception in California's undulating surface is the Great Central Valley appearing as a linear area between the Coast Range and the Sierra Nevada. It is a valley nearly 400 miles long, roughly half the length of the entire state. At its widest, in the vicinity of Visalia, it is 70 miles across. (See the Topographic Map of California; Figure A.)

In its pristine condition, the Great Valley was a region of bountiful resources. Reaches of the Valley were watered by runoff from surrounding mountains. In these areas, luxuriant hardwood forests, riparian and marsh vegetation flourished. Outside of the influence of these runoff and marsh areas, dryland communities (i.e., grasslands and various types of shrublands) grew along gradients of rainfall, soil texture, and soil alkalinity, to provide a rich mosaic of habitat for a myriad of plants and animals.

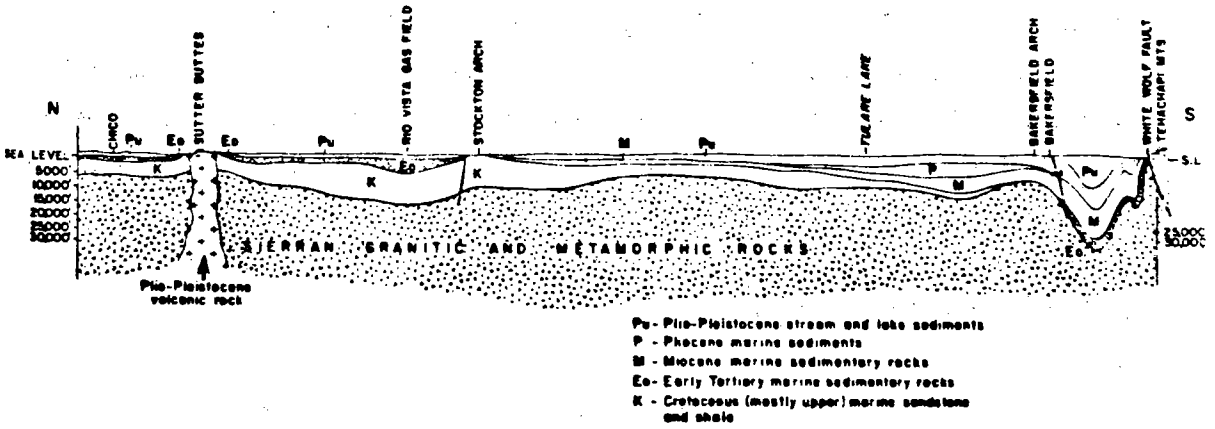
Native Americans, Mexicans and Europeans harvested these productive lands. Today the Great Central Valley hosts approximately 13% of California's 23 million people and has risen to world-wide prominence in agricultural production.

1.1 Geologic History

The geologic history of the Tulare Basin and the surrounding mountains provides a useful foundation of information for the understanding of soils, vegetation, hydrology and other natural processes and features.

The following geologic section delineates major deposition and structural zones for the Great Valley and the Tulare Basin. The associated descriptive timetable outlines additional information concerning important periods and events with particular attention to the southern reaches of the Great Valley.

A geologic section along the length of the Great Valley from north to south



from California's Changing Landscape, 1978

GEOLOGIC TIMETABLE *

Period	Time In Millions of Years Before Present	Major Events/Life Forms	General Composition
**Pu--(late) Pleistocene	1.5 - 3	-extensive subsurface faults & folds develop in the western & central valley as part of Coast Range orogeny. -limited seas primarily remain in the southern central valley; outlets for these seas occur near Santa Barbara & Santa Cruz. -dunes & wind eroded surfaces form significant topographic features. -Sierra Nevada range continues uplift	stream & lake sediments
P-Pliocene	3 - 11	-principal building of Coast & Transverse Ranges -Shallow seas remain in the Tulare Basin & southern San Joaquin -great land mammals; oldest man -Sierra Nevada range continues uplift	marine sediments
M-Miocene	12 - 25	-local movements & uplift in Coast & Transverse Ranges. -shallow seas extend across much of the Coast Range & the Tulare Basin. -first apes	marine sedimentary rocks

* Adapted from California's Changing Landscape, 1978.

** Note that these abbreviations correspond with major deposition and structural zones outlined in the previous geologic section

GEOLOGIC TIMETABLE (CONTINUED)

Period	Time In Millions of Years Before Present	Major Events/Life Forms	General Composition
EO-Eocene	60	-(late Eocene) seas covered the Great Central Valley area south of Stockton -(early Eocene) margins of the valley uplift & seas recede -first placental mammals	marine sedimentary rocks
K-Cretaceous	136	-building of the Sierra Nevada, Klamath, & Peninsular ranges -extinction of dinosaurs	marine sandstone & shale

Geologic Highlights and Summary

The geologic structure of the valley floor is varied sedimentary layers from marine, stream, and lake deposition. These layers of deposition are nearly 15,000 feet thick in the Tulare Basin. Extensive oil and gas resources are associated with these sedimentary layers, particularly from the Pliocene and Cretaceous periods. Where faulting and folding occurs in conjunction with Coast Range orogeny, such as in the Kettleman Hills area, there are substantial reserves of oil and gas. The different sedimentary layers reflect changing sea conditions and rates of deposition as influenced by climatalogical factors and mountain building (uplift) in the Sierra Nevada and Coast Range mountains during the last 200 million years. The seas that did occur in the Central Valley area were generally shallow and broad. These seas remained in the southern San Joaquin-Tulare Basin area to a greater extent than elsewhere in the Central Valley. Dunes and other wind related topographic features developed in association with the changing shorelines of these seas in the expansiveness of the Great Central Valley.

1.2 Hydrology

Climate

The Pacific Ocean is the major source of water that enters California through the atmosphere. The driving force, the sun, provides solar energy for the evaporation of water and movement of water vapors. Thus the Coast Range intercepts water vapor and clouds creating a rainshadow throughout the entire Central Valley.

The Tulare Basin experiences the Mediterranean climate, with cool, moist winters and warm, dry summers. Summer daytime high temperatures frequently exceed 100°F.; freezing temperatures are unusual but can occur at night during the winter months. Based upon rainfall quantities, much of the southern and western portions of the Tulare Basin are considered to be in a desert climate with less than 6 inches of annual rainfall (see Table 1.2). Rainfall occurs during the cool winter months of September through April. A characteristic feature of the winter in the Tulare Basin is the development of dense ground fog ("tule fog") during the nighttime. The tule fogs often persist throughout the daylight hours resulting in consecutive days, sometimes weeks, of overcast, damp, cool weather, without the sun shining to any effect. The tule fog is a result of the regional and local topography of the Tulare Basin which holds the fog once it has developed, unlike areas of identical rainfall, but of a much more open topography; e.g., the western Mojave desert in the vicinity of Lancaster. The tule fog is a major climatic influence upon the species composition of the flora and vegetation of the Tulare Basin.

The following are precipitation and temperature averages for various points in the Tulare Basin.

TABLE 1.2 PRECIPITATION AND TEMPERATURE AVERAGES

	Precipitation[1] 1911 Data	Precipitation[2] 1951-1980	Mean Annual[2] Temperature Normals (°F)
Fresno	9.00	10.52	62.5
Visalia	9.94	9.86	63.1
Portersville	8.43	11.12	63.4
Bakersfield	4.81	5.72	65.6

1 Cone, Irrigation In The San Joaquin Valley, California.
2 National Oceanic and Atmosphere Administration, Monthly Normals of Temperature, Precipitation, and Heating and Cooling Degree Days, 1951-80: California.

This study did not examine what differences exist between weather of the period preceding 1911 and the present data period. One wonders to what extent the former expanse of surface waters of the Central Valley and Tulare Basin influenced weather patterns. Writings from the early period of Whiteman settlement frequently make reference to the tule or ground fogs, particularly in the vicinity of the lakes in the Tulare Basin. Kern, Buena Vista, Goose, and Tulare lakes contained more than 1200 square miles of surface water in the Tulare Basin. An early Tulare Basin account provides this description:

> In winter thick banks of fog rolling inland off the lake was a nightly occurrence. To be lost on the plains after night in the dense fog was no funny thing, as many a sheep herder might vouch for. With no fences and few roads, all foot travelers were careful to come in before nightfall. Summer breezes from off the lake were always cool, but on occasional still days with the always high degree of humidity, it was at times intensely hot.

From "Old-Times Tulare Lake Days" Terra Bella News, May 21, 1937.

Surface Hydrology

As early as 1911, Cone (1911) clearly and definitively described the hydrologic resources of the southern Central Valley. Yet today, due to massive changes in surface flows and ground water abundance, it is difficult to clearly visualize the hydrologic systems that have shaped and continue to dramatically influence the lands of this area. The following excerpt from Katibah (1981) provides a useful introductory description of the San Joaquin and the Tulare hydrologic Basins.

> The San Joaquin Valley is divided into two distinct hydrologic basins; the San Joaquin and the Tulare. The San Joaquin Basin is drained by the San Joaquin River and its tributaries. The Tulare Basin is normally a closed watershed having no perennial outlet.
>
> The Tulare Basin was formed at the south end of the San Joaquin Valley by the merging of the alluvial fans from the Kings River to the east and Los Gatos Creek to the west, Cone (1911). Water originating from the major Tulare Basin rivers, the Kings, Kaweah, Tule, White, and Kern, flowed into this basin and found no normal outlet to the sea. Instead, large inland lakes formed, the Tulare, Buena Vista, Kern, and Goose. These temporary lakes, extremely shallow as they flooded the nearly flat landscape, rose dramatically as the spring run-off, principally from the Sierra Nevada rivers, filled them. As the seasonal lakes filled beyond capacity they flowed into one another. Finally rising above the natural alluvial barriers which divided the Tulare and San Joaquin Basins, sending tremendous quantities of water down the Fresno Slough into the San Joaquin River. Later in the season, after the overland flow of water had ceased, substantial quantities of water were still drained from the Tulare Basin into the San Joaquin River via subsurface flow. This underground accession may have doubled the San Joaquin River's volume, (Irrigation in California, 1873). This undoubtedly helped to maintain the flow of the San Joaquin River, in its southern stretches, through the valley during the long, dry California summer.

Tributary Drainages

The major drainages which are tributary to the Tulare Basin from the Sierra are (from north to south) the Kings, Kaweah, Tule, and Kern for an aggregate drainage area of 5044 square miles. Prior to damming, diversions, and canals, these rivers contributed a mean annual flow of

53,720 cubic ft. second or 3,245,531 acre feet per year, Cone (1911). As a comparison, such a volume of water is roughly equal to the storage capacity of Lake Oroville, the fourth largest man-made reservoir in California, Kahrl (1979). The following summarizes basic hydrologic and management information concerning these four major Sierra watersheds which flow into the Tulare Basin, Department of Water Resources (1982).

Kings River. The Kings River has a drainage area of 3 994 square kilometers (1,542 mi^2) above the Pine Flat Dam. Kings River runoff is regulated by Pine Flat Dam, with a gross storage capacity of 1 234 000 cubic dekametres (1,000,000 acre-feet), and by two Pacific Gas and Electric Company power reservoirs on the North Fork of the Kings River, whose combined gross capacity is 310 000 dam^3 (251,000 acre-feet). Below Pine Flat Dam, estimated flow along the Kings River averages 2 041 400 dam^3 (1,655,000 acre-feet) annually. Water released from Pine Flat Reservoir flows through the natural river channel and its distributaries and is diverted by 22 water agencies in Fresno, Kings, and Tulare Counties.

Kaweah River. The Kaweah River has a drainage area of about 1 350 km^2 (520 mi^2) above Terminus Dam. Kaweah River runoff is regulated by Lake Kaweah, with a gross reservoir capacity of 185 000 dam^3 (150,000 acre-feet). Estimated flow below Terminus Dam averages 586 3000 dam^3 (475,300 acre-feet) annually.

Twenty-nine agencies own and operate the physical works for the diversion and distribution of Kaweah River water.

During periods of far-above-normal runoff, such as 1967 and 1969, some Kaweah River flows reach the Tulare Lake area. In 1980 and 1982, high Kaweah River flows were also diverted through the Friant-Kern Canal for release into the Kern River.

Tule River. The Tule River has a drainage area of about 1 000 km^2 (390 mi^2) above Success Dam. Tule River runoff is regulated by Lake Success, with a gross storage capacity of 105 000 dam^3 (85,000 acre-feet). The estimated flow below Success Dam averages 166 300 dam^3 (134, 800 acre-feet) annually.

Kern River. The Kern River drains 6 200 km^2 (2,400 mi^2) of the southern Sierra Nevada, as measured at First Point near Bakersfield. Kern River flows are regulated by Isabella Dam, whose storage capacity is 680 000 dam^3 (550,000 ac-ft), and estimated annual flows below First Point averaged 822 000 dam^3 (666,000 ac-ft). Isabella Reservoir releases water in the Kern River channel to First Point near Bakersfield, where it is diverted downstream by various water agencies.

Groundwater Resources

As outlined in the geologic section, the structure beneath the surface of the Tulare Basin is composed of sedimentary layers sloping gradually downward from the western edge of the Sierra foothills to a low point near the Basin's west side. From this low point, the layers slope steeply upward into the Coast Range mountains.

The harder, older rocks found in the mountains to the south, east, and west of the Tulare Basin contain little ground water. Additionally, these rocks create an impermeable barrier which bound the water-storing sediments that comprise much of the valley strata. These loose sediments of the valley floor strata where water is naturally stored and recharged by surface flows is referred to as the aquifer.

Prior to modern agriculture, the San Joaquin Valley and the Tulare Basin were endowed with abundant ground water resources. These waters were an important component in the hydrologic cycling of the valley. Through upwelling at artesian springs and lake margins, ground water served as a drought resistant reserve necessary for the sustenance of valley floor habitat and native organisms. Additionally, ground water provided a substantial source of water which augmented lower San Joaquin River flows into the delta, affording benefits to fisheries and estuary life.

As the San Joaquin Valley developed from a semi-arid desert to one of the richest agricultural areas in the world, ground water has been heavily relied upon for irrigation and domestic use.

Large-scale ground water pumping began around 1900 with the advent of the centrifugal pump and began expanding at an even quicker pace in the 1920s, when deep-well turbine pumps came into use. These new pumps, which could lift water from greater depths (powered by abundant, inexpensive electricity), allowed growers to irrigate land not adjacent

to surface water sources and to expand production. Ground water levels began to drop in many parts of the Valley as early as the 1920s, Department of Water Resources (1982).

Authors' Note: The depletion of ground water resources in the Tulare Basin has important implications for both farmers and land managers. As pumping costs for ground water increase, so does the consideration of other management practices which may be more favorable to native species.

1.3 Soils

Of all the natural components and features of the San Joaquin Valley and Tulare Basin, soil resources have undoubtedly received the most attention and study. The reason for this focus is the early recognition of the outstanding agricultural potential of this area.

Initial soil surveys were conducted by the Bureau of Soils in representative sample areas in the San Joaquin Valley and the Tulare Basin between 1901 and 1912. In the Tulare Basin, early survey areas were located near Fresno, Hanford, Porterville, and Bakersfield. Later more extensive soil surveys for the entire Great Central Valley were conducted by the Soil Conservation Service (1938 - 1943).

It is not the intention of this study to outline soils to the level of detail available through their existing soil surveys. Rather, the following will provide a general outline of soil variability as related to major natural processes in the Tulare Basin. Also, soil groupings and soil characteristics will be discussed as part of identification and delineation of the former natural vegetation associations which existed in the Tulare Basin.

GENERAL SOIL GROUPS OF THE TULARE BASIN (See Map 1.3)

Deep alluvial fan and flood plain soils occurring in the intermediate rainfall zone.

Description: This is an important agricultural soils group throughout California. Many of these soils have a calcareous subsoil while some soils are calcareous throughout the profile. Parent material consists of granitic rock alluvium. These soils are primarily of sandy loam soil texture in the Tulare Basin.

Location/Distribution: On the east side of the valley floor from the north end of the Tulare Basin south to the Hanford area. Comparable soils south of Oris point, partially due to reduced rainfall, are included in the desert region soils of the next group.

Alluvial Fan and Flood Plain Soils of the Desert Region

Description: Parent material of these soils is granitic rock and sedimentary rock alluvium. Dominant soil textures are variable from sandy loam to loam. Soils are generally light in color low in organic matter and calcareous.

Location/Distribution: On both the east and west sides of the Tulare Basin between lower seasonally wet and lake areas and the uplands. Sandy, wind modified soils of the intermediate (8 to 13 inches) rainfall zone.

Description: These are light brown, wind modified, sandy soils. Neutral to acid ph. Soils may be deficient in plant nutrients.

Location/Distribution: Limited to isolated areas. Largest examples of this soil group are south and slightly west of Fresno.

Saline and Alkali Soils

Description: Soil characteristics are widely variable with moderate to high contents of soluble salts. Parent material varies from acidic igneous rock alluvium in the Fresno, Pond, Traver and Wankena areas (comprising a dominant loamy soil texture) to a more mixed alluvium near Hacienda.

Location/Distribuition: These soils are widely distributed throughout the lower more central reaches of the Tulare Basin This soils group is found between the imperfectly drained soil group and the alluvial fan and flooded plain soils.

Imperfectly Drained Basin Soils

Description: Parent material is principally mixed alluvium. Clay is the dominant soil texture. These very fine particles settled out of the placid lake waters of the Tulare Basin. Accordingly, this group of soils generally occurs on former lake beds and where seasonal flooding occurs.

Location/Distribution: As associated with lake bottom land, these soils are extensive in the Tulare Basin, stretching in nearly a continuous zone from the former Kern Lake bed to the location where the Fresno Slough would have served as a natural outlet for Tulare Lake. This soils group is approximately 24 miles across at the widest point near Corcoran which correlates with where the Tulare Lake was most extensive.

Terrace Land Having Moderately Dense Subsoils, Usually With Brownish Soils of Neutral Reaction

Description: Parent material consists of fine textured basic igneous rock alluvium. The dominant soil texture is of clay.

Location/Distribution: These soils occupy terrace positions upland of the alluvial fan soils of the "desert" region and the terrace lands having red-iron hardpan soils yet below the shallow foothill soils in the southeastern portion of Tulare Basin.

Terrace Lands Having Red-Iron Hardpan Soils

Description: These soils are characterized by reddish-colored surface soils with dense clay subsoils that rest on a silica-iron cemented hardpan that is generally more than a foot in thickness and is impermeable to roots and water. Locally referred to as "hogwallow land" due to the mounded hummocky microrelief.

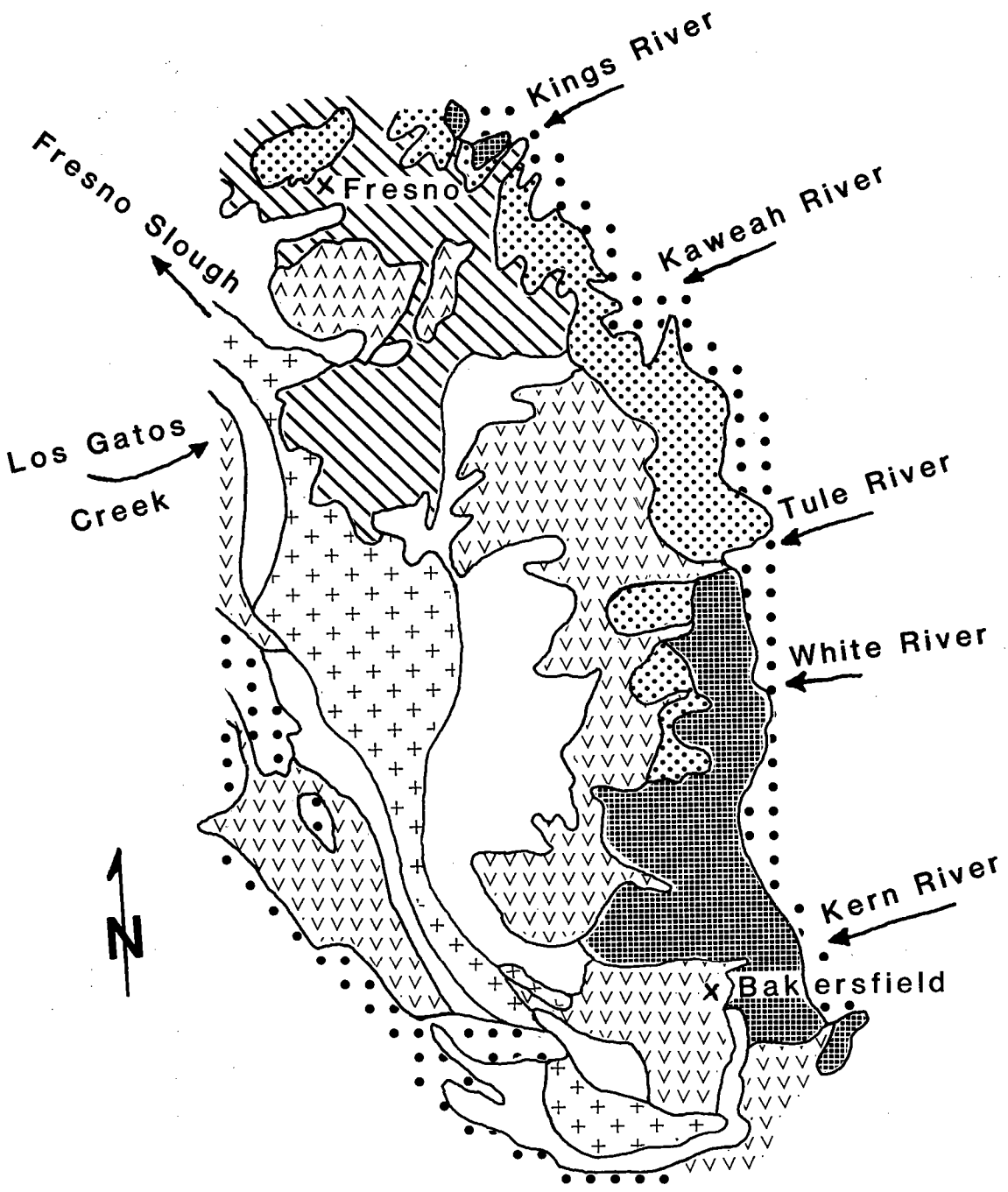
Location/Distribution: A relative narrow band of soil immediately below the upland foothill soils on the east side of the valley extending south slightly into Kern County.

TABLE 1.3 TULARE BASIN SOILS

Soil Groups	Vegetation	Parent Material	Texture	Alkalinity	Other
Imperfectly Drained Basin Soils	Freshwater Marsh; Slough	Lake Bed Deposits	Clay	Low or None	Alkalinity comes with Irrigation
Saline and Alkali Soils	-Iodine Bush Scrub (high alkalinity) -Spiney Saltbush Scrub (low alkalinity) -Alkaline Soil Grasslands (very low alkalinity) -Vernal Pools	Mixed Alluvium	Silt and Clay	High or Low; Variable	Claypan Vernal Pools on Fresno Series
Sandy, Wind Modified Soils of the Intermediate Rainfall Zone	-Sandy Soil Grassland -*A. polycarpa* Shrubland	Windblown Sand and Alluvium	Sandy	None	
Terrace Lands with Red-Iron Hardpan Soils	-Hogwallow-Mima Topography -Vernal Pool Grassland	Ancient Alluvium	Clay	None	Iron-silicate Hardpan
Alluvial Fan and Floodplain Soils of the Desert Region	-Mesquite-Saltbush Scrub -*A. polycarpa* Scrub -Sandy Soil Grassland	Alluvium	Silt-Sandy	None	
Deep Alluvium and Fan Soils in the Intermediate Rainfall Zone	-Valley Oak Woodland	Alluvium	Sandy-Silt	None or Low	
Terrace Land with Moderate Dense Sub-Soil	-Heavy Soil Grassland	Ancient Alluvium	Clay	None	Commanche Point

General Soils and Hydrology Map

MAP 1.3



- Imperfectly Drained Basin Soils
- Saline and Alkali Soils
- Sandy, Wind Modified Soils of the Intermediate Rainfall Zone
- Terrace Lands with Red-Iron Hardpan Soils
- Alluvial Fan and Floodplain Soils of the Desert Region
- Deep Alluvium and Fan Soils in the Intermediate Rainfall Zone
- Terrace Land with Moderate Dense Sub-Soil
- Uplands Outside of the Study Area

1.4 Man and Agriculture in the Tulare Basin

The abundance of food and the temperate climate of the Tulare Basin provided extremely favorable conditions for native Americans. Cone (1912) reports that in 1825, when Jedediah Smith and 40 trappers made the first appearance by White men, no part of the United States was so densely populated with Indians.

The Yokuts, meaning "the people," lived by the thousands along the shores of the Tulare and the other basin lakes. With boats constructed of bundles of the buoyant tules, the Yokuts had convenient access to the extensive waters in the basin and the array of waterfowl, bird eggs, fish, turtles, mussels and other edibles that collecting could furnish. On land there was a comparable bounty. Game was plentiful and there was always ample edible green plants, tubers, and acorns to be foraged in the near vicinity.

Spaniards were the first White men to the Tulare Basin, so naming this vast swampy area "Los Tulares." In the Spanish language, "tule" is a word for the bulrushes that grow in swampy areas. "Tular" is a place where tules grow. The Spaniards may have entered "Valle de los Tulares" as early as 1772, but they did not spend much time in this area. Gradually there was more Spaniard passage through Los Tulares, as potential sites for missions were examined, runaway horses collected, and as wanderers ventured into this mysterious land of lakes, sloughs and tules. With increased intrusions into the Yokuts' region and the accompanying altercations between such vastly different cultures, hostilities developed. In 1824 the Indians were defeated by the Mexicans in a battle beside Buena Vista Lake. The final chapter for the Yokuts came in 1830 when a cholera epidemic nearly eliminated these native people.

In 1849 the Gold Rush profoundly influenced this region of California. Not only was there an onslaught of miners and travelers exploring the foothills and plains for food and gold, but close behind the miners came

the farmers and settlers who would farm the fertile "Tulares." As it was, due to the ideal growing seasons for winter wheat and other grains (rainy season from November to May and favorable harvest conditions from June to October), many people who came west in search of gold instead found their livelihoods, if not their fortunes, in San Joaquin Valley agriculture, Department of Water Resources (1982). Soon, production, which included orchard and vineyard crops, was far ahead of local markets.

Far-sighted businessmen recognized the market potential well outside of California, and in 1863 Governor Leland Stanford advised growers to develop harvesting and packaging techniques that would promote and facilitate exportation of agricultural products. In 1879 the United States' first transcontinental railroad was completed and within 12 years the amount of California vegetables shipped east reached almost 48,000 tons, Department of Water Resources (1982).

Facilitating this almost unprecedented agricultural development were both national and state legislation. To promote the reclamation of the tule marshes and flood plains, the Arkansas Act of 1850 was applied to California. This Act gave the State of California millions of acres of Federally-owned flood plains, providing that the State drain and reclaim these lands, Katibah (1981). In 1868 the Green Act was passed by the California Legislature which allowed that the reclamation and man-made levies required by the Arkansas Act need not be constructed so as to conform with natural drainage systems. These two pieces of legislation, while greatly accelerating agricultural development, also provided for extensive alteration and loss of natural drainage systems and associated riparian forests.

Today, California agriculture has expanded to include commercial production of over two hundred commodities. Three San Joaquin Valley, Tulare Basin, counties -- Fresno, Kern, and Tulare -- are ranked among the nation's top four counties in terms of agricultural revenue.

Additionally, this region has developed a large national and international export market in cotton, citrus, and produce.

Figure 1.4a illustrates the growth of irrigated agriculture in the San Joaquin Valley (including the Tulare Basin) since the late 1950's. Visible in this graph are the significant increases in agricultural acreage which followed the delivery of water from the Central Valley Project (1944) and the State Water Projects (1968). More complex graphs in The Hydrologic-Economic Model of the San Joaquin Valley, (1982), highlight how ground water overdraft, presently a growing concern for all agencies in the San Joaquin Valley region, has dramatically increased despite imported Delta water. The imported Delta water, rather than displacing ground water usage on existing developed farmland, instead is used to bring new land under irrigation as more imported water becomes available.

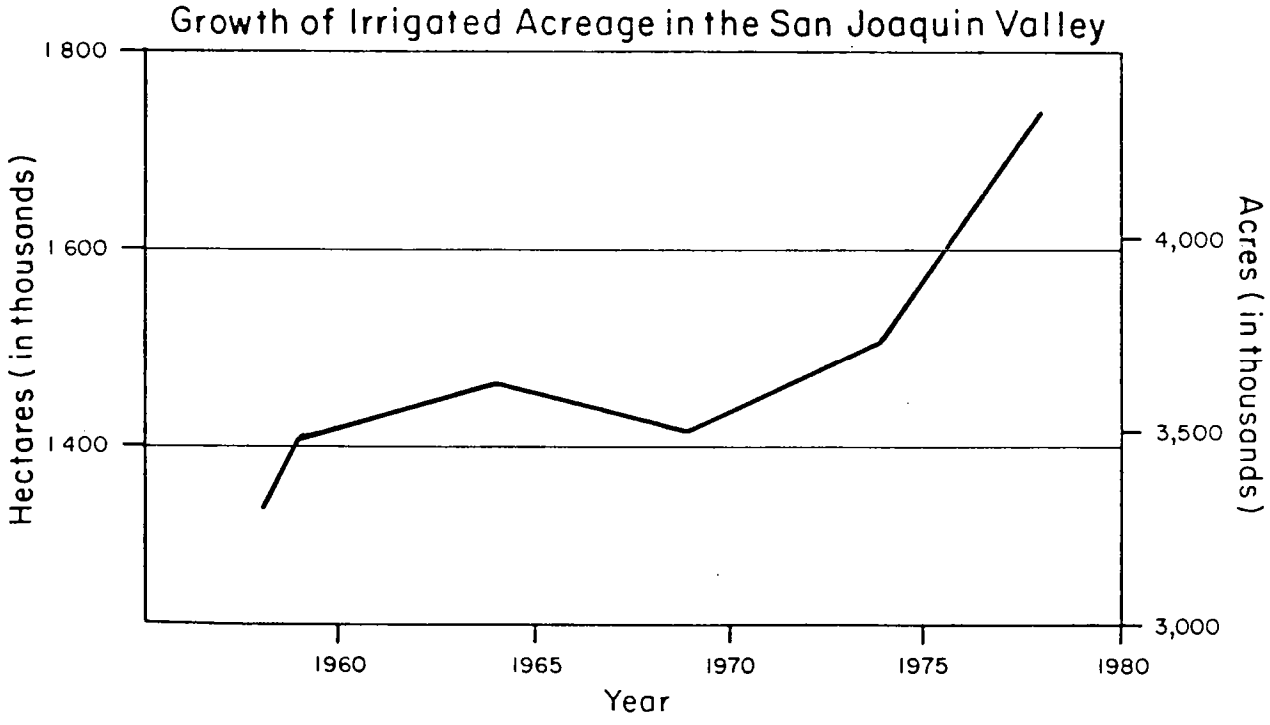


Figure 1.4a from

The Hydrologic-Economic Model of the San Joaquin Valley, 1982

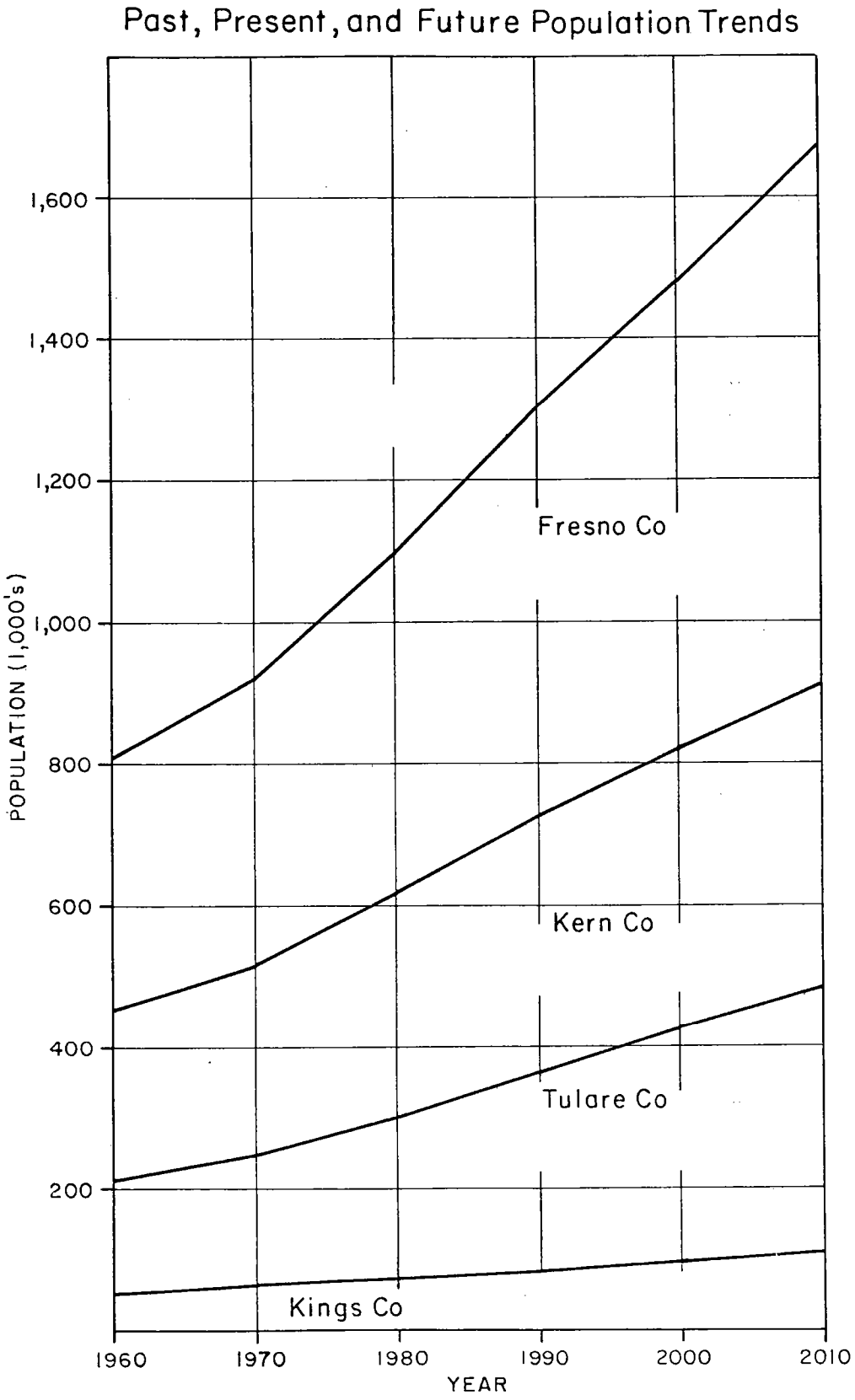


Figure 1.4b from

The Hydrologic-Economic Model of the San Joaquin Valley, 1982

2. FORMER EXTENT OF NATURAL DIVERSITY

2.1 Methodology

The following information sources coupled with extensive field reconnaissance over the course of many years (particularly by J. Zaninovich and F. T. Griggs) made completion of this section possible.

1. Early mapping project (pre-1915) for delineation of former lakes, marshland areas and other habitat indicators. See especially William H. Hall, 1887, "Topographical and Irrigation Map of the Great Central Valley."

2. Early soil surveys. See Holmes, Bureau of Soils, Soil Surveys of Porterville, Fresno, Hanford and Bakersfield areas (separate publications) 1901-1912.

3. Pioneer and early descriptions of the landscapes, native flora, and wildlife.

4. The California Natural Diversity Data Base (CNDDB)* provided computer printouts of all recorded element occurrences in the Tulare Basin. Element occurrences were organized in the following format:

   - Quad Occurrence List (all element occurrences sorted by topographic quadrangle code).

   - Report 2 for all element occurrences (sorted by element name).

     Note: Report 2 provides extensive information including date of collection or observation, directions to site, additional comments and description of the element or occurrence site, ownership/management.

---

*See Appendix I for a description of CNDDB.

2.2 Vegetation

Kuchler (1977) and Twisselman (1967) have prepared discussions of former vegetation relevant to all or portions of the Tulare Basin. However, as will be outlined in these sections, the diversity of natural vegetation and the complex interactions of environmental factors to produce it, has not yet been completely described.

Perhaps dominant among factors inhibiting vegetation analysis of the southern Central Valley has been the very early and rapid rate of transformation of valley lands to agricultural production. Also, the apparent visual uniformity of these vast valley lands when viewed at a distance may have promoted early conclusions of uniformity in vegetation. As suggested in the geologic, hydrologic and soil sections of this document, the Tulare Basin is characterized by gradual transitions through a number of subtle environmental gradients. Accordingly, a number of distinct plant associations, developed through the varied combination and interplay of these environmental factors, are recognizable.

Early Descriptions of the Former Vegetation

The following provides a useful general description of the Great Central Valley.

> As a general proposition, the whole valley may be considered as formed of four plains, two north of the mouth of the Sacramento River and two south of it. The two northern plains slope toward each other along the line of the Sacramento River, and at the same time slope toward the south. The two southern plains slope toward each other along the line of the lakes and San Joaquin River, and at the same time toward the northward.
>
> So flat and level do these plains appear that the eye is constantly deceived by them and the judgment undetermined which way they slope until instrumental means are applied.
>
> South of the mouth of the Sacramento River, the valley gradually increases in width to the vicinity of the Kaweah River, where it reaches a breadth of seventy miles.

> Through the middle or rather west of the middle line of the valley runs the San Joaquin River and the connecting line of sloughs and lakes from the southern extremity of the valley.
>
> As on the Sacramento River, the banks of the San Joaquin River are higher than the land two or three miles on either side, but in a much less marked degree than in the former case; and the same general feature holds good for all the streams.
>
> On the western side the flanks of the mountains are narrow and treeless, and the rainfall upon them probably not over one-third or one-fourth that of the eastern side; consequently the streams are all very short, the courses small, and in summer the beds dry at the base of the foothills, while the plains are treeless, except a narrow fringe along the banks of the streams.

Report of the Board of Commissioners on The Irrigation of the San Joaquin, Tulare, and Sacramento Valleys of the State of California, Government Printing Office, 1874, P.20-21.

While such general descriptions facilitate visualization of the overall landscape, specific and detailed descriptions of individual vegetation types are much more difficult to locate in early literature.

> Prior to the settlement and irrigation of this area the floor of the valley was entirely treeless. In the slightly more moist soils of the foothills there were extensive growths of oak, while at higher elevations were pine and similar trees. Along the rivers in the well-watered bottoms sycamore, cottonwood, willow, and oak thrived, and, with the accompanying underbrush and vines, the growth was often so thick as to form dense jungles. The Kings River Delta country, a portion of which is included within the southern part of the survey, is well watered, and here there was a heavy growth of trees almost dense enough to form true forest. Cottonwood, sycamore, and willow grew close to the streamways, while the intervening lands carried groves of gigantic oaks and a carpet of waving grasses. The combination of feed, shade, and water made this an ideal stock country, and for many years it was devoted entirely to grazing.

Bureau of Soils, Soil Survey, Fresno Area, 1912, P.8.

Soil surveys from the Hanford area gave a slightly more detailed description of sloughs in the Kings River Delta at the north shore of Tulare Lake and associated vegetation.

> [W]here the bluffs give way entirely, and the river enters upon the valley plain, dividing into a number of meandering streams . . . is [w]here the Kings River Delta begins. From this point the main channel finds its way as a broad, shallow stream, frequently obstructed by sand bars, to the valley trough, a distance of about 30 miles. The banks of the river are low, ill defined, and wooded with a heavy growth of valley oak, with some cottonwood, willow, and sycamore. After reaching the valley trough it turns aside and flows in a southerly direction into the Tulare Lake Basin. South of the main channel the country is cut by numerous sloughs, the remnants of abandoned river channels, extending in a southwesterly direction toward the Lake. Some are continuous for many miles; others make their appearance as disconnected sinks only. They contain considerable seepage water in the wet season, and are usually bordered by willows and frequently by a vigorous growth of tule. The name applied to the region is the Mussel Slough Country.

Bureau of Soils, Soil Survey, Hanford Area, 1901, P.452.

A similar soil survey for the Kern River area during the same period provides an interesting comparison for physical similarities and contrasts in vegetation between delta lands of the north end (Kings River) and south end (Kern River) of the Tulare Basin.

> [The Kern River] then takes a westerly course between the gravelly bluffs to the mesa lands to a point near Bakersfield. Here the stream becomes wider and more shallow and threads its way through the delta lands to the lake basins lying to the southwest. Owing to the occurrence of warm rains and melting snows in the mountains, the stream is subject to sudden and violent floods during the spring and early summer. At such times the debris-carrying power of the river is greatly augmented. This has led to the obliteration of old channels and the formation of new, and left may sloughs, streaks, ridges, and spits of sandy land.

> The delta land known locally as Kern Island extends, with a generally smooth, even surface and uniform slope - 6 to 7 feet to the mile - southward and westward to the valley trough marked by Kern and Buena Vista lakes and the swamp lands connecting them with Tulare Lake to the north.
>
> A considerable growth of cottonwood, willow, and sycamore frequently covers the lands bordering stream channels. Upon the soils to the north and east of the delta trees and shrubs are wanting, except for an occasional growth of saltbush and other characteristic bushes usually found on desert or alkali lands. A dense growth of a low-growing form of the prickly pear cactus covers the loose sands along the southeastern margin of the area, while grasses, including salt grass, foxtail, and erodium, cover considerable areas of the valley plains and delta lands utilized for grazing purposes.

Bureau of Soils, Soil Survey, Bakersfield Area, 1904.

Where soils showed little promise for later cultivation, discussion of native vegetation has been consistently vague.

> During the progress of the survey a careful examination was made of each soil type to determine the quantity of alkali present. With two exceptions, the soils are comparatively free from injurious salts, and no anxiety need be felt upon this score. In the Lewis clay loam northwest of Lindsay there is an average of from 0.40 to 0.60 per cent of alkali in the first 6 feet, and 4 miles west of Porterville there is another small strip of land which contains about the same quantity. Both of these areas are small and unimportant, and are covered by the characteristic alkali vegetation, such as salt grass, ink weed, and greasewood. Over the rest of the area, wherever small accumulations of alkali occur, the salts are practically all concentrated within the surface 2 or 3 inches of the soil.

Bureau of Soils, Soil Survey, Porterville Area, 1908, P.20.

> Where the surface accumulation of salts is unusually high the surface of the soil may be entirely bare of vegetation or support but a scanty growth of the alkali grasses. In uncultivated soils the vegetation is commonly salt grass or Bermuda grass, and alkali weeds, which are associated with large quantities of alkali are often present.

Bureau of Soils, Soil Survey, Fresno Area, 1912, P.68.

Willows and other freshwater marsh vegetation created dense thickets as described in this account from the "Terra Bella News," May 21, 1937:

> In our earliest recollections, the water of the lake stood at not far from the now Kings County line. An interesting fact is also that for miles above that yet the ground was covered thick with mussel shells, and wire grass, a sort of swamp grass, grew everywhere. So we presume the lake to have been much larger at some earlier time. A dense growth of tall trees always fringed the lake and was in places a half mile or more in width. A person venturing too far into these thickets of tules had to be a good navigator to find his way out. Hunters cut lands through to open water to their duck blinds and boats. The shore line shifted and changed continually according to weather and season. A strong wind would bring the water out surprisingly long ways. Sometimes the tules were in water a foot or so deep and at other times were high and dry. In the fall of the year occasionally fires swept through the dry tules and the burning of a few thousand acres on a dark night was a sight to behold.

TABLE 2.2 SAN JOAQUIN SYNONYMS

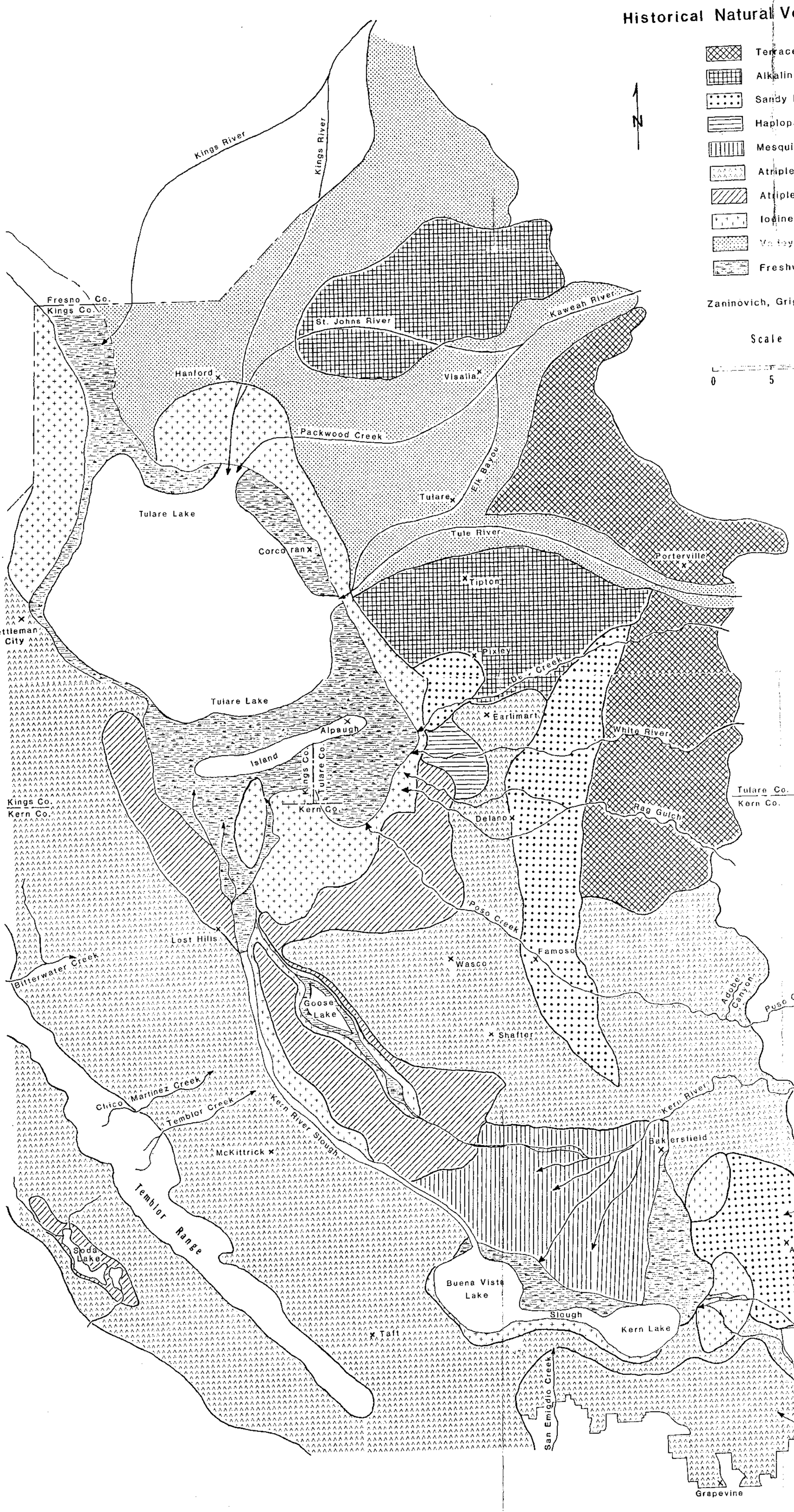
For Names of Vegetation Types

FRESHWATER MARSH	= Tule Marsh = Slough Country
	SHRUBLANDS
IODINEBUSH SHRUBLAND	= Allenrolfea scrub
ATRIPLEX SPINIFERA SHRUBLAND	= Lowland Valley Saltbush scrub, in part = Spiny Saltbush Scrub
ATRIPLEX POLYCARPA SHRUBLAND	= Allscale Shrubland
Valley Floor Allscale Shrubland	= Lowland Valley Saltbush Scrub, in part
West Valley Inner Coast Range Allscale Shrubland	= Upland Valley Saltbush Scrub, in part
Sierra Nevada Tehachapi Foothill Allscale Shrubland	= Upland Valley Saltbush Scrub, in part
PROSOPIS-ATRIPLEX SHRUBLAND	= Valley Mesquite Scrub = Mesquite-Saltbush scrub
	GRASSLANDS
SANDY LOAM GRASSLAND	= Light Soil Flower Field
ALKALINE SOIL GRASSLAND	= Alkali Bunchgrass Prairie = Heavy Clay Soil Grassland
TERRACE GRASSLAND	= Red Clay Terrace Soils
	VERNAL POOLS
NORTHERN CLAYPAN VERNAL POOLS	= Found in Alkaline Soil Grassland
NORTHERN HARDPAN VERNAL POOLS	= Found in Terrace Grassland

HISTORICAL NATIVE VEGETATION MAP

MAP 2.1

Historical Natural Vegetation of Tulare Basin



HISTORICAL NATIVE VEGETATION MAP DESCRIPTION

1. FRESHWATER (TULE) MARSH

   a. Occurrence - Around the margins of lakes and along slough courses, sometimes extending as a band several miles from the shoreline, as at the south shore of Tulare Lake.

   b. Vegetation - Dense thickets of tules, with open water at the mouths of rivers and streams.

   c. Common species - Scirpus acutus, Typha spp., Juncus balticus.

2. IODINE BUSH SHRUBLAND

   a. Occurrence - Along the borders of the lake and in the overflow lands (sinks) of the major streams (e.g., Tejon sink southeast of Bakersfield). In wet years standing water may persist around the plants until mid-summer. Alkalinity of the soil is high, usually with sub-surface moisture. This is the first dryland association encountered upslope from the freshwater marsh. Best developed where there is a low slope away from a lake, as at the south end of Tulare Lake (present day Kern NWR).

   b. Vegetation - An open shrubland with alkali playas (or balds) common.

   c. Common species - Allenrolfea occidentalis, Suaeda fruticosa, Frankenia grandifolia, Distichilis spicata, Haplopappus acradenius ssp. bracteosus, Wislizenia californica, Lasthenia chrysantha, Puccinellia simplex.

3. ATRIPLEX SPINIFERA SHRUBLAND (in part, Lowland Valley Saltbush Scrub).

   a. Occurrence - On semi-alkaline soils (lower alkalinity than Iodine Bush Scrub) with a slightly coarser texture than Iodine Bush Scrub; upslope of the overflow lands. This association occasionally is found interdigitated with the Iodine Bush Scrub (e.g., northwest of Delano) where fingers of silty soil have been pushed into the Iodine Bush Scrub by past flooding of streams. This association supports some of the richest plant and animal communities in the Tulare Basin because of this heterogeneity of soils.

   b. Vegetation - Open shrubland with numerous large playas.

   c. Common species - Atriplex spinifera, Atriplex phyllostegia, Haplopappus acradenius ssp. bracteosus, Delphinium recurvatum, Hemizonia pungens.

4. ATRIPLEX POLYCARPA SHRUBLAND (is composed of three geographical variants).

   4.1 Valley Floor Allscale Scrub (Lowland Valley Saltbush Scrub, in part).

      a. Occurrence - On non-alkaline, sandy soils which are on the floor of the valley.

      b. Vegetation - Open shrubland with a dense herbaceous layer of annuals in favorable rainfall years.

      c. Common species - Atriplex polycarpa, Lasthenia crysostoma, Gilia tricolor, Platystemon californicus, Haplopappus acradenius ssp. bracteosus.

4.2 West Valley Inner Coast Ranges Allscale Scrub (Upland Valley Saltbush Scrub, in part).

a. Occurrence - From near Pacheco Pass (Merced County) on the north to about 10 miles east of Maricopa (Kern County), lower elevations (less than 2000 feet) of inner south Coast Range mountains bordering on the San Joaquin Valley and on the alluvial fans extending east into the valley. This association abruptly stops as soil becomes alkaline.

b. Vegetation - Open shrubland on sloping hillsides or alluvial fans.

c. Common species - Atriplex polycarpa, Haplopappus acradenius bracteosus, Gutierrezia bracteata, Astragalus lentiginosus var. nigricalycis, Astragalus oxyphysus, Isomeris arborea var. globosa, Ephedra california, Delphinium gypsophilum.

4.3 Sierra-Tehachapi Foothill Allscale Scrub (Upland Valley Saltbush Scrub, in part).

a. Occurrence - From 10 miles west of Grapevine eastward and northward to a point south of Porterville (Tulare County). Typically on well-drained foothill slopes.

b. Vegetation - Open shrubland, interspersed with extensive areas of grassland.

c. Common species - Atriplex polycarpa, Opuntia treleasii, Isomeris arborea var. globosa, Encelia virginensis var. actone, Stephanomeria pauciflora, Stephanomeria virgata, Haplopappus acradenius ssp. bracteosus.

5. PROSOPIS-ATRIPLEX SHRUBLAND

a. Occurrence - On the broad delta of the Kern River, west and southwest of Bakersfield to Buena Vista Lake. Soils are sandy to sandy-loam. This association occurs above the floodplain of the Kern River, but because of adjacent water courses, moisture is sufficiently deep that Atriplex can grow without competition from riparian plant species. This vegetation type provides habitat for a very rich and complex biological and wildlife component.

b. Vegetation - Open savannah with numerous sloughs and stream courses cutting through it.

c. Common species - Prosopis juliflora Torreyana, Atriplex polycarpa, Haplopappus acradenius bracteosus, Eremalche parryi, Astragalus hornii, Eschscholzia californica, Nemophila menziesii, Lasthenia chrysostoma, Atriplex lentiformis.

6. SANDY LOAM GRASSLAND

a. Occurrence - On fairly level alluvial deposits from the Sierra Nevada and the Tehachapi Mountains.

b. Vegetation - An open grassland, dominated by annuals.

c. Common species - Haplopappus acradenius ssp. bracteosus, Lomatium utriculatum, Brodiaea pulchella, Eschscholzia californica, Platystemon californicus, Collinsia bartsiaefolia, Orthocarpus purpurascens, Nemophila menziesii.

7. TERRACE GRASSLAND WITH VERNAL POOLS

a. Occurrence - These are the oldest soils on the basin, and are found at the base of the Sierra Nevada. The red color derives from the millenia of weathering, which has leached away many of the minerals leaving the iron minerals behind.

b. Vegetation - Open grassland. In the Porterville-Exeter area, level terrain has resulted in the formation of hog-wallow topography and vernal pools.

c. Common species - Lomatium utriculatum, Brodiea pulchella, Eschscholzia californica, Eschscholzia lobbii, Calochortus luteus, Dodecatheon clevelandii patulum, Holocarpha virgata. In vernal pools: Lasthenia fremontii, Downingia bella, Eryngium vaseyi, Mimulus tricolor.

8. ALKALINE GRASSLAND WITH VERNAL POOLS

a. Occurrence - On the flat plains between the Tule River on the north and Deer Creek on the south; and between the Kings River on the north and the Kaweah River on the south. Soils have a calcareous hardpan thus vernal pools are common.

b. Vegetation - Grassland with vernal pools.

c. Common species - Sporobolus airoides, Haplopappus acradenius bracteosus, Brodiaea pulcella, Delphinium recurvatum, Lasthenia chrysostoma, Gilia tricolor, Hemizonia pungens, Lepidium dictyotum, Lepidium nitidens.

9. VALLEY OAK WOODLAND (Including Bottomland Valley Oak Forest).

a. Occurrence - On the broad floodplain (delta) of the Kaweah River and along the Tule River, and on the floodplain of the Kings River.

b. Vegetation - Closed canopy forest to open savannah.

c. Common species - Quercus lobata, Platanus racemosa, Salix gooddingii, Salix laevigata, Fraxinus latifolia, Vitis californicus, Rubus ursinus, Populus fremontii, Cephalanthus occidentalis, Elymus triticoides.

10. HAPLOPAPPUS SHRUBLAND

a. Occurrence - Limited to about ten square miles northwest of Delano.

b. Vegetation - An open shrubland. The topography and soils are unique in the Tulare Basin. East-west trending hillocks one meter high with low areas of shallow or deep soils, semi-alkaline to silty loam non-alkaline, many alkali playas and other barren areas; in some areas the dominant cover is composed of lichens.

c. Common species - Haplopappus acradenius bracteosus, Sporobolus airoides, Lasthenia chrysantha, Hemizonia pungens, Lepidium dictyotum.

11. INTERMITTENT STREAM CHANNELS

a. Occurrence - Deer Creek, White River, Poso Creek, Caliente Creek, and Tejon Creek are the major ones. These are not dammed, the bed being sandy and flat. Only during high rainfall years does water reach the valley floor; most years they are dry a few miles away from the mountains.

b. Vegetation - Scattered shrubs and herbs with occasional trees, but rarely forming a true woodland or forest.

c. Common species - Lepidospartum squamatum, Stephanomeria virgata, Atriplex lentiformis, Salix gooddingii.

12. RIPARIAN WOODLANDS

a. Occurrence - Along the larger rivers: Kern, Tule, Kaweah, Kings.

b. Vegetation - Usually an open woodland with densely forested groves common. This is typically a narrow corridor along the water courses, not as extensive as along the rivers of the Sacramento Valley due to narrower natural levees along the Tulare Basin rivers. Also, thickets of willows were frequent around the high water levels of the lakes.

c. Common species - Along the Kings, Kaweah, and Tule Rivers: Quercus lobata, Salix gooddingii, S. lasiolepis, S. lasiandra, Platanus racemosus, Populus fremontii, Fraxinus latifolia, Vitis californicus. Along the Kern River west of Bakersfield Populus fremontii, Salix spp., and Cepalanthus occidentalis dominate and the oaks and sycamores and grapes are restricted to the Sierra foothills and not found on the basin floor.

13. ALKALINE SPRINGS, SEEPS, MEADOWS

a. Occurrence - At the toe of the alluvial fans from the Sierra Nevada and Tehachapi Mountains; caused by ground water in the alluvial fan moving horizontally along the interface with the underlaying clay materials. Historically at Earlimart, Delano and Greenfield. Due to generally lowered ground water levels, this phenomenon is extinct today except at Gator Pond, Goose Lake and Kaweah Oaks.

b. Vegetation - Trees, shrubs and tules near any open water, otherwise a nearly continuous cover of low halophytes.

c. Common species - Scirpus sp., Typha sp., Salix goodingii, Populus fremontii, at the open water; Juncus balticus, Distchlis spicata, Salicornia subterminalis, Suaeda fruticosa, Atriplex lentiformis, Anemopsis californicus, Spergularia macrotheca, var. leucantha, Cordylanthus mollis var. hispidus, Atriplex tularensis in the moist soil zone surrounding the spring.

2.3 Wildlife

The Tulare Basin and the San Joaquin Valley contained seasonal and year-round habitat for a remarkable diversity and abundance of wildlife. The following passages give glimpses of the former magnificence of the Tulare Basin wildlife. For specific species listings and current status see Section 3, The Current Extent of Natural Diversity.

> Every beast and bird of the chase and hunt is to be found in abundance on the Tulares. Horses, cattle, elk, antelope, black tail and red deer, grizzly and brown bear, black and grey wolves, coyotes, ocelots, California lions, wildcats, beaver, otter, mink, weasels, ferrets, hare, rabbit, grey and red foxes, grey and ground squirrels, kangaroo rats, badgers, skunks, muskrats, hedgehogs, and many species of small animals not here mentioned; swan, geese, brant, and over twenty different descriptions of ducks also cover the plains and waters in countless myriads from the first of October until the first of April, besides millions of sandhill crane, plover, snipe, and quail. The rivers are filled with fish of the largest and most delicious varieties, and the sportsman and epicurean can find on the Tulares everything their hearts can desire, Carson (1852).

> Tulare Lake terrapin soups and stews were commonly on the bill of fare of hotels throughout the Pacific Coast. They were taken on Tulare Lake in unbelievable numbers. This industry led to the naming of Terrapin Bay where these reptiles are said to once have been more plentiful than at any other place on Tulare Lake. Terrapin Bay was situated just south of Gordon Point, about 6 miles south of the site of present Kettleman City. Terrapin were so thick that they were taken with seine. Pioneers have stated that they could be seen on the banks of Tulare Lake and on drift logs so thick that the ground was completely covered. When disturbed they popped into the water in a solid mass making a roar like the surf on a beach.

> Tulare Lake trout reached 30 pounds in weight, a size few people will believe. Fred Wells, Porterville pioneer, attests some of them were more than 4 1/2 feet long. As late as the present century these trout ran back up streams such as the Tule River and could be scooped out with pitch forks in quantity, Latta (1937).

Tule elk once numbered about 500,000 in the Valley, McCullogh (1966). Newberry (1957) stated that the herds of grazing animals in the Central Valley rivaled those of the bison of the great plains or the antelope of

South America . . . Fremont (1856) reported multitudinous herds of elk by the Tulare River, and there are numerous accounts of abundant elk in the Tulare Lake area. Similarly elk were abundant about Buena Vista Lake near the southern end of the San Joaquin Valley.

Some of the San Joaquin herds were very large. Audubon (1906) reported a herd of about 1000 head, and Bryant (1848) estimates some herds at 2000 animals.

The thunder of wings from millions of geese and other waterfowl with the distant throaty calls from wading birds such as the curlew and the evening squawk of the black-crowned night heron must have been a stunning, ever changing presence in the Tulare Basin. In fact, California originally contained five million acres of wetlands -- including about four million acres in the Central Valley. Tulare Lake, Buena Vista Lake, and Kern Lake, together with the surrounding overflow marshes, provided the largest single block of wetland habitat in California, USFWS (1978).

The impressiveness of these water bodies cannot be grasped by merely reflecting on their sheer immensity. During wet periods, these lakes comprised roughly 19% of the valley floor in the Tulare Basin Yet equally striking is consideration of the more than 2100 miles of shoreline edged for many hundreds of yards with tules, swamp thistle, cattails, and the accompanying cacophony of trills, warbles, and hoots from the assemblage of marsh wrens, blackbirds, herons, and coots.

> Sandhill Cranes and other water fowl are to be seen in large bodies over the plains between the railroad and the Lake. Many acres sometimes are to be seen feeding and sporting in the grass, The Weekly Delta (1873).

3. CURRENT EXTENT OF NATURAL DIVERSITY

3.1 Methodology

The following information sources and approaches were utilized in the determination of the current extent of natural diversity.

1. Department of Water Resources (DWR) Land Use Mapping for differentiation between "cultivated" and "native" lands. This Mapping for the Tulare Basin (and the rest of the agricultural lands in California) is periodically updated by DWR (5000' aerial photographs; 60-75 color slides per U.S.G.S. quadrangle) and provides data on agricultural water consumption. Contact: Fred Sawyer, DWR Sacramento.

2. Field reconnaissance was utilized to verify "native vegetation" designations on this DWR land use mapping.

3. Blunt-nosed Leopard Lizard (BNLL) Critical Habitat Mapping as authorized by the Endangered Species Act and funded through the office of Endangered Species, U.S. Fish and Wildlife Service (USFWS), Sacramento. This mapping was aerially updated in June 1983 by BNLL recovery team member, Dan Christenson, California Department of Fish and Game (DFG), Region Four.

4. Dan Christenson. DFG Biologist, was a link to extensive occurrence information and field observations of BNLL and the San Joaquin Kit Fox (SJKF).

5. Rob Hansen, Preserve Manager at The Nature Conservancy's Creighton Ranch Preserve, and Gary Ivy, Biologist with USFWS, combined their extensive knowledge of birds in the development of the Tulare Basin Birds Checklist.

6. The California Natural Diversity Data Base (CNDDB)* printouts and maps were useful in specific occurrence updating and delineation of natural communities and plants.

The precise current distribution of all native taxa is not listed here. Rather, the current extent of native vegetation is delineated on Map 3.1. The general status of Birds, Reptiles and Amphibians, and Mammals is outlined on checklists and tables.

It is fundamental that where native vegetation is eliminated or substantially altered, most elements of natural diversity will also be lost. A very few migrating and transient species may be able to exist outside of their native habitat for a limited period of time. For the most part, however, loss of habitat means loss of native species.

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*See Appendix I for a description of the California Natural Diversity Data Base (CNDDB).

3.2 Current Extent of Native Vegetation

Table 3.2, Historic and Current Acreages for Tulare Basin Native Vegetation highlights the dramatic loss of native vegetation. Acreages for this table were derived from the Historic and the Current Vegetation Maps utilizing the methods and approaches previously described. Delineation of historical and current acreages for the different vegetation types could permits estimation of the loss of natural diversity associated with each vegetation type.

CURRENT EXTENT OF NATIVE VEGETATION

MAP 3.1

Current Extent of Native Vegetation

Zanonivich, Griggs, Werschkull (1983)

Scale 1:250,000

N

0 5 10 15 20 miles

Kings River

Fresno Co.
Tulare Co.

Fresno Co.
Kings Co.

Hanford

Visalia

Kaweah River

Boundary of
Aerial Survey

Tulare

Tule River

Corcoran

Tipton

Porterville

Kettleman City

Pixley

Deer Creek

Alpaugh

Earlimart

White River

Kings Co.
Kern Co.

Kings Co.
Tulare Co.
Kern Co.

Rag Gulch

Delano

Tulare Co.
Kern Co.

Lost Hills

Posa Creek

Wasco

Famoso

Bitterwater Creek

Shafter

Chico Martinez Creek

Temblor Creek

Kern River

McKittrick

Bakersfield

Caliente Creek

Boundary of
Aerial Survey

Arvin

Sycamore Creek

Taft

Commanche Creek

Grapevine

TABLE 3.2

HISTORICAL AND CURRENT ACREAGES FOR TULARE BASIN NATIVE VEGETATION

VEGETATION	HISTORICAL ACREAGE	CURRENT* ACREAGE	% REMAINING
FRESHWATER (TULE) MARSH	259,189	0	0
IODINE BUSH SHRUBLAND	260,283	45,314	17.41
ATRIPLEX SPINIFERA SHRUBLAND	200,711	25,495	12.70
ATRIPLEX POLYCARPA SHRUBLAND	589,406	9,144	1.55
PROSOPIS-ATRIPLEX SHRUBLAND	130,690	16,164	12.37
SANDY LOAM GRASSLAND	208,332	1,902	.91
TERRACE GRASSLANDS	208,275	0	0
ALKALINE GRASSLAND	247,456	7,066	2.86
VALLEY OAK WOODLAND	437,388	1,682	.38
HAPLOPAPPUS SHRUBLAND	14,558	3,264	22.42
TOTAL ACREAGES FOR TULARE BASIN STUDY AREA	2,556,288	110,031	4.30

*Based upon aerial survey of June 1983 by Dan Christenson, CDFG.
Note: Both Historical and Current Acreages represent only the valley floor of the Tulare Basin. See delineation on Map 3.2.

3.3 Birds of the Tulare Basin

This list includes all bird species recognized as regular components of the Tulare Valley avifauna. "Regular" implies annual occurrence in some numbers or else cyclic occurrence with some regularity (i.e., Varied Thrush or Pine Siskin). This list includes species of historical record back to approximately 1900.

Seasonal Status and Breeding Status

For each species status is noted historically and currently.

R = year-long resident (records every month of the year).
W = winter visitor.
S = summer visitor.
T = transient (migrant only . . . none stay to breed or winter here).
B = a breeding species.
I = introduced (exotic species now established in Tulare Valley).
N = naturalized newcomer (species not present historically, recent arrivals).

Changes in Status

After noting historical and current seasonal status, a symbol will be used to signify major changes in seasonal status.

\+ = species whose seasonal status has lengthened.
\- = species whose seasonal status has decreased in length.

The same symbols will be used to signify changes in breeding status.

\+ = a species which began nesting in Tulare Valley at settlement.
\- = a former breeder now reduced to a winter visitor or transient.
X = species which no longer occur in the Tulare Valley.
A = signifies aerial, flying over any habitat.

Abundance

True abundance and relative abundance rely on so many variables and are therefore difficult to determine with any accuracy. Since acreages of all Tulare Valley native plant communities have declined substantially, it can be argued that numbers of all species have declined in direct proportion to the acres of their preferred habitat which have been lost. In the context of this section on birds, it is more meaningful to note only major increases (+) or declines (-) in relative abundance since historic times which can be attributed to influences other than direct habitat loss. Species which have declined to the point of being locally extirpated are noted by an "X" under seasonal status.

Habitats

Each species' preferred habitats (plant communities) are listed in order of preference.

O = open water
F = mudflats, alkali flats and islands with no vegetation
M = freshwater marsh
R = riparian woodland
G = grassland
S = scrub (Allenrolfea, Atriplex, Suaeda, etc.)
W = Oak woodland (Quercus lobata)

This section will permit the reader to determine the seasonal status and preferred habitats of the birds of Tulare Basin. One will also be able to determine whether and/or how a species' seasonal status, breeding status, and/or relative abundance have changed since historic times. At the end of the graphic portion of this section summary of Tulare Basin avifauna and the changes that have occurred since settlement. Comments about conservation and protection considerations are included in the final section of this report.

Nomenclature follows the 6th Edition American Ornithologists Union check-list of North American Birds, July 1982.

SPECIES NAME	SEASONAL STATUS 1900	SEASONAL STATUS 1983	CHANGE IN SEASONAL STATUS	BREEDING STATUS 1900	BREEDING STATUS 1983	CHANGE IN BREEDING STATUS	MAJOR CHANGE IN RELATIVE ABUNDANCE	HABITATS
Common Loon	W	W						O
Pied-billed Grebe	R	R		B	B			O,M
Horned Grebe	W	W						O
Eared Grebe	R	R		B	B			O,M
Western Grebe	R	R		B	B			O,M
American White Pelican	R	W	-	B		-	-	O,F,M
Double-crested Cormorant	R	R		B	B			O,F,M,R,W
American Bittern	R	R		B	B			M
Least Bittern	R	R		B	B			M
Great Blue Heron	R	R		B	B			M,F,R,W,G
Great Egret	R	R		B	B			M,F,R,W,G
Snowy Egret	R	R		B	B			M,F,R
Cattle Egret		R	+		B	+	+	M,F,R,G
Green backed Heron	R	R		B	B			R,M
Black-crowned Night Heron	R	R		B	B			M,F,R
White-faced Ibis	R	R		B	B			M,F
Fulvous Whistling Duck	S	S		B	B		-	M
Tundra Swan	W	W					-	M,O
Greater White-fronted Goose	W	W						M,O,G
Snow Goose	W	W					-	M,O,G
Ross' Goose	W	W					-	M,O,G
Canada Goose	W	W						M,O,G
Wood Duck	R	R		B	B			M,R.W.O
Green-winged Teal	R	R		B	B			M,F,O
Mallard	R	R		B	B			M,F,O

N

SPECIES NAME	SEASONAL STATUS 1900	SEASONAL STATUS 1983	CHANGE IN SEASONAL STATUS	BREEDING STATUS 1900	BREEDING STATUS 1983	CHANGE IN BREEDING STATUS	MAJOR CHANGE IN RELATIVE ABUNDANCE	HABITATS
Northern Pintail	R	R		B	B			M,F,O,G
Blue-winged Teal	R	R		B	B			M,F,O
Cinnamon Teal	R	R		B	B			M,O,F
Northern Shoveler	R	R		B	B			M,O,F
Gadwall	R	R		B	B			M,O,F
American Wigeon	R	R		B	B			M,O,F,G
Canvasback	R	R		B	B			O
Redhead	R	R		B	B			M,O
Ring-necked Duck	W	W						O
Greater Scaup	W	W						O
Lesser Scaup	W	W						O
Common Goldeneye	W	W						O
Bufflehead	W	W						O
Hooded Merganser	W	W						O,R,W
Common Merganser	W	W						O,F
Red-breasted Merganser	W	W						O
Ruddy Duck	R	R		B	B			M,O
Turkey Vulture	S	S						A***
California Condor	R	R					-	G,S
Black-shouldered Kite	R	R		B	B		+	W,G,R,M
Bald Eagle	R	W	-	B		-	-	O,F,M
Northern Harrier	R	R		B	B			M,G
Sharp-shinned Hawk	W	W						R,W,M,S,G
Cooper's Hawk	R	R		B	B			R,W,M,S,G
Red-shouldered Hawk	R	R		B	B			R,W

SPECIES NAME	SEASONAL STATUS 1900	SEASONAL STATUS 1983	CHANGE IN SEASONAL STATUS	BREEDING STATUS 1900	BREEDING STATUS 1983	CHANGE IN BREEDING STATUS	MAJOR CHANGE IN RELATIVE ABUNDANCE	HABITATS
Swainson's Hawk	S	S		B	B		-	G,R,W
Red-tailed Hawk	R	R		B	B			G,W,R,S,A
Ferruginous Hawk	W	W						G,S
Rough-leged Hawk	W	W						G,S
Golden Eagle	R	R						G,S,W,A
Osprey	W	W						O,R
American Kestrel	R	R		B	B			G,W,R,S
Merlin	W	W						G,F,R,S,M
Peregrine Falcon	R	W	-				-	M,O,F
Prairie Falcon	R	R						G,R,W,S
Ring-necked Pheasant		R	+		B	+	+	G,M,S
California Quail	R	R		B	B			S,G,R,W
Virginia Rail	R	R		B	B			M
Sora	R	R		B	B			M
Common Moorhen	R	R		B	B			M,R,O
American Coot	R	R		B	B			O,M
Sandhill Crane	W	W					-	G,M,F
Black-bellied Plover	W	W						F,G
Snowy Plover	S	S		B	B			F
Semipalmated Plover	T	T						F
Killdeer	R	R		B	B			F,G,M
Mountain Plover	W	W					-	G
Black-necked Stilt	R	R		B	B			M,F
American Avocet	R	R		B	B			M,F
Greater Yellowlegs	W	W						M,F

SPECIES NAME	SEASONAL STATUS 1900	SEASONAL STATUS 1983	CHANGE IN SEASONAL STATUS	BREEDING STATUS 1900	BREEDING STATUS 1983	CHANGE IN BREEDING STATUS	MAJOR CHANGE IN RELATIVE ABUNDANCE	HABITATS
Lesser Yellowlegs	W	W						F,M
Solitary Sandpiper	T	T						M,F
Willet	W	W						F
Spotted Sandpiper	R	R		B	B			F,R
Whimbrel	T	T						F,G
Long-billed Curlew	R	R						G,F
Marbled Godwit	W	W						F
Western Sandpiper	W	W						F
Least Sandpiper	W	W						F,M
Baird's Sandpiper	T	T						F,M
Pectoral Sandpiper	T	T						M,F
Dunlin	W	W						F
Short-billed Dowitcher	T	T						F
Long-billed Dowitcher	W	W						F,M
Common Snipe	W	W						M,G,F
Wilson's Phalarope	S	S		B	B			F,O,M,G
Red-necked Phalarope	T	T						O,F
Bonaparte's Gull	T	T						O,F,M
Ring-billed Gull	R	R						O,F,M
California Gull	R	R		*B		-		O,F,M
Herring Gull	W	W						O,F,M
Caspian Tern	R	R		B	B			F,O,M
Forster's Tern	S	S		B	B			O,F,M
Black Tern	S	S		B	B			M,O
I Rock Dove	*	R	+		B	+	+	AG-URBAN

SPECIES NAME	SEASONAL STATUS 1900	SEASONAL STATUS 1983	CHANGE IN SEASONAL STATUS	BREEDING STATUS 1900	BREEDING STATUS 1983	CHANGE IN BREEDING STATUS	MAJOR CHANGE IN RELATIVE ABUNDANCE	HABITATS
Band-tailed Pigeon	W	W						W,F
Spotted Dove		R	+		B	+	+	AG-URBAN
Mourning Dove	R	R		B	B			G,R,S,W
Yellow-billed Cuckoo	S	X	-	B		-	-	R
Greater Roadrunner	R	R		B	B		-	S,G
Common Barn Owl	R	R		B	B			R,G,M,W,S
Western Screech Owl	R	R		B	B		-	R,W
Great Horned Owl	R	R		B	B			W,R
Burrowing Owl	R	R		B	B			G,S
Long-eared Owl	R	W	-	B		-	-	R,W
Short-eared Owl	R	R		B	B			G,M
Lesser Nighthawk	S	S		B	B			F,G,R,S,M
Common Poorwill	T	T						S,W,G
Black Swift	S	S						A
Vaux's Swift	T	T						A
White-throated Swift	R	R						A
Black-chinned Hummingbird	S	S		B	B			R,W
Anna's Hummingbird	R	R		B	B			R,W,S
Calliope Hummingbird	T	T						R,W,S
Rufous Hummingbird	T	T						R,W,S
Belted Kingfisher	R	R		B	B			R,O
Lewis' Woodpecker	W	W						W,R
Acorn Woodpecker	R	R		B	B			W
Red-breasted Sapsucker	W	W						R,W
Nuttall's Woodpecker	R	R		B	B			W,R

SPECIES NAME	SEASONAL STATUS 1900	SEASONAL STATUS 1983	CHANGE IN SEASONAL STATUS	BREEDING STATUS 1900	BREEDING STATUS 1983	CHANGE IN BREEDING STATUS	MAJOR CHANGE IN RELATIVE ABUNDANCE	HABITATS
Downy Woodpecker	R	R		B	B			R,W
Northern Flicker	R	R		B	B			W,R,S
Olive-sided Flycatcher	T	T						R,W
Western Wood-Pewee	T	T						W,R,S
Willow Flycatcher	S	T	-	B		-	-	R
Hammond's Flycatcher	T	T						R,W,S
Dusky Flycatcher	T	T						R,W,S
Gray Flycatcher	T	T						R,W,S
Western Flycatcher	T	T						R,W,S
Black Phoebe	R	R		B	B		+	R,M,G,W
Say's Phoebe	W	W						G
Ash-throated Flycatcher	S	S		B	B			W,R
Western Kingbird	S	S		B	B			G,R,W,S,M
Horned Lark	R	R		B	B			G,S
Purple Martin	T	T						A
Tree Swallow	R	R		B	B		-	R,M,W,A
Violet-green Swallow	W	W						A,R
Northern Rough-winged Swallow	S	S		B	B			R,M,A
Bank Swallow	T	T						R,M,A
Cliff Swallow	S	S			B	+	+	A,M,G
Barn Swallow	S	S		B	B		+	R,M,A
Steller's Jay	W	W						W,R
Scrub Jay	R	R		B	B		+	W,R
Yellow-billed Magpie	R	X	-	B		-	-	W,R
American Crow	R	R		B	B		+	R,W,G,M

SPECIES NAME	SEASONAL STATUS 1900	SEASONAL STATUS 1983	CHANGE IN SEASONAL STATUS	BREEDING STATUS 1900	BREEDING STATUS 1983	CHANGE IN BREEDING STATUS	MAJOR CHANGE IN RELATIVE ABUNDANCE	HABITATS
Common Raven	R	R						G,S,A
Plain Titmouse	R	R		B	B			W,R
Bushtit	R	R		B	B			R,W,S
Red-breasted Nuthatch	W	W						W,R
White-breated Nuthatch	R	R		B	B			W,R
Brown Creeper	W	W						R,W
Rock Wren	R	R		B	B			S,R
Bewick's Wren	R	R		B	B			S,W,R
House Wren	R	R		B	B			W,R,S
Winter Wren	W	W						S,R
Marsh Wren	R	R		B	B			M,R
Golden-crowned Kinglet	W	W						R,W
Ruby-crowned Kinglet	W	W						R,W,S,M
Blue-gray Gnatcatcher	R	W	-	B		-	-	S,R,W
Western Bluebird	R	R		B	B		-	W,G
Mountain Bluebird	W	W						G,
Townsend's Solitaire	W	W						W,R
Swainson's Thrush	T	T						R,W
Hermit Thrush	W	W						R,W,S
American Robin	W	R	+		B	+	+	W,R,G
Varied Thrush	W	W						W,R
Northern Mockingbird	R	R		B	B			G,S,R,W
Sage Thrasher	R	W	-	B		-	-	S,G
California Thrasher	R	R		B	B		-	S,R,W
LeConte's Thrasher	R	R		B	B		-	S

SPECIES NAME	SEASONAL STATUS 1900	SEASONAL STATUS 1983	CHANGE IN SEASONAL STATUS	BREEDING STATUS 1900	BREEDING STATUS 1983	CHANGE IN BREEDING STATUS	MAJOR CHANGE IN RELATIVE ABUNDANCE	HABITATS
Water Pipit	W	W						G,F
Cedar Waxwing	W	W						W,R
Phainopepla	R	R		B	B			W,R
Loggerhead Shrike	R	R		B	B			G,W,S,M,R
European Starling		R	+		B	+	+	W,R,G,M
Bell's Vireo	S	X	-	B		-	-	R
Solitary Vireo	T	T						W,R
Hutton's Vireo	T	T						W,R
Warbling Vireo	T	T						R,W
Orange-crowned Warbler	W	W						R,W,S,M
Nashville Warbler	T	T						R,W,S
Yellow Warbler	S	T	-	B		-	-	R,W,S
Yellow-rumped Warbler	W	W						R,W,S,G,M
Black-throated Gray Warbler	W	W						W,R
Townsend's Warbler	W	W						W,R
Hermit Warbler	T	T						R,W
McGillivray's Warbler	T	T						R,W,S
Common Yellowthroat	R	R		B	B			M,R
Wilson's Warbler	T	T						R,W,S
Yellow-breasted Chat	S	S		B	B		-	R
Western Tanager	T	T						R,W
Black-headed Grosbeak	S	S		B	B			R,W
Blue Grosbeak	S	S		B	B		-	R,G
Lazuli Bunting	S	S		B	B		-	R,W,G
Green-tailed Towhee	W	W						S,R

SPECIES NAME	SEASONAL STATUS 1900	SEASONAL STATUS 1983	CHANGE IN SEASONAL STATUS	BREEDING STATUS 1900	BREEDING STATUS 1983	CHANGE IN BREEDING STATUS	MAJOR CHANGE IN RELATIVE ABUNDANCE	HABITATS
Rufous-sided Towhee	R	R		B	B			R,W,S
Brown Towhee	R	R		B	B			R,W,S
Chipping Sparrow	W	W						R,G,W
Brewer's Sparrow	R	W	-	B		-	-	S,G
Vesper Sparrow	W	W						G
Lark Sparrow	R	R		B	B			G,W,S,R
Sage Sparrow	R	R		B	B		-	S
Savannah Sparrow	W	W						G,M
Grasshopper Sparrow	S	S		B	B			G
Fox Sparrow	W	W						S,R,W
Song Sparrow	R	R		B	B			M,R,S,F
Lincoln's Sparrow	W	W						R,S,M,G
Golden-crowned Sparrow	W	W						S,G,R,W
White-crowned Sparrow	W	W						G,R,S,W
Dark-eyed Junco	W	W						W,G,R,S
Red-winged Blackbird	R	R		B	B			M,G,F,R,W
Tricolored Blackbird	R	R		B	B			M,G,F,R
Western Meadowlark	R	R		B	B			G,S
Yellow-headed Blackbird	R	R		B	B			M,G,F
Brewer's Blackbird	W	R	+		B	+	+	G,M,F,R
Brown-headed Cowbird	T	R	+		B	+	+	R,G,W,M
Hooded Oriole	S	S		B	B		+	R
Northern Oriole	S	S		B	B			W,R,G
Purple Finch	W	W						W,R
House Finch	R	R		B	B		+	G,W,R,S

SPECIES NAME	SEASONAL STATUS 1900	SEASONAL STATUS 1983	CHANGE IN SEASONAL STATUS	BREEDING STATUS 1900	BREEDING STATUS 1983	CHANGE IN BREEDING STATUS	MAJOR CHANGE IN RELATIVE ABUNDANCE	HABITATS
Pine Siskin	W	W						W,R,G
Lesser Goldfinch	R	R		B	B			R,W,G
Lawrence's Goldfinch	R	R		B	B			R,W,G
American Goldfinch	R	R		B	B			R,W,G,M
Evening Grosbeak	W	W						R,W
I House Sparrow	**	R	+		B	+	+	R,W,G

* 1850 **Pre-1850 ***Widespread

Total Species = 231

Native Species = 225 (Presettlement)
Introduced Species = 5
Naturalized Species = 1
Extirpated Natives = 3

Current Total = 228 (1983 . . . net gain of three species because of introductions).

	Residents	Winter Visitors	Summer Visitors	Transients	Breeders
Pre-Settlement	101	68	26	30	116
1983	103-6=97 Natives	72	22	31	94-6=88 Natives

Table Summary

Since the Tulare Valley was settled, three species of native birds have been extirpated, five exotics have been introduced by man and one species (Cattle Egret) extended its range north and west into this area. Nine species have a longer seasonal stay in the valley: these are the five exotics, the Cattle Egret, American Robin, Brewer's Blackbird, and Brown-headed Cowbird. Eleven species have shorter seasonal stays: this group includes the extirpated Yellow-billed Cuckoo, Yellow-billed Magpie and Bell's Vireo. Most of the others are species which once bred in the valley and no longer do so. Ten species which did not breed in the valley in pre-settlement times now do so (this includes the five exotics and Cattle Egret) but twelve species which used to breed here no longer do so. Sixteen species (including the five exotics and Cattle Egret) are more common now than in pre-settlement times. Most are species which have benefited from settlement and man-made changes in the Valley; for example, American Crow, Cliff Swallow, Brewer's Blackbird and House Finch. Thirty species have made notable declines in abundance (independent of habitat loss) since the Valley was settled.

Increases for Tulare Basin Birds

These notes summarize the additions to Tulare Valley

# of new exotics.....5

# of naturalized newcomers.....1

# of natives (originally winter visitors) now breeding here.....2

# of natives (originally transients) now breeding here.....1

# of natives (originally non-breeding summer visitors).....1
now breeding here.

# of natives whose seasonal status has not changed but.....7
which are now more abundant in Tulare Valley than at the
time of settlement.

Decreases for Tulare Basin Birds

Even though more species are present in Tulare Valley in 1983, the natives have suffered some serious setbacks. Compare the following with the preceding figures:

# of natives extirpated from Tulare Valley.....3

# of natives which were once residents, now winter visitors.....7

# of natives originally summer visitors, now transients.....2

# of natives originally bred here and are now extirpated.....3

# of natives originally bred here which are now non-breeders....12
but still occur at other seasons.

# of natives whose seasonal status and breeding status have.....18
not changed but which are now notably less abundant in
Tulare Valley than at the time of settlement.

Conclusions

The extirpated species are Yellow-billed Cuckoo (loss of riparian habitat), Yellow-billed Magpie (loss of habitat and bounty hunting), and Bell's Vireo (habitat loss and Cowbird parasitism). The former residents which have been reduced to winter visitors are American White Pelican (intolerant of disturbances at breeding grounds), Bald Eagle (radical changes in Tulare Lake), Peregrine Falcon (nearby breeding sites in Sierra and Coast Range no longer active; DDT), Long-eared Owl (loss of willow thickets), Blue-gray Gnatcatcher (Cowbird parasitism and habitat loss), Sage Thrasher (loss of saltbush scrub), and Brewer's Sparrow (loss of saltbush scrub). The natives which have been reduced from summer visitors to transients are Willow Flycatcher and Yellow Warbler (both impacted by loss of riparian habitat and by Cowbird parasitism). California Gull once bred at Tulare Lake according to earliest accounts but has not in this century. It still occurs in summer in small numbers but only as a non-breeder. Those 18 species

which still occur here at the appropriate seasons but in much reduced numbers are: Fulvous Whistling Duck (marshland still exists but water regime is too unpredictable for regular successful breeding), Tundra Swan, Snow Goose, and Ross' Goose (most winter farther north in San Joaquin and Sacramento Valleys nowadays), California Condor (population reduction a result of causes other than loss of Tulare Valley foraging land alone), Swainson's Hawk (habitat conversion, shooting, possible losses of this migrant buteo's South American wintering grounds), Sandhill Crane and Mountain Plover (grassland habitat loss and shooting . . . possible declines on breeding grounds), Greater Roadrunner (many fall prey to feral dogs and habitat fractioning and isolation), Western Screech Owl (loss of old growth willows with cavities), Tree Swallow and Western Bluebird (Starling competition and fewer new cavities in preferred habitats because Starlings also displace breeding woodpeckers), California Thrasher and LeConte's Thrasher (habitat still present . . . though much reduced . . . but bird numbers very depressed), Yellow-breasted Chat, Blue Grosbeak, and Lazuli Bunting (all potential Cowbird hosts), and Sage Sparrow (wintering and breeding populations both lower, possibly for different reasons).

3.4 Mammals of the Tulare Basin*

Marsupialia - Marsupials

Common Opossum (*Didelphis marsupialis*)	Introduced

Insectivora - Shrews and Moles

Buena Vista Lake Shrew
Ornate Shrew (*Sorex ornatus*)
Broad-handed (California Mole)- (*Scapanus latimanus*)

Chiroptera - Bats*

Hoary Bat - (*Lasiutus cinereus*)
Western Mastiff Bat - (*Eumops perotis*)
Brazilian Free-tailed Bat

Carnivora - Carnivores

Raccoon (*Procyon lotor*)	
River Otter (*Lutra canadensis*)	
Mink (*Mustela vison*)	
Long-tailed Weasel (*Mustela frenata*)	
Spotted Skunk (*Spilogale putorius*)	
Striped Skunk (*Mephitis mephitis*)	
Badger (*Taxidea taxus*)	
Coyote (*Canis latrans*)	
Gray Fox (*Urocyon cinercoargentens*)	
San Joaquin Kit Fox (*Vulpes macrotis mutica*)	Endangered
Gray Wolf (*Canis lupus*)	Extinct from Valley
Grizzly Bear (*Ursus horribilis*)	Extinct from Valley
Bobcat (*Lynx rufus*)	

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*This represents a "working" list. Additional discussion of former and current mammal populations is needed.

Rodentia - Rodents

Western Gray Squirrel (Sciurus griseus
Beechey (or California) Ground Squirrel (Otospermophilus or Citellus beecheyi)
San Joaquin Antelope Ground Squirrel (Ammospermophilus nelsoni)
Valley (Bottas) Pocket Gopher (Thomomys bottae)
Tulare Grasshopper Mouse (Onychomys torridus tularensis)
San Joaquin Pocket Mouse (Perognathus inornatus)
Giant Kangaroo Rat (Dipodomys ingens)
Heermann Kangaroo Rat (Dipodomys heermanni)
Tipton Kangaroo Rat (Dipodomys nitratoides nitratoides)
Deer Mouse (Peromyscus maniculatus)
California (Vole) Meadow Mouse (Microtus californicus)
Muskrat (Ondatra zibethica) Introduced
Norway Rat (Rattus norvegicus) Introduced
House Mouse (Mus musculus) Introduced
Beaver (Castor canadensis)

Lagamorpha - Rabbits

Black-tailed Jackrabbit (Lepus californicus)
Audubon (or Desert) Cottontail (Sylvilagus audubonii)

Artiodactyla - Hoofed Mammals

Tule Elk (Cervus elephus nelsoni)
Pronghorn Antelope (Antilocarpa americana)
Mule Deer (Odocoileus hemionus)

3.5 Reptiles and Amphibians of the Tulare Basin

Iquanidae - Iguanids

Blunt-nosed Leopard Lizard (*Gambelia silus*) Endangered
Desert Spiny Lizard (*Sceloporus magister*)
Western Fence Lizard (*Sceloporus occidentialis*)
Sagebrush Lizard (*Sceloporus graciosus*)
California Side-blotched Lizard (*Uta stansburiana hesperis*)
Coast (California) Horned Lizard (*Phrynosoma coronatum frontale*)

Teiidae - Whiptails

Western (California) Whiptail (*Cnemidophorus tigris mundus*)

Colubridae - Colubrids

Coachwhip (San Joaquin Whipsnake) (*Masticophis flagellum ruddocki*)
Racer (*Coluber constrictor*)
Gopher Snake (*Pituophis melanoleucus*)
Common Kingsnake (*Lampraopeltis getulus*)
Common Garter Snake (*Thamnophis sirtalis*)
Giant Garter Snake (*Thamnophis conchi gigas*)
Gilbert's Skink (*Eumeces gilberti*)
Long-nosed Snake (*Rhinocheilus lecontei*)

Viperidae - Vipers

Western (Northern Pacific) Rattlesnake (*Crotalus viridis oreganus*)

Ranidae - True Frogs

Bullfrog (*Rana catesbeiana*) Introduced

Hylidae - Treefrogs

Pacific treefrog (Hyla regilla)

Bufonidae - True Toads

Western (California) Toad (Bufo boreas)

Pelobatidae - Spadefoot Toads

Western (Pacific) Spadefoot Toad (Scaphiopus hammondi)

Testudindae - Turtles

Western Pond Turtle (Clemmys marmorata)

4. OPPORTUNITIES FOR PROTECTION OF NATURAL DIVERSITY

This chapter of the Tulare Basin Protection Plan includes the following:

4.1 An element-by-element listing of protection opportunities in the Tulare Basin.

4.2 A review of agency roles and programs in the Tulare Basin highlighting significant problems and opportunities.

TABLE 4.1 - ELEMENT PROTECTION OPPORTUNITIES

ELEMENT	CNDDB RANK	LOCATION	ACREAGE	MANAGING AGENCY
Northern Claypan Vernal Pool	B1	-Creighton Ranch	160	TNC
		-Pixley Vernal Pool Preserve	40	TNC
		-Tulare County Correctional Institute	200	County of Tulare
Northern Hardpan Vernal Pool	B1	-Hogwallow Preserve	10	Tulare County Historical Society
Alkaline Seep and Meadow	A1*	-Kaweah Oaks (meadow)	150	TNC
		-Gator Pond (seep and meadow)	90+	J.G. Boswell Company
		-Goose Lake (seep)	20	Private
Valley Oak Woodland	B1.1	-Kaweah Oaks Preserve	170	TNC
		-Lindsay-Strathmore Irrigation District	ca.500	Lindsay-Strathmore Irrigation District
Iodine Bush Shrubland	BU	-Creighton Ranch	500	TNC
		-Kern NWR - RNA	2,330	US F&WS
		-Paine Preserve (Lonsmith)	40	TNC

* Data Base Preliminary Ranking

TABLE 4.1 - ELEMENT PROTECTION OPPORTUNITIES (CONTINUED)

ELEMENT	CNDDB RANK	LOCATION	ACREAGE	MANAGING AGENCY
Freshwater Marsh	B2.2	-Creighton Ranch	900-2,000	TNC
		-Kern NWR	4,000	US F&WS
		-South Wilbur Flood Area	7,000	J. G. Boswell Company
		-Bakersfield Percolation Basin	1,000	City of Bakersfield
Riparian Woodland (Willow-Cottonwood)	B1.2	-Base of Terminus Dam Kaweah River	100	US Army Corps of Engineers
		-Corridors along Poso Creek, White River, Deer Creek, Tule River	Unknown	Private
Prosopis Atriplex Shrubland (Valley Mesquite Scrub)	A1	-City of Bakersfield Percolation Basins	ca.400	City of Bakersfield
Atriplex spinifera Shrubland (Lowland Valley Saltbush Scrub, in part)	A2	-Paine Preserve (Paine & Lonsmith)	260	TNC
		-Semitropic Ridge	2,000	Various Private
		-Highway 43-County Line	800	Private
		-Goose Lake (Ecology Staircase)	80	Private
		-Carizzo Plan	3,000	Private & BLM

* Data Base Preliminary Ranking

TABLE 4.1 - ELEMENT PROTECTION OPPORTUNITIES (CONTINUED)

ELEMENT	CNDDB RANK	LOCATION	ACREAGE	MANAGING AGENCY
Atriplex polycarpa Shrubland (Lowland Valley Saltbush Scrub, in part	A1*	-Paine Preserve (Hunt Club and Standard Oil)	320	TNC
		-Voice of America	640	US Communications Agency
		-Goose Lake (Ecological Staircase)	80	Private
Alkaline Grassland (Alkali Bunchgrass)	B1	-Pixley NWR	2,400	US F&WS
		-Pixley Horse Pasture	700	US F&WS
		-Creighton Ranch	280	TNC
		-Pixley Vernal Pools	40	TNC
		-Tulare County Correctional Institute	100	County of Tulare
Atriplex tularensis	A1	-Gator Pond	90	J.G. Boswell Company
Atriplex valicola	A1	-Soda Lake Carizzo Plain	2,000	BLM-Private
Cordylanthus mollis var. hispida	B1.2*	-Gator Pond	90	J.G. Boswell Company
Cirsium crassicaule (Slough Thistle)	A2.1*	-Kern NWR	10	US F&WS
		-Buena Vista Slough	200?	Private

* Data Base Preliminary Ranking

TABLE 4.1 - ELEMENT PROTECTION OPPORTUNITIES (CONTINUED)

ELEMENT	CNDDB RANK	LOCATION	ACREAGE	MANAGING AGENCY
Streptanthus californicus		-Paine Preserve	1	TNC
Opuntia basilaris var. treleasii	B1.1	-Sand Ridge	116	TNC
Eriogonum gossypinum	B1.2	-Sand Ridge	116	TNC
		-Tejon Ranch (Commanche Point)	Unknown	Tejon Ranch
Pseudobahia piersonii	A2.1	-Commanche Point	Unknown	Tejon Ranch
Eriastrum hooveri	B3.1*	-Percolation Basins	20	City of Bakersfield
		-Paine Preserve	10	TNC
Eremalche kernensis	A2.1*	-Belridge area	Unknown	Private
		-Soda Lake, Carizzo Plain	Unknown	BLM-Private

* Data Base Preliminary Ranking

TABLE 4.1 - ELEMENT PROTECTION OPPORTUNITIES (CONTINUED)

ELEMENT	CNDDB RANK	LOCATION	ACREAGE	MANAGING AGENCY
San Joaquin Kit Fox	B2.1	-Pixley NWR	3,520	US F&WS
		-Pixley Horse Pasture	700	US F&WS
		-Kern NWR (RNA)	2,330	US F&WS
		-Paine Preserve	580	TNC
		-Sand Ridge	116	TNC
		-Semitropic Ridge	2,000	Private
		-Highway 43-County Line	800	Private
		-Voice of America	640	US Communications Agency
		-Elk Hills Naval Petroleum Reserve	61,440	US Navy
		-Goose Lake	9,500?	Private
		-Carizzo-Elkhorn Plains	230,000±	BLM-Private
San Joaquin Antelope Ground Squirrel (Nelsons GS)	B2.2	-Paine Preserve	580	TNC
		-Allensworth Ecological Preserve	480	CF&G
		-Semitropic Ridge	2,000	Private
		-Highway 43-County Line	800	Private
		-Carizzo Plain	230,000	BLM-Private

TABLE 4.1 - ELEMENT PROTECTION OPPORTUNITIES (CONTINUED)

ELEMENT	CNDDB RANK	LOCATION	ACREAGE	MANAGING AGENCY
Giant Kangaroo Rat	B1.2	-Carizzo Plain	230,000	BLM-Private
Tipton Kangaroo Rat	B1	-Paine Preserve	580	TNC
		-Semitropic Ridge	2,000	Private
		-Voice of America	640	US Communications Agency
Blunt-nosed Leopard Lizard	B1.2	-Pixley NWR	3,520	US F&WS
		-Pixley Horse Pasture	700	US F&WS
		-Kern NWR (RNA)	2,330	US F&WS
		-Allensworth EA	480	CA F&G
		-Creighton Ranch	200	TNC
		-Paine Preserve	580	TNC
		-Sand Ridge	116	TNC
		-Voice of America	640	US Communication Agency
		-Elk Hills Naval Petroleum Reserve	61,440	US Navy
		-Carizzo Plain	230,000	BLM-Private

4.2 Public Agency Roles and Programs for Element Protection

There are five principal entities responsible for management and protection of important elements in the Tulare Basin as outlined in Table 4.1, Element Protection Opportunities. (See Table 4.1 for a summary of element information and protection opportunities.) The question of "degree of protection" is addressed below with a brief analysis of agency programs for element protection. An additional entity not listed in Table 4.1, but mentioned throughout this report, is the California Natural Diversity Data Base (CNDDB).* CNDDB is discussed in this section since its involvement and success in identification and tracking of elements of natural diversity is most important to the management and policy decision-making concerning natural diversity.

For more background information on agency programs, a very detailed discussion, Programs for the Preservation of Natural Diversity in California, 217 pgs, May 1983, by S. A. Cochrane, is available from The Nature Conservancy. Of the organizations with major management responsibilities in the Tulare Basin, the Department of Fish and Game, U.S. Fish and Wildlife Service, and The Nature Conservancy are thoroughly discussed in this document.

The California Natural Diversity Data Base (CNDDB)

While substantial amounts of new information and data are entered into the Data Base each month, there are many parts of California where data is incomplete and dated. The Tulare Basin floor exemplifies this problem of out-of-date element occurrence records.

Of a total of 101 EO's listed on the CNDDB printouts, 67% or a total of 68 of these were from literature and museum specimens. Only 32% or 33 of these EO's were from field observation. 47% of all EO's including both observation and museum-literature sources were pre-1950.

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*See Appendix 1 for background discussion of CNDDB.

There are two instructive conclusions implicit in these figures:

1. Where native vegetation is being rapidly eliminated in California, such dated records will not provide an accurate account of natural diversity status. Section 3.2 illustrates the startling loss of native vegetation in the Tulare Basin.

2. Lack of more recent EO's, particularly those derived from field observation, is indication that a network of field specialists has not been completely developed for the particular element or area. This is quite true in the Tulare Basin. The two principal public agencies with staffs of field biologists, USFWS and Region 4 of the DFG, while aware of the CNDDB are still in the process of developing more complete data exchange programs.

At the outset of the Tulare Basin project, it was expected that extensive field work would be conducted to verify and update EOs. As the immensity of this task became apparent, it was recognized that a complete updating would not be possible. In some cases, previously known element occurrences of plant communities and rare plants could be updated with limited field checking and the use of Department of Water Resources Land Use Maps delineating cultivated and irrigated lands. A new EO could not be identified through this process, however. Also existing EO's, particularly more mobile fauna, could not be confirmed or eliminated confidently without intensive field survey beyond the capabilities of this study.

Plant Communities and Rare Plants

Existing EO's for plant communities and rare plants have been updated as part of this project. New EO data collection regarding plant communities and rare plants is being coordinated beyond this project by Robin Cox, Element Protection Planner for TNC.

CNDDB Coordination with USFWS

Through Chuck Houghton, USFWS Planning Coordinator, data exchange programs with CNDDB including plant communities and other elements have been initiated for Kern and Pixley Refuges. USFWS Master Planning and Refuge Planning programs which necessitate extensive data on numerous Tulare Basin elements provided opportunity for this exchange of data. With continued attention, this data exchange could well serve as a model cooperative effort where CNDDB benefits from the primary source data collected by refuge biologists and the refuge benefit from the state-wide assessment, mapping, and organization of element data.

CNDDB Coordination with Cal DFG Region Four

Though CNDDB is presently under the auspices of DFG there is a tremendous lack of coordination and understanding within the department concerning the Data Base. Field biologist Dan Christenson served as an intermediary between DFG data and field observations on vertebrates and the Tulare Basin project. Christenson would be willing to assist in further cooperative efforts involving DFG Region Four biologists. One approach suggested for Region Four is distribution (through Christenson) of a list of Tulare Basin elements to all field biologists. This would be followed by telephone calls to these biologists to discuss elements of interest, Field Survey Forms, and future data exchanges.

U.S. Fish and Wildlife Service: Kern and Pixley Refuges

Historically, much more staff time and refuge resources at Kern and Pixley have been devoted to waterfowl management than to endangered species and element management. In the last ten years with application of the Endangered Species Act and development of Recovery Plans for the Blunt-Nosed Leopard Lizard (BNLL) and the San Joaquin Kit Fox (SJKF), the Kern and Pixley Refuges have directed increasing attention toward these non-game "outputs." (Outputs is the USFWS term for production of life forms from managed lands.) As a result of the Recovery Plan for BNLL, roughly 1200 acres of BNLL habitat were added to Pixley Refuge.

Actual management for BNLL and other important elements has been negligible since refuges have lacked important species and community data to guide management programs.

The U.S. Fish and Wildlife Service (USFWS) is near completion of a 15-year Master Plan for Kern and Pixley Refuges. This Master Plan as described by USFWS will be a general guide for the development and management of the two refuges. It describes overall refuge objectives and those developments, habitat changes, new facilities, and management needs necessary to meet these objectives. Individual refuge Management Plans will then be developed for both Kern and Pixley to outline exact procedures for arriving at each refuge objective. Responsibility for carrying out the actual management of the refuge rests with the refuge manager.

Listed on the next page are the "priority outputs" (as referred to in the USFWS planning process) from the nearly completed Master Plan organized for each refuge.

KERN NATIONAL WILDLIFE REFUGE
OUTPUTS IN PRIORITY ORDER

Wildlife/Resources:

Endangered Species Production
- Blunt-Nosed Leopard Lizard
- San Joaquin Kit Fox

Endangered Species Maintenance
- Blunt-Nosed Leopard Lizard
- San Joaquin Kit Fox

Environment
- Scientific Sites
- Natural Area

Candidate Species Prod. & Maint.
- Slough Thistle
- Mountain Plover
- Tri-Colored Blackbird
- Tipton Kangaroo Rat

Sensitive Species Production

Sensitive Species Maintenance

Duck Maintenance
- Dabbling Ducks
- Diving Ducks

Goose, Swan & Crane Maintenance

Waterbird Maintenance

Raptor Production & Maintenance

Duck Production

Waterbird Production

Utilitarian & Other Species Maint.

Species Transplanted

PIXLEY NATIONAL WILDLIFE REFUGE
OUTPUTS IN PRIORITY ORDER

Wildlife/Resources:

Endangered Species Production
- Blunt-Nosed Leopard Lizard
- San Joaquin Kit Fox

Endangered Species Maintenance
- Blunt-Nosed Leopard Lizard
- San Joaquin Kit Fox

Candidate Species Prod. & Maint.
- Mountain Plover
- Nelson's Antelope Ground Squirrel
- Tipton Kangaroo Rat

Environment
- Scientific Sites

Sensitive Species Production

Sensitive Species Maintenance
- Greater Sandhill Crane

Duck Maintenance
- Dabbling Ducks
- Diving Ducks

Goose, Swan & Crane Maintenance

Waterbird Maintenance

Raptor Production & Maintenance

Duck Production

Waterbird Production

Special Management Species
- Vernal Pool Plants

Utilitarian & Other Species Maint.*

Species Transplanted

The USFWS defines "Utilitarian Species" as resident species that are used commercially or for consumptive purposes. This includes such species as Grey Fox, Racoon, Muskrat, Pheasant, Morning Dove, Cottontail Rabbit, Skunk, Badger and California Quail.

The priority of these outputs is most encouraging from a perspective of proposed attention to important elements. It is clear that continued TNC involvement will greatly facilitate the actual management focus on these non-game elements.

Also to be identified in the Kern and Pixley Master Plan under "Support Functions" are Potential Cooperative Management Programs with TNC, and Cooperative Data Programs with CNDDB. Considerable dialogue between USFWS, TNC and CNDDB has occurred regarding the importance and value of these programs. However, again it is most important that The Nature Conservancy involvement be continued during development of individual Refuge Management Plans and that a cooperative relationship be strengthened with refuge staff. This continued cooperation and involvement will ensure that important refuge outputs and cooperative programs are realized.

California Department of Fish and Game: Ecological Reserves

The first Ecological Reserves (ER's) were established in 1968 for "the purpose of protecting rare or endangered native plants, wildlife or aquatic organisms or specialized habitat types both terrestrial and aquatic, or large heterogenous natural marine gene pools. . . ." (Fish and Game Code, Section 1580). In the Tulare Basin, there are two ER's both located in Tulare County.

No budget is designated specifically for management of ER's statewide. In theory, Regional staff are responsible for management of these areas. Necessary operation and maintenance costs are to be covered by Regional budgets.

In the Tulare Basin, Region Four of California Department of Fish and Game (DFG), there are no comprehensive site specific management plans for ER's which outline how individual elements are presumed to function and the management policy necessary to maintain these elements. There are no outlines of needed baseline research to facilitate development of

site-specific management programs. Unfortunately, there are no programs in DFG at any level which appear to be bringing any relief to this serious deficiency in management.

The existing management plans for ER's in the Tulare Basin are generalized documents outlining primary purpose and restricted activities. Restricted activities without permission from the Fish and Game Commission include: off road vehicle use, collecting, grazing, pets not on a leash, and introduction of exotic species.

Region Four staff are fully aware of the lack of species and community data and other data on which management decision should be based. Staff also recognize that by having no management this may jeopardize the long-term survival of the very elements for which the ER was created.

It appears this is a problem partially precipitated by a historical DFG focus on more game-oriented programs and a consequent lack of funds and commitment to non-game management.

U.S. Communications Agency

The U.S. Communications Agency has no program for management and protection of natural diversity. The Nature Conservancy has been involved in discussions with this Agency and USFWS to formalize "management overlay" which would provide for USFWS management, through Kern and Pixley Refuges, of the VOA site in Kern County.

U.S. Navy

While the U.S. Navy officially recognizes and manages Ecological Reserve Areas (ERA's) and Research Natural Areas (RNA's) on their lands, the Elk Hills Naval Petroleum Reserve in Kern County does not include any such designations. At sometime it may be appropriate for a detailed evaluation of the procedures and possible protection value of establishing an ERA or RNA at the Elk Hills site.

Bureau of Land Management

The Bureau of Land Management (BLM) has extensive land holdings throughout California with a variety of management designations. On the valley floor of the Tulare Basin, BLM presently owns a few small scattered parcels. An example of these parcels is approximately 200 acres of Iodine Bush Scrub south of Buena Vista Lake which is impacted by unauthorized (trespass) farming from nearby landowners.

City of Bakersfield

Bakersfield has park, recreation area, and ecological reserve designations which could be useful for the protection of natural diversity. Currently, the City of Bakersfield has filed a Draft EIR for development of percolation ponds along the Kern River on a viable remnant of Valley Mesquite Scrub (the most endangered plant community in California). Considerable public involvement may be necessary to secure an ecological reserve designation at this site.

5. ELEMENT PROTECTION MEASURES

A protection measure is the action or activity recommended to protect a given element. Therefore, protection measures are site specific. Table 5.1 identifies protection measures for important sites in the Tulare Basin. (Note that ranked elements in the second column are those elements from Table 4.1).

Protection measures for The Nature Conservancy preserves are not listed in Table 5.1. However, management and research focus for existing preserves is discussed in Section 5.2, Cooperative Management.

TABLE 5.1 - ELEMENT PROTECTION MEASURES

KINGS COUNTY

LOCATIONS	ELEMENTS/RANK	MANAGING AGENCY	MEASURES
South Wilbur Flood Area	Freshwater Marsh/B2.2 White-faced Ibis (nesting)	J.G. Boswell Co.	Cooperative Management; Improve nesting habitat*
Waste Water Disposal Ponds	Mud Flats Potential Marshland Snowy plover (nesting)	Tulare Lake Drainage District	Cooperative Management Improve nesting/feeding habitat*
Corcoran Irrigation District Ponds	Freshwater Marsh (potential)/ B2.2	Corcoran Irrigation District	Cooperative Management Improve nesting/feeding habitat*
Riparian Corridors along Deer Creek, Poso Creek, White River (also Tulare and Kern County)	Riparian Woodland/B1.2 Intermittent Stream	Irrigation Districts Various Private Owners	Cooperative Management/ Landowner notification

*See Appendix II; Outline and Information for Levee Vegetation Projects

TABLE 5.1 - ELEMENT PROTECTION MEASURES

TULARE COUNTY

LOCATIONS	ELEMENTS/RANK	MANAGING AGENCY	MEASURES
Pixley National Wildlife Refuge	San Joaquin Kit Fox/B2.1 Blunt-nosed Leopard Lizard/B1.2 Alkaline Grassland/B1 Sandy Soil Grassland	US Fish & Wildlife Service	Cooperative Management (especially with grassland)
Pixley Horse Pasture	Blunt-nosed Leopard Lizard/B1.2 San Joaquin Kit Fox/B2.1 Alkaline Grassland/B1	US Forest Service	Cooperative Management
Allensworth Ecological Preserve	Blunt-nosed Leopard Lizard/B1.2 Haplopappus Shrubland Nelson's Ground Squirrel/B2.2	California Fish & Game	Cooperative Management
Yaudanchi Ecological Preserve	Riparian Woodland/B1.2 Great Blue Herons (nesting)	California Fish & Game	Cooperative Management
Hogwallow Preserve	Northern Hardpan Vernal Pool/ B1	Tulare County Historical Society	Cooperative Management (Removal of Cattle)
Kaweah Oaks Preserve	Valley Oak Woodland/B1.1 Alkaline Meadow/A1.1 Great Blue Herons (nesting)	The Nature Conservancy	

TABLE 5.1 - ELEMENT PROTECTION MEASURES

TULARE COUNTY (CONTINUED)

LOCATIONS	ELEMENTS/RANK	MANAGING AGENCY	MEASURES
Creighton Ranch Preserve	Freshwater Marsh/B2.2 Riparian Woodland/B1.2 Iodine Bush Shrubland/BU Northern Claypan Vernal Pool/B1 Blunt-nosed Leopard Lizard/B1.2 Northern Harrier (nesting) Black-shouldered Kite (nesting) Great Blue Heron (nesting) Prairie Falcon (winter) Mountain Plover (winter) Alkaline Grassland/B1	The Nature Conservancy	
Pixley Vernal Pool Preserve	Northern Claypan Vernal Pools Alkaline Grassland/B1	The Nature Conservancy	
Pump Fields Northwest of Kaweah Oaks	Valley Oak Woodland/B1.1	Lindsay-Strathmore Irrigation District	Cooperative Management (Plant more trees)*
Tulare County Correctional Institution	Northern Claypan Vernal Pools Alkaline Grassland/B1	County of Tulare	Cooperative Management
Highway 43-County Line	Atriplex spinfera Shrubland/A2 Atriplex polycarpa Shrubland/A1 Iodine Bush Shrubland/BU San Joaquin Kit Fox/B2.1 Nelson's Ground Squirrel/B2.2	Private	

*See Appendix II

TABLE 5.1 - ELEMENT PROTECTION MEASURES

KERN COUNTY

LOCATIONS	ELEMENTS/RANK	MANAGING AGENCY	MEASURES
Kern National Wildlife Refuge	San Joaquin Kit Fox/B2.1 Blunt-nosed Leopard Lizard/B1.2 Slough Thistle/A2.1 Freshwater Marsh/B2.2 Iodine Bush Shrubland/BU	US F&W Service	Involvement in the development and implementation of the Refuge Management Plan; Cooperative Management
Paine Preserve (Including Semitropic Ridge)	Atriplex spinifera Shrubland Valley Floor Atriplex polycarpa Shrubland/A2 Iodine Bush Shrubland/BU San Joaquin Kit Fox/B2.1 Blunt-nosed Leopard Lizard/B1.2 Nelson's Ground Squirrel/B2.2 Tipton Kangaroo Rat Streptanthus californicus	The Nature Conservancy	
Sand Ridge Preserve	Atriplex polycarpa Shrubland Sierra Foothill Phase Opuntia basilaris var. treleasii/B1.1 Eriogonum gossypinum/B1.2 San Joaquin Kit Fox/B2.1 Blunt-nosed Leopard Lizard/B1.2	The Nature Conservancy	
Voice of America (Delano)	Atriplex polycarpa Shrubland/A1 Blunt-nosed Leopard Lizard/B1.2 San Joaquin Kit Fox/B2.1 Tipton Kangaroo Rat (Diverse Soils)	US Communications Agency	Wildlife Refuge Overlay (USFWS to manage) Cooperative management, i.e., grazing, impacts, ground squirrel control

TABLE 5.1 - ELEMENT PROTECTION MEASURES

KERN COUNTY (CONTINUED)

LOCATIONS	ELEMENTS/RANK	MANAGING AGENCY	MEASURES
Bakersfield Ground-water Recharge Area	Prosopis-Atriplex Shrubland/A1 Riparian Woodland/B1.2 Freshwater Marsh/B2.2	City of Bakersfield	Secure as an ecological preserve; Cooperative Management
Elk Hills Naval Petroleum Reserve	San Joaquin Kit Fox/B2.1 Blunt-nosed Leopard Lizard/B1.2 Coast Range Foothill Atriplex polycarpa Shrubland	US Navy	Secure as ecological preserve status, advise as to placement of roads and other facilities
Gator Pond	Alkaline seep & Spring margin/A1 Cordylanthus mollis hispidus/B1.2 Black-shouldered Kite (nesting) Atriplex tularensis/A1	J. G. Boswell Co.	Secure as Ecological Preserve; Cooperative Management
Goose Lake Bed	Alkaline Seeps/A1 Extensive Mud-flats Valley Floor Atriplex polycarpa Shrubland/A2 Iodine Bush Shrubland/BU Ecological Staircase San Joaquin Kit Fox/B2.1	Various Private Owners	Landowner Contact; Improve and protect native habitat*
Buena Vista Slough (South of Kern NWR)	Slough Thistle/A2.1 Freshwater Marsh/B2.2	Various Private Owners	Currently used for floodwater storage. Cooperative Management*; Landowner Notification

TABLE 5.1 - ELEMENT PROTECTION MEASURES

KERN COUNTY (CONTINUED)

LOCATIONS	ELEMENTS/RANK	MANAGING AGENCY	MEASURES
Carizzo Plain (San Luis Obispo Co.)	Spiny Saltbush Shrubland/A2 Coast Range Atriplex polycarpa Shrubland San Joaquin Kit Fox/B2.1 Blunt-nosed Leopard Lizard/B1.2 Nelson Ground Squirrel/B2.2 Giant Kangaroo Rat/B1.2 Atriplex vallicola/A1	Bureau of Land Management Various Private Owners	Cooperative Management
Tejon Ranch	Upland Valley Saltbush Unique Flower Fields Many rare plants on Commanche Ridge Layia leucopappa	Tejon Ranch Co.	Cooperative Management; Assist in Planning of Development

*See Appendix II

5.2 Cooperative Management: An Element Protection Measure

Cooperative management is defined here as joint or collective involvement with other agencies or entities in management activities. Conceivably, TNC involvement may take many forms. Through TNC staff or local membership, assistance in inventory, planning, research and implementing of management programs may be needed to catalyze a management effort for a critical element. For example, at the implementation stage, local legal assistance is needed to close a cattle leasing arrangement that has been allowed to seriously impair a protected site of vernal pools owned by Tulare County Historical Society. In another instance, field assistance may be needed annually in plant survey activity to provide the baseline information necessary for a controlled burn program to proceed on a Department of Fish and Game Ecological Reserve.

Why is cooperative management a consideration? Where critical habitat or important elements of natural diversity are located on land which is not a practical or cost effective acquisition, some form of cooperative management is a protection alternative.

Constrained budgets, conflicting management objectives and a lack of staff expertise are fundamental problems preventing public agencies from developing adequate management programs for many of the more sensitive elements of natural diversity. These problems will continue to obfuscate management efforts well beyond the Tulare Basin of California.

In addition, private land owners often lack the interest and expertise, as well as the capital, for protective management programs. Yet where tax dividend or deductions are possible through easements involving cooperative management, TNC may find viable partnerships.

Management and the concommitant research and planning continues to be an underdeveloped component of element protection efforts for all public

and private entities.* For a private organization interested in element protection, it may be easier to raise money for a new acquisition than for the purpose of expanding stewardship and management programs. This must be recognized as a technical problem and a perceptual hurdle to be creatively overcome.

As an initiator of cooperative management, it is important that TNC Preserves be the focus of exemplary planning and management. This increased emphasis on TNC preserve management serves four important functions.

1. Provides that TNC will develop the management experience and leadership necessary for initiating cooperative management programs.
2. Ensures that optimum attention and protection is provided for elements on TNC Preserves.
3. Stimulates dialogue and attention to management science on natural areas throughout the United States.
4. Allows for the accumulation of hard scientific data on natural processes and components, thus providing a foundation for improved decision-making and understanding of the environment.

While TNC is probably recognized as having one of the more advanced management programs in operation, it is the intention of this study to emphasize the need for a more intensive management program. TNC should continue to set the standard . . . and the standard should be significantly elevated for the above reasons.

The following outline for Species and Community Data** provides an example of the level of detail that should ideally be assembled for TNC Preserves. Other categories of information such as Historical and Physical Data should be equally developed.

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* California Significant Natural Areas Program Advisory Board; Meeting Minutes.

**Adapted from "Research Goals for Natural Areas," by Dennis Anderson. Natural Areas Journal, Volume 3, No.1.

Species Data

To create an adequate base of information from which management decisions can be made, compile from existing sources and/or fieldwork the following species data:

1. All historical data from herbarium and museum records, and literature or personal accounts on the flora and fauna in and around the area.

2. Voucher specimens, lists and population measurements, and/or estimates of species for:

   a. Selected microorganism groups.
   b. Selected non-vascular plant groups.
   c. All vascular plant groups.
   d. All vertebrate groups.

3. Autecology studies of selected species, including endangered and threatened species. Include studies of:

   a. Species' habitat requirements.
   b. Species' life histories.
   c. Species' interactions with other species.
   d. Species' "roles" in their communities.
   e. Species' reproductive viabilities and population trends.
   f. Parameters threatening species or their habitats.

4. Population trends of all or selected species per community type (i.e., a monitoring program of the genetic diversity or species richness of each community).

5. Data on how a given natural area complements other natural areas for species survival in the regional perspective. Data should be obtained on the sizes, shapes, relative positions, and community types of the different areas, and how well they provide for the inter-migration of species and the establishment of minimal ranges of appropriate habitat types.

Community Data

Compile from existing sources and/or fieldwork the following plant and/or animal community data:

1. All historic data from original land surveys, literature and personal accounts, and aerial photography on previous vegetation covers in and around each area. Where possible, obtain additional data from pollen, tree-ring, and remnant soil studies.

2. Quantitative data on the composition and structure of all major plant communities, correlating animal community data where possible. The data should be obtained on permanent plots, with comparative data taken from these plots at set intervals. Repetitious, standardized ground and/or aerial photographic records of these plots or communities should be made wherever useful.

3. Physical data on the areas studied for plant and animal communities. Gradient studies correlating the occurrences of community and physical parameters should be considered.

4. Impact assessment data where appropriate. The impacts of all major unusual factors (management factors; experimental factors; air, water and noise pollution; destructive natural grazing; disease; etc.) affecting the compositions or structures of communities should be assessed.

With a comparable level of investigation in several other categories, preserve managers and management advisory boards would begin to have the foundation of information necessary for decision making regarding the maintenance and expansion of select species and natural communities.

Tulare Basin Research Facility

It seems plausible, with the increasing interest in protection and management of natural diversity in the Tulare Basin, that a centralized research facility might be established in this area. (A research facility currently exists in a limited state at the Kern National Wildlife Refuge.) Such a facility could be supported by both public and private entities. Careful consideration as to how local farmers, irrigation districts, environmental education programs, and historical interest constituencies could participate and support this effort will be the key to its success.

In conclusion, a TNC commitment to element preservation directly leads to cooperative management scenarios. Increased involvement in cooperative management programs necessitates an expansion of TNC experience and leadership in stewardship and management programs. This phase of TNC development and initiative will facilitate broader recognition and discussion of management as the cornerstone of long-term natural diversity protection.

5.3 Specific Comments and Measures for Tulare Basin Birds

Endangered, Threatened, and Rare Bird Species

California Condor: The only action in Tulare Valley which may benefit this species is the preservation of much grassland in large unbroken parcels where these birds can forage undisturbed.

Bald Eagle: With historical breeding grounds in Tulare Lake altered, this bird winters in Tulare Valley and at adjacent foothill reservoirs. Breeding could be enhanced by reducing motorboat use in upper reaches of reservoir.

American Peregrine Falcon: Efforts are underway to reintroduce captive bred birds into historic breeding sites in adjacent ranges.

California Yellow-billed Cuckoo: It will be several years before this species is attracted to any potential Tulare Valley breeding sites. Cuckoos need more extensive and more mature cottonwood/willow riparian woodlands than exist today along Tulare Valley streams.

Least Bell's Vireo: Suitable habitat exists in several riparian areas in Tulare Valley. The question is whether this decimated race migrates into this area in suitable numbers today to repopulate potential habitat and whether the large Cowbird population would allow for successful reproduction.

Bird Species of Special Concern*

Highest Priority: Common Loon, White Pelican, White-faced Ibis, Fulvous Whistling Duck, Swainson's Hawk, Merlin and Willow Flycatcher.

Second Priority: Double-crested Cormorant, Marsh Hawk, Osprey, Snowy Plover, Burrowing Owl, Long-eared Owl, Short-eared Owl, Barn Swallow, Purple Martin, Yellow Warbler and Yellow-breasted Chat.

Third Priority: Least Bittern, Sharp-shinned Hawk, Cooper's Hawk, Golden Eagle, Prairie Falcon, Sandhill Crane, California Gull, Black Swift and LeConte's Thrasher.

The recommendations included in Van Remsen's "Bird Species of Special Concern in California," (Calif. DFG, 1978), are critically relevant for the Tulare Valley today. Freshwater marsh and associated freshwater islands need to be protected and enhanced in Tulare Valley. Creighton Ranch (especially with more control over water flows), South Wilbur Flood Area, and Kern National Wildlife Refuge are the major Tulare Valley Marsh systems. If permanent protection of South Wilbur Flood Area could be obtained, it would provide an unparalleled opportunity to protect imperiled wetland representatives of Tulare Valley avifauna. Goose Lake, alkali land in the western portion of Kern National Wildlife Refuge, and the Hacienda Ranch drainage basins in southern Tulare Lake Basin are important to Snowy Plover. Riparian woodland at Creighton Ranch is in good condition but this vegetation type has very limited representation in the valley. Valuable riparian areas in unprotected state still exist along Kings River near Centerville Kaweah River gravel pits below Terminus Reservoir, and on Tule River west of Porterville. Protection (not necessarily purchase) should be investigated. Grassland areas at Pixley National Wildlife Refuge, Poso Creek watershed, along the eastern edge of Tulare Basin, the area between Wheeler Ridge and the

*California DFG, 1978

Tehachapis and the head of Tulare Valley south of Bakersfield also need protection (these areas would benefit Mountain Plover, Sandhill Crane, California Condor, and several other raptors). Alkali areas and saltbush scrub near Paine Preserve, Kern National Wildlife Refuge and other southern Tulare Valley locations need rapid acquisition/protection for Roadrunner, LeConte's Thrasher, Sage Thrasher, Brewer's Sparrow and Sage Sparrow. Oak woodland at Kaweah Oaks Preserve was an important acquisition that must be carefully managed to preserve bird habitat. Other oak parks (Mooney's Grove, Burriss Park) and other oak areas near Hanford and LeMoore could be managed to better serve native birds; perhaps Magpie could even be reintroduced in the area.

Non-habitat considerations are Starling control to aid native cavity nesters and Cowbird control to aid small riparian passerines. All such comments can be expanded upon. This report serves primarily as a status report in hopes that more people will become aware of changes and what positive steps can be initiated to help Tulare Valley's birds.

APPENDIX

APPENDIX I

California National Diversity Data Base: Background and Information

In 1979, the State of California and TNC entered into an agreement to establish the CNDDB. Now under the jurisdiction of the Department of Fish and Game, the CNDDB is patterned after similar programs in twenty-seven other states. The CNDDB is a central location for the storage and maintenance of accurate up-to-date records regarding the locations of the rare, threatened, or otherwise unique elements of California's natural diversity. Information in the CNDDB serves two functions.

1. To aid in the systematic identification and selection of natural areas deserving protection.

2. To assist public and private planners in decision making so that needless conflicts between conservation and development can be avoided.

Through these two functions, it is anticipated that CNDDB will provide a solid basis for the development of a comprehensive resource management strategy for the state.

The basic unit of information for the CNDDB is the documented location of an element, or an "element occurrence." An "element" is defined as a natural feature of particular interest because it is exemplary, unique, threatened, or endangered on a statewide or national basis. At present, the elements being inventoried by the CNDDB include rare and endangered plants and animals, representative natural communities, both terrestrial and aquatic. An element occurrence is the mapped location where one of these elements occurs. Information on the distribution and ecology of each element is compiled from publications, museum specimens, public and

private organizations, interviews with specialists, and field work by CNDDB staff. Each element occurrence is mapped onto USGS topographic quadrangles, with the information relating to the element and element occurrence retrievable by both manual and computer based searches.

In this element-based inventory, important sites are identified by the type and number of elements which occur on them. This method ensures that ecologically important areas which are little known or unprotected will not be ignored. Sites on which highly endangered or many elements occur must, by definition receive a higher protection priority than those with occurrences of less threatened or fewer elements. Thus, the subjectivity which often accompanies the analysis and comparison of sites is reduced to a minimum.

With the rapid environmental changes in California, it is recognized that element inventories must be continually updated and refined, thus allowing the CNDDB to function as a source of current information on the State's natural diversity.

APPENDIX II

OUTLINE & INFORMATION FOR LEVEE VEGETATION PROJECTS

July 21, 1983

Dear Grant,

I have made a brief outline of the major points that should be considered in planning for trees and shrubs on levees in the Tulare Basin:

I. Purpose and function of the levee

- A. Flood control
  - 1. Stream/river bank
  - 2. Dikes in low-lying areas
- B. Water storage
  - 1. Irrigation run-off
  - 2. Water supply
- C. Channels and ditches for water transport
- D. Multiple purpose/function

II. Construction of the levee

- A. Dimensions
- B. Structural materials
- C. Structural problem history (e.g., burrowing animals, seepage, slumps, erosion)

III. Maintenance goals and needs

- A. Maintain crown roadways
- B. Maintain channel water carrying capacity
- C. Control levee erosion
- D. Provide slope visibility for damage inspection

IV. Biological/ecological considerations

- A. Goals of plantings (wildlife habitat, recreation, erosion control, multiple use, etc.)
- B. Plant species selection
  - 1. Fits with goals
  - 2. Fits with maintenance needs
  - 3 No potential to become a pest (e.g., tamarisk)

Concerning water use by plantings, no decent references exist on water use by native riparian/phreatophyte species, and none at all (to my knowledge) for the environment of the Tulare Basin. The technology of plant water relations research has recently made some amazing progress, but these new tools are just beginning to be applied to this problem. The older studies I mostly take with a grain of salt, although the figures often quoted for riparian/phreatophyte plant water use are only

1-3 acre-feet of water/year per acre of vegetation.

It would take a substantial number of trees planted in patches on the levees to make just one acre total, and one acre-foot of water is reasonably cheap for the farmers in the valley. In sum, I don't think this issue should be a serious consideration for levee vegetation management.

I recommend the following references on levees and their maintenance; the information is mostly about big flood control levees, but many of the principles would be the same for ditch banks, dikes, reclamation levees, etc.

1. "Guide for Vegetation on Project Levees" by the Reclamation Board.

2. An article from the Corps of Engineers' perspective by Michael Nolan, presented at the 1981 Riparian Systems Conference.

3. An excerpt from the draft DWR "Vegetation Managemnet Handbook," by the IPM Program (Diana Jacobs, A. L. Riley and using some work done by Sheila Darr under contract last year).

Two other references which have background information on the values of riparian/phreatophyte vegetation and water use by this type are:

4. Campbell, C. J., 1970. Ecological implications of riparian vegetation management. J. Soil and Water Conservation 25(2): 49-52.

5. Horton, Jerome S., and C. J. Campbell. 1974. Management of phreatophyte and riparian vegetation for maximum mulitple use values. USDA Forest Service Res. Pap. RM-117. 23p.

I hope this information will be useful. If you have questions, you can reach me at the Department of Water Resources or at my residence.

Diana Jacobs
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APPENDIX III

ELEMENT RANKING EXPLANATION

CNDDB	TNC	Explanation ("EO" = Element Occurrence)
1	(A1.1)	Critically rare and endangered. Unprotected full species with less than 6 EO's, or distinct communities with less than 20 EO's. Examples: Modoc Sucker, Western lily, Ione Chaparral.
2	(A1.2)	Critically rare, adequately protected. Full species with less than 6 EO's or distinct communities with less than 20 EO's. Examples: Owen's Pupfish, Swallenia alexandrae, Torrey Pine Forest.
3	(A2.1)	Endangered, unprotected. Full species with more than 5 EO's or distinct communities with less than 40 EO's. Examples: Inyo Mountain salamander, Mariposa pussy paws, San Diego Mesa Clay-pan Vernal Pools.
4	(A2.2)	Endangered, partial protection, full species with more than 5 EO's, or distinct communities with less than 40 EO's. Examples: Ashy Storm Petrel, Enceliopsis covillei, Southern Coastal Salt Marsh.
5	(B1.1)	Endangered subspecies and varieties with less than 6 EO's or critically rare subspecies with less than 6 EO's or phases of a community with less than 20 EO's. Examples: Morro Bay Kangaroo Rat, Presidio Manzanita, Northern Basalt Flow Vernal Pool.
6	(B1.2)	Threatened throughout range or endangered subspecies and varieties with more than 5 EO's or phases with more than 20 EO's. Examples: California Yellow-Billed Cuckoo, Death Valley perennial desert pools.
7	(B2)	Peripheral elements endangered in the state but not so outside the state or rare elements not threatened. Examples: Great Grey Owl, Big Tree Forest, desert limestone endemic plants.
8	(B3.1)	Peripheral elements threatened in the state but not so outside the state or uncommon and declining elements or uncommon with few good examples. Examples: Aleutian Canada Goose, Sphagnam bog.
9	(B3.2)	Widespread and declining. Watch list. Examples: Burrowing Owl, Ladyslipper, Alkali playa.
10	(BU)	Possibly in peril. Needs more information.

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NOTE: Additional notes and historical descriptions of the former Tulare Basin may be obtained through the following sources:

Fremontia; a publication of the California Native Plant Society.

The Plow; a publication of the Delano Historical Society.

Los Tulares; a publication of the Tulare County Historical Society.

Creighton Ranch (The Nature Conservancy); maintains limited files on former resources and conditions in the Tulare Basin.

Also, John Lindsay, Biology Teacher in the Three Rivers area has assembled an extensive collection of materials describing the former Tulare Basin. John would be a valuable contact in planning further historical research.