8 Description of the Parks

LOCATION AND GEOGRAPHY

Sequoia and Kings Canyon National Parks are located in the eastern part of central California. Park headquarters at Ash Mountain (in Sequoia National Park) is located 175 air miles north of Los Angeles and 215 air miles southeast of San Francisco. Both parks occupy the western slope of the Sierra Nevada, the 400- mile- long mountain range that forms the eastern edge of the California biological and cultural province. Combined acreage for the two parks is 865,257 acres.

Kings Canyon is the northern of the two parks and consists of two sections. The small, detached General Grant Grove section of Kings Canyon National Park preserves several groves of giant sequoia including the General Grant Grove, with the famous General Grant Tree, and the Redwood Canyon/Redwood Mountain Grove, which is the largest remaining natural giant sequoia grove in the world. This section of the park is mostly mixed conifer forest, and is readily accessible via paved highways.

The remainder of Kings Canyon National Park, which comprises over 90% of the total acreage of the park, is located to the east of General Grant Grove and forms the headwaters of the South and Middle Forks of the Kings River and the South Fork of the San Joaquin River. Both the South and Middle Forks of the Kings Rivers have extensive and spectacular glacial canyons. One portion of the South Fork canyon, known as the Kings Canyon, gives the entire park its name. The Kings Canyon, and its developed area, Cedar Grove, is the only portion of the main part of the park that is accessible by motor vehicle. Both the Kings Canyon, and its Middle Fork twin, Tehipite Valley, are glacial "Yosemites" – deeply incised glacial gorges with relatively flat floors and towering granite cliffs thousands of feet high. To the east of the canyons are the high peaks of the Sierra Crest culminating in 14,242- foot- high North Palisade, the highest point in the park. This is classic high Sierra country – barren alpine ridges and glacially scoured lake- filled basins.

Usually snow free only from late June until late October, the high country is accessible only via foot and horse trails. The Sierran crest forms the eastern boundary of the park. Altogether, Kings Canyon National Park contains 716.9 square miles.

Sequoia National Park lies south of Kings Canyon and adjoins it. The park consists of a single unit that rises from the low western foothills to the crest of the Sierra at 14,495- foot- high Mt. Whitney, the highest point in the 48 contiguous states. The western third of the park consists of two natural regions – a zone of foothill vegetation below 5,000 feet, and an extensive band of mixed conifer forest between 5,000 and 9,000 feet. This latter forest contains 32 separate giant sequoia groves, including the famous Giant Forest, which covers three square miles and contains the world's largest tree – General Sherman. Both the Generals Highway and the Mineral King Road provide vehicular access to this western third of the park. Immediately east

of the forest belt is the Great Western Divide, a north- south ridge that runs through the middle of Sequoia National Park. Peaks in the vicinity of the Divide rise as high as 13,802 feet.

The eastern half of the park consists of the alpine headwaters of the North Fork of the Kern River, the glacial trench of Kern Canyon and the Sierra Crest itself, which runs north- south and forms the eastern boundary of the park. All of this area, which comprises approximately two-thirds of Sequoia National Park, is designated wilderness. Like the eastern highlands of Kings Canyon National Park, the eastern portion of Sequoia is a high, cold land of stark beauty. Sequoia National Park contains 632.7 square miles.

The parks contain resources of geological, biological, cultural, and sociological value. In addition to holding national park status, the two reservations have also been designated as a unit of the International Biosphere Preserve Program and 85% of the parks has been designated wilderness.

GEOLOGY AND TOPOGRAPHY

The Sierra Nevada is generally considered to have been formed by the detachment and uplifting of a large portion of the earth's crust resulting in a massive block, or batholith, tilted to the west in a long, moderate slope which is segmented laterally by deep canyons.

In the area of Sequoia and Kings Canyon, the western edge of this fault lies several thousand feet below the level of the San Joaquin Valley, buried beneath the gravel, sand, and mud which has washed down the range. The eastern profile is characterized by a precipitous escarpment plunging from the upper reaches of the block to the Owens Valley below. The rugged topography ranges from 1,500 feet at the southwestern boundary to 14,495 feet at the summit of Mt. Whitney on the eastern crest.

The land surface of the parks has been deeply eroded by stream and glacial action. The South Fork of the San Joaquin River and the Middle and South Forks of the Kings River constitute the major hydrological drainages of Kings Canyon National Park. The canyons of the two forks of the Kings River are two of the deepest in the United States.

All five tributaries of the Kaweah River; North, South, East, Middle and Marble Forks - originate in and drain the western portion of Sequoia National Park. The Kern River drains the eastern portion of the park. Originating along the Great Western and Kings- Kern Divides, the Kern flows south rather than following the westerly flow of other major rivers of the Sierra Nevada.

About 2000 alpine lakes are found throughout the higher portions of the two parks. Most are not deep, as they occupy the shallow rock basins formed by glacial action. Numerous streams drain from high elevation lakes and springs into the larger river canyons.

The fundamental basis of the great tilted block which created the Sierra Nevada is igneous rock; granite in various forms and textures. Massive domes such as Moro Rock and Tehipite Dome are common, as well as perpendicular cliffs, exfoliated slabs, broken talus, rectangular blocks, and huge

boulders. Metamorphic rocks such as marble, schist, and quartzite are found throughout most of the parks. J.G. Moore has constructed geologic maps of several quadrangles, as well as discussed other geologic aspects of these parks (Moore and Dodge 1980).

Glacial action has extensively shaped the terrain of the parks. Several large canyons, all exhibiting the typical U- shaped valley, trend westward from the Sierra crest. Glaciers dot the higher elevations and have created the numerous lake basins characteristic of this region. Moraines outline the courses of the ancient glaciers and mark the extent of ice flows in the canyons.

The two parks contain over 200 known karst features. Several major cave systems have been located, including Lilburn Cave, which is the most extensive in California with over 17 miles of measured passages. The two parks contain some of the wildest and least- impacted caves in the United States.

SOILS

The soils of the parks are primarily granitic in origin. Depths vary from several feet in limited low elevation areas on the western slope, to a very thin or nonexistent soil mantle at higher elevations which resulted from glacial scouring in the alpine and subalpine areas. While no definitive soils map has been made for the parks, Storie (1953) has classified the soils of this general area as upland residuals, which have formed in place by the disintegration and decomposition of the underlying parent rock. Huntington and Akeson (1987) have mapped soils in the Kawaeh drainage.

This upland category is further divided into two groups, which are applicable to these parks. Rolling, hilly- to- steep upland having acid residual soils of good depth to bedrock are common to much of the timbered portion of the parks. These podzolic soils are characterized by depths of three to six feet to bedrock and a moderate to strongly acid reaction. Residual soils of very shallow depth to bedrock are found throughout most of the remainder of the parks, especially at the higher elevations.

CLIMATE

One of the unique characteristics of the Sierra Nevada is its climate. This area enjoys a relatively mild, Mediterranean climate with a distinct winter- spring wet season and an equally distinct summer- fall dry season. Lower elevations are generally warm and clear in winter and hot and dry during the summer, whereas higher elevations are cool during the summer, and cold in the winter.

The average annual temperature at Ash Mountain Headquarters (elevation 1,700 feet) is 63 F, with extremes of 114 F and 17 F having been recorded. Extremes of 91 F and 1 F have been recorded at Giant Forest (elevation 6,409 feet) where cool daytime and evening temperatures prevail during the summer and cold nights and moderate to relatively mild days are common during the winter.

The average annual precipitation in the lower elevation foothills at Ash Mountain is 27 inches. Lodgepole receives an average annual precipitation of around 47 inches, Grant Grove around 42 inches.

Most winter precipitation above 5,000 feet occurs in the form of snow. Mean snow depths at 6,400 feet average 40 inches with 17 inches of water content. Snow infrequently falls at the lower elevations in small amounts; it usually melts within a few days.

The general wind is from the west to southwest. Strong winds are rare at lower and middle altitudes but more common at higher elevations and ridgetops. Thunderhead downdrafts can be both erratic and intense. Canyon winds generally follow the daily pattern of blowing up- canyon during the day and down- canyon during the night.

Fritts and Gordon (1982) note, based on a reconstruction of precipitation patterns using tree rings, that long- term droughts, lasting as long as 60 years, have occurred during the last 400 years in California. They also note that "the period since 1890 has been one of precipitation surplus," relative to the last 400 years.

VEGETATION

Continuously varying climate, soils, and physiography, together with an elevational gradient from 1,500 to over 14,000 feet, support a rich variety of plant communities. For descriptive purposes these ecosystems are categorized primarily on the basis of dominant vegetation and their elevational limits.

In actuality, interrelated and interdependent ecosystems, primarily due to microenvironmental conditions, give this region of the Sierra Nevada a unique diversity.

The parks contain biological resources of the highest level of significance. Congress created Sequoia and General Grant National Parks in 1890 expressly to protect the giant sequoia. The General Sherman Tree, growing in Sequoia National Park's Giant Forest, is generally recognized as the largest sequoia and the largest living tree on earth. Three other trees in the Giant Forest, and the General Grant Tree in Kings Canyon National Park, complete the list of the five largest single organisms (excluding giant fungus and aspen clones) in the world.

Sequoia trees do not grow continuously through the mixed conifer forest belt, but rather in geographically limited areas called groves. In the Sierra Nevada, the only present natural home of the sequoias, the trees grow in roughly 75 separate groves. The 39 named groves in the two parks contain roughly one- third of all naturally occurring sequoias.

The biological resources of the two parks are not limited to the sequoias. Extensive tracts of Sierran mixed conifer forest surround the sequoia groves. This forest belt, which generally clothes the mountains at altitudes between 5,000 and 9,000 feet, covers much of the southern Sierra. On surrounding lands, however, the great majority of this forest zone is being managed for multiple use. As a result, the parks now contain the largest remaining old growth forest in the

southern Sierra. This forest is a very significant resource because its largely pristine nature gives it both a high recreational value and a very critical scientific value. Below the conifer forest, in the western portions of the Sierra, are the various plant communities and environments that together constitute the foothill region. Kings Canyon contains very little land within this natural zone; but in Sequoia National Park, the lower canyons of the several forks of the Kaweah River include extensive foothill lands. This environment, typified by blue oak savanna, chaparral, and oak woodland, covers much of lowland Central California outside the parks. However, very little of this non- park land is receiving any protection. In the southern Sierra Nevada, the foothill lands of Sequoia National Park are among the only foothill tracts currently designated for long- term preservation.

The remainder of the parks, most of it above 9,000 feet in altitude, can be described as High Sierra. This environment, which covers nearly as much acreage as the other two parks' environments combined, is a spectacular land of rugged, ice- sculptured alpine ridges and sparsely wooded lake- jeweled basins. As the heart of the largest wilderness area in California, these lands are of very high recreational and scientific significance.

Exotic plants have the potential to displace native plants and alter the structure and processes of native plant communities. Research biologists at the parks have recently completed baseline surveys identifying 154 exotic species within its boundaries. With several highly invasive species currently forming discrete populations within the parks and several poised along the parks' boundaries, a comprehensive management program focused on early detection and eradication will prevent many species from becoming widespread, ecologically damaging, and expensive problems.

WILDLIFE

The preservation of native wildlife within the two parks results naturally from the habitat protection that the parks afford and adds yet another level of biological significance. While the wildlife found within the parks does not differ significantly from that found naturally on surrounding lands, those lands are mostly undergoing profound changes in development. As a result, the wildlife protection function of the parks is becoming increasingly important. The regional survival of a number of species may ultimately be largely dependent upon the protection the parks provide.

The various plant communities of the parks support a rich diversity of wildlife species as both year- round residents and migratory visitors. Of the vertebrates, the parks are known to have 262 native terrestrial species, and nine more species may be present. Of the native vertebrates, four species are extirpated, and 145 are rare or uncommon. The 262 terrestrial vertebrates include four species of fully terrestrial amphibians, 21 species of reptiles, 168 species of birds, and 69 species of mammals. Rather than confining themselves to a single ecosystem, most species range between several of the habitats described. Far- ranging ungulates and predators such as the mule deer, black bear, mountain lion, red- tailed hawk, golden eagle, coyote, the rare wolverine, and fisher occur within its boundaries. The Sierra Nevada bighorn sheep herd, which spends the

summer in portions of the alpine and subalpine ecosystems of these parks, is estimated to have approximately 200 individuals as of 2002.

In addition to native wildlife species found in the parks, people have introduced a few exotic species. The Rio Grande turkey, starling, Virginia opossum, and House sparrow are occasionally seen at lower elevations. The chukar partridge has been observed in the alpine ecosystem. However, the incidence of these exotics is quite low. The beaver has extended its range from U.S. Forest Service land where it was introduced in the 1930s to the adjacent Kern Canyon portion of Sequoia National Park. This animal has had a significant impact on the area through activities such as cutting trees, building dams, and subsequent flooding of meadows.

AQUATIC RESOURCES

These parks contain a rich array of diverse wetlands and deepwater habitats. The entire area has been surveyed by the U.S. Fish and Wildlife Service as part of the National Wetlands Inventory. Therefore, summaries describing the surface area covered by the various wetland taxa are not yet available. The primary types of wetlands and deep- water habitats are persistent palustrine emergent (wet meadows), deciduous broad- leaved palustrine scrub- shrub (primarily willow thickets), upper perennial riverine (permanent rivers and streams), lacustrine (lakes), and open-water palustrine (ponds), and intermittent riverine (ephemeral streams). Many of the rivers and streams have riparian areas that are either forested palustrine (e.g., alder) or deciduous broad-leaved palustrine scrub- shrub (e.g., spice bush) along their banks.

Wetlands are some of the most important areas ecologically and also among the most fragile. In the Sierra Nevada Ecosystem Project, aquatic resources were identified as among the most impacted in the Sierra Nevada (SNEP 1996). On the other hand, wetlands are one of the great cleansers of human nutrients. As such, they help mitigate some of the nutrient impacts discussed above, and it is probably because of the responsiveness of wetlands to absorb nutrients that human nutrient enrichment was not found conclusively at high- use backcountry sites.

Water is a powerful attractant for people, and the interface between water and the terrestrial world is often a wetland. Wetlands and deep- water habitats are the stage for many park resource issues, most of which are discussed under the sections on water and native aquatic wildlife. Additional issues not discussed there relate to degradation of biological communities and structural landscapes in wetlands and deep- water habitats. Specific wetland issues include: 1) impacts to wetland flora and fauna as a consequence of grazing by pack stock, 2) impacts to riparian areas due to illegal trespass grazing, 3) destruction of wetland flora due to social trails forming around lakes, 4) exotic wetland flora, 5) degradation of stream banks in high- use areas, 6) disturbance of lake and stream bottoms by swimmers, waders, and anglers, 7) the need for floodplain studies in all developed areas of these parks, and 8) loss of natural fire as a force that influences the composition and structure of some wetlands.

For purposes of distinguishing aquatic fauna from terrestrial fauna, aquatic wildlife is defined as species that depend on occupying either lentic or lotic environments for all or portions of their life. These species may be either fully aquatic or amphibious. Aquatic wildlife does not include

species that frequent wetlands or deep- water habitats but which are not obligate occupants of (or dependent on) those environments (e.g., *Microtus longicaudus*).

Of the vertebrates, the parks are known to have 46 native species that fit this definition, and seven more species may be present. Of the 46 native vertebrates, one species (*Rana boylii*) is extirpated, and 33 are rare or uncommon. The 46 vertebrates include five fish taxa, six species of amphibians, three species of reptiles, 30 species of birds, and two species of mammals. One species is federally listed as threatened. Twelve are sensitive species. Sensitive species listings include federal sensitive, California sensitive, California protected, and Forest Service sensitive.

While there have been some studies of aquatic invertebrates (Abel 1977, 1984; Kubly 1983; Bradford *et al*. 1998; Kratz *et al*. 1994; Stoddard 1987; Taylor and Erman 1980; and Knapp et al 2001), known invertebrates have not been compiled into a master list. The broad taxonomic groups studied include both benthic invertebrates (primarily aquatic insects) and zooplankton. There are no known listed or sensitive aquatic invertebrates in these parks though some species merit special attention due to their scarcity.

The primary threats to native aquatic wildlife include competition and genetic introgression from exotic species. Thirteen vertebrate species have been introduced to the parks' aquatic environments and at least nine of these have become established. At least one aquatic invertebrate and several plants have been introduced into park waters. There is serious concern about the introduction of contaminants, especially biocides and pollutants from internal-combustion engines. Some native aquatic species are declining. There has been some anthropogenic alteration of aquatic habitats and there has been some harvest of select aquatic species.

SENSITIVE SPECIES

Sequoia and Kings Canyon National Parks support remarkably rich and diverse flora and fauna. The parks have over 1,400 taxa of vascular flora. Of these, 40 taxa have been identified as sensitive. The parks also support over 262 taxa of terrestrial vertebrates and 46 aquatic vertebrates. Of these, 47 taxa are considered sensitive.

The term sensitive is applied generally here to include those species that are state or federally listed, are rare or endemic in California, or have a limited distribution. Little is known about the status and habitat requirements of many sensitive species within the parks.

AIR RESOURCES

Air pollution is one of the most serious external threats to Sequoia and Kings Canyon National Parks. The parks have some of the worst air quality in the National Park Service and air pollution threatens the health and welfare of park resources, park staff, and visitors alike. Current research and monitoring indicates that ozone, acidic and nitrogen deposition, pesticide drift, and regional haze pose the most serious threats, though future research may reveal even

greater threats as yet unknown. The National Park Service Organic Act and the Clean Air Act mandate that these parks protect park resources and air quality related values from the adverse impacts of air pollution.

Most of the parks' air pollution originates in the San Joaquin Valley and is transported into these parks by prevailing winds (Roberts et. al. 1991). Four factors contribute to the area's high pollution levels: climate, lifestyle, population, and topography. Hot, dry summers create perfect conditions for smog formation. A spread- out, car- dependent society with the highest population growth in the state produces increasing numbers of mobile and small stationary emission sources. Bowl- like topography promotes nightly temperature inversions that trap and concentrate pollutants.

Unlike many other states, California has few large stationary sources of air pollution; mobile, area, and small stationary sources emit the majority of the state's pollutants. Mobile sources contribute 60% of the ozone pollution (1999 California Almanac). Mobile sources and agricultural activities together account for most of the direct PM10 emissions (particulate matter ten microns in diameter or less). Nitrate, sulfate, and organic particles formed indirectly through conversion of directly emitted pollutants can contribute the majority of the sulfur dioxide emissions. Vegetation (especially cotton, alfalfa, beans, tomatoes, pines and oaks) emits up to 70% of the hydrocarbons involved in ozone and organic particle formation.

CULTURAL RESOURCES

In addition to their rich natural diversity the parks preserve a rich, and by definition, unique cultural record of prehistoric and historic sites. It is estimated that five percent of the parks' collective acreage has been inventoried (surveyed) for the presence/absence of cultural resources. This figure translates into approximately 43,000 acres.

The earliest systematic inventories of cultural resources date from the late 1950s and early 1960s. Previous investigations, including interviews with Native Americans and early settlers, were infrequently conducted and tended to focus on the most highly visible sites and included extrapolations of knowledge from outside the parks. The compliance inventories of the mid-1960s to the 1990s have expanded the database of known cultural resources within the parks to 312 prehistoric sites, 110 historic sites, and 169 site leads. This database represents the best available information on the range of site types and human activities carried out over time in the parks (see Appendix H).

In general, the parks' known cultural resources span a time period of at least 3- 5,000 years, and almost certainly longer. These resources document prehistoric, historic, and even contemporary use of park areas. They run the gamut from well- defined and effectively permanent bedrock mortars (grinding holes) to log or lumber structures easily susceptible to loss from fire and decay to rock art sites, expansive vistas, and wild plant resources visited discretely by contemporary Native Americans for spiritual or cultural purposes.

Prehistoric Resources

Prehistoric cultural resources are those human- made sites, structures, features, or objects which pre- date the arrival of European or American explorers or settlers. By definition then, they are synonymous with Native American or American Indian use. At the time of the first Spanish movements into the Great Central Valley of California (circa 1800), the native groups living in the valley and the western foothills of the Sierra Nevada were the Yokuts and Monache (aka Western Mono) Indians (as referred to today). Prehistoric site types within the parks include small villages, lithic scatters (marking areas of stone tool production or use such as campsites), midden soils, bedrock mortars and basins, caves, stone circles and hunting blinds, pictographs, and petroglyphs.

Ethnographic Resources

Ethnographic resources are recognized as including combinations of natural resources and standard cultural resource types. The distinction traditionally made by agency managers between natural and cultural resources may not apply when focussing on ethnographic resources. These latter resource types can be locales where subsistence or religious (ceremonial) activities are conducted, by either groups or individuals, and include associated sites, structures, objects, and landscapes that are assigned cultural significance by traditional users. Ethnographic resources within the parks can include such things as the sites of historic villages or campsites, caves, rock art sites, traditional plant gathering areas, graves, landscapes, and vistas and other natural features (e.g., monoliths and promontories).

Historic Resources

Historic resources are those human- made sites, structures, features, or objects which date from the time of the arrival of European or American explorers and settlers up until the middle of the 20th century (i.e., at least 50 years of age). Historic sites, by definition then, can be of Native American association but are most often associated with Euroamerican use and occupation. Aspects of all of the episodes of historic activity can be found in historic sites in the parks. The associated site types include cattle camps, trails, sawmills, logging camps, stumps, shake piles, mines, trash dumps, hydroelectric dams and water flumes, the Colony Mill Road, military campsites, Civilian Conservation Corps- era ranger stations and roads, and NPS- constructed "Mission 66" facilities.

DEVELOPMENTS AND INFRASTRUCTURE RESOURCES

The park has five major developed areas with approximately 1,064 buildings in five sub- district areas. The development zone area in the park is about 1,000 acres in total size. The quality of the buildings range from well planned modern buildings that were adequately designed for protection against wildland fires to several hundred old buildings that are at risk of being significantly damaged or destroyed by fires. The total replacement value of the buildings within the park is well above 200 million dollars. Serving the developed areas are about 152 miles of paved and unpaved roads. There are uncounted miles of above ground powerlines and

telephone lines within four of the five developed areas that are mostly at risk of significant damage or destruction from unwanted wildland fires.

All five developed areas in the parks have significant wildland/urban intermix fire threats. The fire management program has been working for many years on mitigating these threats by using a combination of mechanical hazard abatement near the buildings and prescribed burning to create wide buffer zones around the developed areas.