# ECOLOGICAL SURVEY OF THE PROPOSED LONG CANYON RESEARCH NATURAL AREA SEQUOIA NATIONAL FOREST, KERN COUNTY, CALIFORNIA

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INTRODUCTION

The Long Canyon candidate Research Natural Area (LCRNA) is on the Greenhorn Ranger District of the Sequoia National Forest. The area was selected and nominated by the Sequoia National Forest as a candidate RNA in 1983 to preserve an example of California juniper *(Juniperus californica*[1]*),* single-leaf pinyon pine *(Pinus monophylla),* and Piute *cypress (Cupressus nevadensis)* target elements for the Southern Sierra Nevada Province.

The LCRNA as defined in this report covers 2389 acres (967 ha) including the entire drainage of Long Canyon south of the Forest Service Boundary between T 26 and 27 S Mount Diablo Base and Meridian (MDBM). This includes portions of sections 3, 4, 9, 10, 15, and 16 T 27S, R34E, MDBM. The approximate center of the proposed RNA is 35° 36′ N longitude and 118° 20′ W longitude

The overall topographic relief is substantial, ranging from about 3550 ft. at the mouth of Long Canyon to 6901 ft. atop Heald Peak (1082-2103 m) for a total elevation difference of 3351 ft. (1021 m).

Access (reference maps I and 2)
The LCRNA is accessible from the north across Bureau of Land Management (BLM) lands from State Highway 178. From the Greenhorn Ranger Station in Bakersfield drive east on Highway 178 toward Lake Isabella. Drive approximately 8.5 miles (13.7 km) east of the town of Lake Isabella to a point about 0.2 miles (O.3 km) east of the town of South Lake, turn South on Navaho Road. Travel approximately 0.2 miles (0.3 km) to a unnamed dirt road which turns south through a gate. Follow this road for approximately 2 miles (3.2 km) to the mouth of Long Canyon where a drift fence crosses the road. This is approximately 100 m north of the proposed RNA boundary.

Several other dirt roads cross the BLM land and approach the northern boundary to the east of this road (between Navaho Rd. and Weldon), however, the above road is in the best condition and is the easiest to follow.

Travel within the RNA is restricted by the steep slopes and the dense chaparral vegetation. The most accessible route to the upper elevations is via the un-maintained Forest Service trails 34E31, This trail begins near the end of the main access road and ascends the western boundary ridge. It continues to the southwestern edge of the RNA where it departs the area at about 6600 ft. (202m) elevation. It has not been maintained since the Bodfish Fire of 1984. However, it is still in good condition and is passable along the entire western periphery of the RNA. From the southwestern corner of the RNA it is possible to walk along the southern boundary ridge around to the northeast and reach the summit of Heald Peak. A fire in 1984 has opened up much of the vegetation in this area and as of 1989 walking was relatively easy along the entire ridgetop.

[1] tree taxonomy follows Little, E. R. Jr. 1979, Checklist of United States Trees (Native and Naturalized). Agriculture Handbook No. 541 U.S.D.A. Washington D.C.

Access to the Paiute cypress stands is also easiest from trail 34E31. The trail may be walked to point 5698 (see map 2) at which point it is possible to drop east along a spur ridge for approximately 0.5 miles (0.8 km) to the cypress stands.

Access to the lower elevations of Long Canyon is relatively easy by following the arroyo up the canyon to the south. However, after traveling about 0.75 mile (1.2 km) south, the canyon closes up and travel along the creek bed becomes more difficult. The roadbed continues into the RNA and is still passable by four-wheel-drive vehicles for about 0.5 miles (0.8 km) south of the RNA boundary. It stops along the southern side of the main arroyo near the southern extent of the bajada (alluvial fan) in the NW 1/4 SE 1.4 Sec. 4 (see map 2).

Cross-country travel in the RNA is generally easiest on south-facing slopes where open scrub and grassland predominate. The north- and east-facing exposures are dominated by relatively impenetrable desert chaparral. The steep marble outcrop forming the northeastern boundary may be ascended to the summit area of Heald Peak. This is a shorter, but more time-consuming and laborious route to the summit than that previously described.

PRINCIPAL DISTINGUISHING FEATURES

The LCRNA has been nominated to represent the Piute cypress, California juniper, and single-leaf pinyon pine target elements for the Southern Sierra Nevada province, The Piute cypress stands at Long Canyon represent one of the easternmost populations of this localized species. It was not known at the time of Griffin and Critchfield's (1972) map of the species' distribution. The local stands cover about 20 acres (B. I ha). The majority of the area was burned in 1984) where cypress seedlings are now relatively common. A smaller portion was spared from the fire and appears to date back to a fire approximately 35 years prior to the last fire.

The California juniper vegetation at LCRNA was much more extensive prior to the 1984 Bodfish Fire. Charred snags and stems of juniper indicate a woodland on portions of the west boundary ridge up to 6500 ft. (1981 m). Virtually all of this high elevation woodland is gone from the western side of the area. The only remaining California juniper-dominated vegetation occurs on a portion of the marble outcrop forming the northeastern boundary of the area and as a few small groves scattered in the bajada slope of the lowest elevations. As will be discussed further, the LCRNA is not recommended as a California juniper target.

The pinyon forest of the upper elevations of the LCRNA was also affected by the **f**ire of 1984. However, damage to this vegetation type was not as widespread as to the California juniper. Extensive pinyon forest still exists on the west and nw-facing slopes of Heald Peak. There are also interesting transitional communities featuring pinyon pine and various subdominants such as Digger pine *(Pinus sabiniana***),** canyon live oak *(Quecus chrysolepis)* and several chaparral shrubs. These transitional stands occupy relatively **f**ire protected areas on north-facing slopes at midelevations, and indicate a blend of environmental conditions favoring cismontane and desert species.

The most extensive vegetation in the RNA is desert chaparral (Holland 1986). This vegetation was not originally selected as a target for the area (it was not considered a PSW target element when the LCRNA was first recommended). However, it exhibits great variation not only in successional state,, as a result of differential effects of fire history, but also as a result of slope exposure, elevation, and geological substrate. It is recommended that the desert chaparral target be substituted for the California juniper target in this RNA.

Long Canyon is highly varied topographically and geologically. There is a great elevational range and a variety of slope exposures. Rock types vary from metamorphic schists, gneisses, and marbles to granitics. Virtually the entire drainage is contained within the proposed boundaries,

JUSTIFICATIONS FOR ESTABLISHMENT

Piute Cypress:
The Long Canyon candidate RNA is one of two Forest Service areas chosen to preserve populations of this rare endemic to the Southern Sierra Nevada province. The other area is the Bodfish Paiute Cypress Botanical Area. This area occupying all of section 30 T275, R 33E was set aside to preserve the type locality and largest stand of Piute cypress. It lies approximately nine miles (14.5 km) west-southwest of the Long Canyon stand.

Piute cypress is known from about 10 sites in the drainage of the Kern River in Kern and southern Tulare Counties (Griffin and Critchfield 1972). It is considered by Little (1979) to be a variety of Arizona cypress (*C. arizonica var. nevadensis*). However, recent genetic work suggests that it may be more closely related to the coastal cypresses such as *C. goveniana, C. abramsiana, C. pygmaea, and C. sargentii* (Connie Miller, pers. comm. April 1990). Aside from Baker cypress (*C. bakeri*) it is known from higher elevations than any other cypress in North America, ranging to about 6000 ft. (1829 m) at the Bodfish grove (Vogl et al. 1977).

As with other cypresses in California, Piute cypress is a fire-adapted, sero~inous-coned species, requiring fire for effective dispersal and regeneration. Fire history of each of the approximately 10 stands known varies (Twisselmann 1967). Some stands, such as the Back Canyon stand, are relatively old (over 100 years). The Bodfish stand appears to have a varied fire history with some young and old trees. Other smaller stands are even-aged; e.g. Hobo Ridge (fire 1966), Stormy Canyon (fire 1924).

The stands at Long Canyon, though small in extent have varied fire history. This variation in age is one of the most significant aspects of the local population. Over half of the area dominated by cypress burned in 1984. Most of the remaining trees date back to a fire ca. 1954. A few older survivors also exist in protected areas. Seedling regeneration was fair to good in the recently burned areas with up to 75 seedlings counted on 100 $m^2$ (7500/ha).

Unlike many other cypresses in California, Piute cypress appears to have a relatively wide tolerance of soil types. Twisselmann (1967) indicates that stands may occur on heavy black clay, ultra-fine red clay, and decomposed and fractured granite. The stands at Long Canyon occur primarily on dark metamorphics, with prominent quartz banding (schist, *sensu lato)*. Granitic soils immediately adjacent to the stands are without cypress.

The Piute cypress is the most xerophytic of the California cypresses. Average rainfall over the sites shown in Griffin and Critchfield (1972) ranges between 8 and 16 inches (203-406 mm) per year (Rantz 1972). All other cypress populations in California average at least 20 inches (508 mm) per year (Rantz, op. cit.). Possibly as a result of the xeric nature of the environment, the Piute cypress have very active resin glands on the leaf scales. These glands are located well above the middle of the scale, and are visible even on the newest leaves. In many cases the older leaves are entirely coated in this whitish resin, and most of the trees have a distinct glaucous look from a distance. The resin undoubtedly protects the foliage from excessive moisture loss due to evapotranspiration.

Slope exposure is relatively important to the cypress at Long Canyon. Few individuals exist on aspects south of ENE or WNW." The largest trees occur in draws on n-f acing slopes, with stature progressively declining up-slope away from mesic conditions (photo 1).

Desert Chaparral

This is a transitional vegetation type (also known as desert-transition, or semi-desert chaparral) containing a mixture of cismontane chaparral shrubs and cool or hot desert species. This vegetation type is not well studied, although, it has been recognized since 1936 (Clements 1936). It is widespread in the southern half of California adjacent to deserts. Holland (1986) characterizes a semi-desert chaparral (code 37400) commonly ranging between 2000 and 5000 ft. (610-1524 m). This vegetation occupies the inner South Coast Ranges from San Benito County to Kern County, extending into northern Ventura and Santa Barbara counties) and also occupies the interior slopes of the Transverse and Peninsular Ranges bordering the Mojave and Colorado deserts north to Kern County.

Twisselmann (1967 states that the typical chaparral of Kern County differs from many other areas in its relative xericness. Rainfall, he states, is lower and winter temperatures are colder than in most chaparral areas. Such widespread dominant species as chamise *(Adenostoma fasciculatum)* are rare and often only the most drought-resistant species of the typical chaparral genera *(Arctostaphylos, Ceanotbus, Quercus)* constitute the dominants of the local chaparral. Thorne (1976) and Holland (1986) discuss the relatively open nature of the desert (or desert transition) chaparral and its mixture of cold desert and typical cismontane chaparral plants. Hanes (1977) suggests that due to its open nature desert chaparral has low fire frequencies. Cover is usually less than 50% and thus, it is more open than all types except serpentine and some montane chaparrals (Hanes op. cit.)

Hanes (1977) lists the following species as dominants of desert chaparral: *Adenostoma fasciculatum, Arctostaphylos glauca, Ceanothus greggi* ssp. *perplexans and* ssp. *vestitus, Cercocarpus betuloides, Dendromecon rigida, Ephedra* spp., *Eriodictyon trichocalyx, Eriogonum fasciculatum, Frementodendron californicum, Garrya flavescens var. pallida, Juniperus californica, Opuntia spp., Prunus fremontii, P. fasciculatum, Purshia tridentate, Quercus turbenella var. californica, Rhus trilobatta, and Yucca whipplei.* Thorne (1976) also mentions *Covania mexicana, Arctostaphylos pungens, Ceanothus leucodermis, C. crassifolius, and C. cuneatus* as typical species. Beauchamp (1986) considers additional species such as *Thmanosma montana, Ziziphus parryi, Nolina bigelovei, Coleogyne ramosissima, and Quercus Cornelius-mulleri* as important members of the community of San Diego County.

The desert chaparral at Long Canyon is variable in composition and density depending upon elevation, slope exposure, and soil type. North-facing stands are relatively dense and dominated by cismontane species such a *Ceanothus greggi ssp. vestitus, Fremontodendron californicum* and *Arctostapbylos, qlauca.* High elevation ridge crest stands on granitic soil may be dominated by cool desert species such as big sagebrush *(Artemisia tridentata), Ephedra viridis,* and others. South-slope dominants include California juniper, *Yucca whipplei, Haplopappus linearifolius, Erioqonum fasciculatum, and Encelia virginiensis.* Low elevation gently sloping sites have mixtures of cismontane woodland species such as Digger pine and scrub interior live oak *(Quercus wisilzenii var. fructescens)* with xerophytic species characteristic of deep soils such as *Senecio douglasii and Chrysothamnus nausiosus.* Variation is also expressed successionally as a result of the recent 1984 fire. About half of the western side of the drainage was burned and exhibits varying types of secondary succession.

Despite the numerous brief references to the type and its relatively wide distribution, little appears to be known of the successional seres, fire frequency, and other ecological aspects of this community. Long Canyon is the first candidate RNA to represent this vegetation type in the Pacific Southwest Region. The extensive stands of this vegetation in various forms and successional states should be of value to researchers wishing to study this interesting vegetation, transitional between desert and Mediterranean climates.

Rare Plants:
The following species listed by the California Native Plant Society (Smith and Berg 1988**)** are known from within, or in the immediate vicinity of the LCRN: Piute cypress (list 1b**),** *Delphlnium purpusii* (list 4**),** *Streptanthus cordatus var. piutensis* (list 1b) dudleya calcicola (list 4), and Eriogonum breedlovei var. breedlovei (list 1b) Navarretia setiloba (list 1b) may be in the area (known from nearby foothill grasslands, pinyon, pine forest, and cismontane woodland).

*Delphinium purpusii* is a Southern Sierra Nevada endemic which is notable as being the only pink flowered *Delphinium* in North America (Twisselmann 1967) (photo 2). It is relatively common and conspicuous in shady rock crevices, particularly on the marble outcrop, along the eastern boundary. It is characterized as a limestone endemic by Smith and Berg (1988), however it occurs off of limestone on other metamorphics and to a

lesser extent on granitics throughout the LCRNA.

*Streptanthus cordatus var. plutensis,* is a local endemic to Kern County. It is characterized as a species of clay soils. A plant closely resembling this taxon (although not positively determined yet) occurs locally. It is relatively common on the upper reaches of the marble outcrop, where It tends to grow in semi-shaded areas with some soil development (photo 3).

*Dudleya calicola* is a Southern Sierra endemic, characterized as a limestone endemic by Bartel and Shevock (1983). Nakai (1987) describes additional sites off of limestone. At LCRNA the plant appears about equally common on granitics, marble and schist. It is widespread through out the lower and middle elevations in rock outcrops. Flower color varies from yellow to greenish yellow.

*Eriogonum breedlovei var. breedlovei* is a rare endemic to the Piute Mountains of Kern County. It has been reported from cancarious substrates in the vicinity of Heald Peak (Smith and Berg 1988), although it was not identified during the field work for this ecological survey. With further exploration it is likely to be found on marble in the RNA.

Pinyon Forest:
The single leaf pinyon pine forest of the upper elevations of LCRNA is extensive and varied. At low elevations on north slopes it intergrades with several plant communities with cismontane elements such as Digger pine, canyon live oak, and various species of the chaparral. At upper elevations it is well developed and covers large areas of north, west, and east-facing exposures. Portions of the upper elevation stands were burned in 1984 and exhibit interesting successional seres with a mixture of cismontane and montane successional species. Other portions of the pinyon forest appear to have been burned perhaps 35 years ago, with young trees and resprouts of canyon live oak. The vegetation occurs largely on soils derived from schistose metamorphic rock, but also occurs on granitic and marble substrates.

Limestone Values and Geologic Diversity:
A prominent band of marble runs up the eastern boundary ridge from the northeastern comer of the area to approximately 6350 ft. (1935 m) elevation. Along this outcrop grow a number of interesting plants characteristic of limestone substrates. These include principally desert species such as *Forsellesia nevadensis, Criptanthaa confertiflora,* and *Cheilanthes jonesii;* local endemics such as *Delphinium purpusii and Dudleya calycina,* as well as several wide ranging species which are n highest local densities on limestone such as *Salvia dorrii, Stipa speciosa, Eriogonum plumatella, Selaginella asprella, Haplopappus (cf.) palmeri ssp. Pachylepis, and Oruzopsis humenoides.*

Although not characterized as a limestone endemic, *Streptanthus* (cf*.) cordatus, var. piutensis*, another local rare species appears to be largely restricted to the marble at LCRNA. In addition to the species locally restricted to limestone, the best remaining stands of California juniper exist on this outcrop.

The LCRNA is principally underlain by metamorphic rocks including schists,

phyllites, and gneisses. However, the upper elevations also have extensive outcropp ings of granitic rocks. Although not as well defined as the marble, these substrates also have their varying influences on the vegetation of the area. Deep decomposed granitic soils along the upper ridges are the only habitat for such herbaceous species as *Oreochaenactis thysanocarpha, Mimulus fremontii x viscidlus, Calyptridium parryi*, *and Allium burlewii.* The few small stands of Jeffrey pine *(Pinus jeffreyi)* are restricted to granitic soils at the head of Long Canyon. The schistose summit of Heald Peak supports a dense pinyon forest, while the adjacent granitic summit area is dominated by a high elevation form of desert chaparral.

Rare Fauna:
The golden eagle *(Aquila chrysaetos)* and the gray vireo *(Vireo vicinior)* were seen several times in the LCRNA. Both species are considered species of special concern by the State Fish and Game (Steinhart 1990). Golden eagles were seen soaring several times in different parts of the area (particularly over the eastern side).

Gray vireos were found singing from the desert chaparral in several areas in the northeastern portion of the RNA, and are presumed to breed here. This species is restricted in its habitat to pinyon and juniper woodland, and desert chaparral in California. With few and widely scattered breeding sites (Small 1974). It is thought to have suffered declines in its population as a result of brown-headed cowbird *(Molothrus ater)* parasitism.

PHYSICAL AND CLIMATIC CONDITIONS

The LCRNA lies at the northeastern end of the Piute Mountains, a small range separated from the main southern Sierra Nevada by the valley of the Kern River. Although the LCRNA is in the drainage of the South Fork of the Kern River, which flows westward into the Buena Vista basin of the San Joaquin Valley, it is a dry area with substantial desert influence. The broad valley of the Kern River between the Kernville and Onyx exhibits a rapid west – to – east gradation from cismontane to desert vegetation. Long Canyon lies about halfway along this gradient. Only two miles to the east in Kelso Valley are extensive stands of Joshua trees *(Yucca brevifolia var. jaegeri)* and other characteristic Mojave Desert vegetation types, while typical cismontane California species such as blue oak *(Quercus douqlasii),* which occur a few miles to the west at similar elevations, are absent at Long Canyon. The desert-cismontane mix is apparent from the lowest to the highest elevations at LCRNA. Desert olive *(Foresteria neo-mexicana)* and interior live oak *(Quercus wislizenii)* may occur side by side In the low elevation arroyos, while pinyon pine and shin oak *(Quercus garryana var. brewerii)* may co-occur at the upper elevations.

The LCRNA is geologically diverse, dominated by pre-Cenozoic metasedimentary rocks including schists, phyllite and marbles. These rocks are most prevalent in the northern and western parts of the RNA. Mesozoic granitic rock dominates on the southwestern side of the area and intrudes portions of the eastern part of the area. At these points of intrusion gneissic intergrades are also present. The granitic rocks are part of the Sierra

Nevada Batholith and are Mesozoic (Bateman 1981).

There is some evidence of a fault existing on the north side of the Piutes separating the South Fork of the Kern Valley from the precipitous slope of the Piutes to the south (Jennings et al. 1977). This presumed fault lies very close to the northern RNA boundary. The Piutes rise abruptly from the alluvium-filled valley of the Kern River. Consequently, temperature and precipitation change rapidly with elevation In the RNA.

No temperature or precipitation recording stations exist within or adjacent to the RNA. The closest station recording year-round precipitation data is Wofford Heights approximately nine miles (14.5 km) northwest of the Southwestern edge of the RNA and at an elevation of 2625 ft. (800.1 m), about 2575 ft. (785 m) lower than median elevation (5200 ft., 1585 ~m) of the LCRNA. The following table summarizes the 1941-1970 average mean monthly precipitation for Wofford Heights in inches (with mm beneath)[2].

Table 1: A thirty year average monthly precipitation record for Wofford Heights.

| | Jan. | Feb. | Mar. | Apr. | May. | Jun. | Jul. | Aug. | Sept. | Oct. | Nov. | Dec. | Tot. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| inches | 2.36 | 1.92 | 1.49 | 0.84 | 0.17 | 0.05 | 0.06 | 0.20 | 0.14 | 0.26 | 1.16 | 2.05 | 10.70 |
| mm | 59.9 | 48.8 | 37.9 | 21.3 | 4.3 | 1.3 | 1.5 | 5.1 | 3.6 | 6.6 | 29.5 | 52.1 | 271.8 |

It is likely that precipitation at the upper elevations averages about 16 inches (406 mm) per year, while the lowest elevations average about eight inches (203 mm) annually (Rantz 1972).

Temperature data is also likely to change strongly depending on elevation. However, this variation is not possible to demonstrate given the small scale of temperature maps available and the lack of any real data. At the upper elevations It is assumed that snow falls regularly and may linger on the ground in protected areas (sheltered north-slopes) for many weeks during the winter. The average frost-free period probably varies from around 240 days at the lowest elevations to only about 180 days at the upper elevations. Lowest temperatures probably come to the area in mid-January and highest temperatures occur from mid- to late July. Depending on elevation there are probably from 30 to 90 days with the maximum temperature exceeding 90° F (32°C) (projected data from Donely et al 1979).

According to C.W. Thornwaite (cited in Donely et al. 1979) the area of Long Canyon is in a semi-arid moisture region where there is an average annual water deficit of 7.8-15.7 inches (20-40 cm) and an average annual water surplus of 0 to less than 7.8 inches (0-20 -

[2] data from Goodrige, J.D. 1981. California Rainfall Summary. State of California Department of Water Resources, Sacramento.

cm). The area borders between a Mediterranean climate characterized by precipitation averaging more than potential evaporation with the average of the coldest month between 0 and 64° F (0-18° C) and the average of the warmest month greater than 720 F (22° C); and a steppe climate with precipitation more than half but less than potential evaporation and the average of the coldest month >32° F (0° C).

During the visit for this ecological survey (May 28-31, 1989) temperatures were unseasonably cold as a result of a weak low pressure system which produced low cumulus clouds and strong winds on three days. Low temperatures at the lowest elevation on the northern boundary varied from 40-49° F (4-9° C) while high temperatures were 63-71° F (17-22°C).

VEGETATION AND FLORA

The flora of the LCRNA is relatively rich for a xeric site, containing at least 245 taxa of vascular plants (Appendix 1). The relatively high number of species is a factor of habitat diversity as a result of elevations diversity, topographic complexity, and substrate diversity. The large recently burned area also increases diversity due to a number of fire following ephemeral species.

The majority of the five rare species known from the RNA are at least somewhat associated with the marble outcrop along the northeastern boundary. These species have been discussed in the justifications section.

Vegetation Types:
The vegetation map (Map 3) is organized based on the system of Holland (1986). Following is a description of the major plant associations occurring in the LCRNA. Table 2 gives the acreages of the vegetation types. The code numbers following the names of the associations are Holland type numbers. Associations are listed in order of decreasing size. See Table 2 for acreage of Holland and equivalent Kuchler (1966), and SAF (Eyre 1980) vegetation types.

Desert Chaparral (37400):
This is the most widespread vegetation type in the RNA. It ranges from 3550 ft. (1082 m) a long the arroyo banks on the northern boundary to 6800 ft (2073 m) near the summit of Heald Peak. Within this broad elevations range the structure, dominants, exposures and soils vary substantially. Throughout the area the principal dominants are *Ceanothus greggi;I var. vestitus, Fremontodendron californicum, Ephedra viridis, Artemisia tridentata, and Garrya flavescens* ssp. *Pallida.* However, there are several sub-types.

Generally the densest and most extensive stands occur on northerly-facing slopes. On these exposures shrub height is usually about 3to5ft. (1-5.5m) and ground cover averages 60 to 75%. Most of these stands were unburned in the 1984 fire and may have sustained fires in the mid-1950's, and some again in the late 1960's or early 1970's. *Ceanothus qreggii var. vestitus* is usually dominant with *Fremontodendron* as the principal sub-dominant. *Garrya flavescens, Cercocarpus betuloides*, *Arctostaphylos glauca,* shrubby

interior live oak, *Artemisia tridentata, Haplopappus linearifolius* var *interior*, *and Ephedra virids* are the other principal species.

Herbs are fairly common in the openings and semi-shade of shrubs. Principal understory species include: *Lomatium dissectum, Melicaaa stricta, Delphinium purpusii, Balsamorhiza deltoidea, Areneria macrandenia var. arcuifolia, Castilleja jepsonii, Galium hallii, Erysimum moniliforme, Claytone spathulata, and Gilia interior.*

Table 2: Acreage of vegetation types in Long Canyon candidate RNA.

| Vegetation Type with Holland (1986), Kuchler (1966), and SAF (Eyre 1980) code equivalents\ | Acres | Hectares | % of Total |
|---|---|---|---|
| Desert Chaparral (H37400, K29, no SAF) | 1042 | 421.7 | 43.7 |
| (burned desert chaparral) | (266) | (107.60) | (11.1) |
| (montane desert chaparral) | (50) | (20.2) | (2.1) |
| Pinyon Woodland (H72210, K21, SAF 239) | 525 | 212.5 | 22.0 |
| (burned pinyon woodland) | (29) | (11.7) | (1.2) |
| Annual Grassland (H42210, K41, no SAF) | 492 | 199.1 | 20.6 |
| Digger Pine Woodland (H71300, K26±; SAF 250±) | 115 | 46.5 | 4.8 |
| Shin Oak Brush (H37541, no K or SAF) | 89 | 36.1 | 3.7 |
| (burned shin oak brush) | (56) | (22.7) | (2.3) |
| Jeffrey Pine Forest (H85100, no K, SAF 247) | 55 | 22.3 | 2.3 |
| (burned Jeffrey pine forest) | (29) | (11.7) | (1.2) |
| Limestone outcrop (no H.K. or SAF) | 22 | 8.9 | 0.9 |
| Plute Cypress (83330) no K or SAF) | 20 | 8.1 | 0.8 |
| (burned Piute cypress) | (14) | (5.7) | (0.6) |
| White Alder Riparian Forest (H61 01, no K or SAF) | 15 | 6.1 | 0.6 |
| California Juniper Woodland (H72400, no K or SAF) | 12 | 4.9 | 0.5 |
| unvegetated rock outcrop | 2 | 0.8 | 0.1 |
| Totals | 2389 | 967.0 | 100.0 |

This modal type of desert chaparral is relatively uniform in composition on all north exposures on schistose substrates (photos 4 and 5). However, there is a tendency for *Artemisia tridentata* to increase in dominance with elevation. This trend reaches its apex at the saddle area at the head of the drainage on the southern edge of the RNA (photo 6). Here at about 6200 ft., *A. tridentata* is dominant (ca. 65% relative cover), with *Ephedra viridis* (12% rel. cover), *Ceanothus greggii var. vestitus (*10% rel. cover), *Garrya flavescens* (7% rel. cover), and *Fremontodendron* (6% rel. cover).

A distinctive sub type of desert chaparral occurs on the granitic summit area of Heald Peak (photo 8). It is shown on map 3 as montane desert chaparral. This vegetation is co-dominated by *Arctostaphylos glauca,* scrubby canyon live oak, and Ceanothus greggii var. vestitus. It is broken by outcrops and small open patches of decomposed granitic soil. In the rocky areas *Symphoricarpos parishii, Holodiscus boursieri, Ribes velutinum var. glanduliferum, Ephedra viridis, Haplopappus linearifolius ssp. Interior,*

*Chrysothamnus viscidiflorus, and Leptodactylon pungens ssp. Pulchriflorum* are common shrubs along with herbs such as *Penstemon newberryi* and *Heuchera rubescens var. alpicola.* In the open gravely areas herbs such as *Gayophytum diffusum ssp. Parviflorum, Calyptridium parryi, Mimulus fremontii, Eriophyllum pringlei, and Allium burlewii* may occur. Several long-dead fallen trunks of Jeffrey pine occur in this rolling summit area, indicating a relatively recent local extinction of this species.

A low elevation type of desert chaparral occurs on moderate to gently sloping exposures in the lower part of Long Canyon. Here, shrub cover is relatively low, still dominated by *Ceanothus gregii* and *Fremontodendron*, but with occasional California juniper, *Ceanothus leucodermis*, Digger pine) and *Yucca whipplei. Haplopappus linearifolius* is a common shrub. This sub-type has large openings dominated by annual grasses and herbs such as *Bromus rubens*, *Erodium cicutarium, Calochortus venustus, Allium campanulatum* and *Gilia interior*. This vegetation grades into the Digger pine woodland and annual grassland of the relatively flat alluvial terraces (see later sections).

Much of the variation in the local desert chaparral comes from the effects of the fire in 1984. Areas burned in this fire that were formerly dominated by desert chaparral shrubs have a diverse composition depending upon elevation and slope exposure. Most northerly-facing burned slopes are exhibiting rapid recovery of the former shrub cover. *Fremontodendron* already gained dominance in cover (up to 5 ft., 1.5m, high in 4.5 years). However, seedlings of the non-sprouting *Ceanothus gregii* ssp. *vestitus* are abundant in most areas (averaging about, 150/100 m$^2$), 12 inches (30 cm) in height and 18 inches (46 cm) in spread). Based on their current densities and growth rates, they will come to dominate the bums in less than five years (photo 8). Other subordinate shrub species of mature chaparral show little variation in relative density and cover as seedlings or resprouts. Resprouters of moderate to low density on most burns include *Ephedra, Viridis, Cercocarpus betuloides*, and *Garrya flavescens*. Obligate seeders include *Artemisia* tridentate *haplopappus linearifolius*, and *Ceanothus leucodermis*.

The greatest compositional change between the recently burned and unburned stands of desert chaparral at Long Canyon involves the increased densities of post-fire herbaceous species. Four-and-a-half years after the fire, many of the chaparral slopes were still a profusion of colorful short lived annuals and perennials (photo 9). Conspicuous among these were *Turricula parryi* (photo 10), *Malacothamnus orbiculatus, Eriophyllum confertiflorum, Haplopappus arborescens, Lotus grandifolius, Dicentra chrysantha, Amsinkia tessellata, Monardella linoides* ssp. *oblonga, Calystegia longpipes, Penstemon grinnellii* ssp. *schorphuloides, Aniscoma acaulis, Sisimbriom altissimum*, and *Catilleja jepsonii.* Annual grasses such as *Bromus rubens* and *B. tectorum* covered much of the ground.

In general these annuals tended to be more conspicuous in areas where shrub cover was (and is) less dense. Steep east-facing exposures tended to be dominated by *Eriophyllum confertiflorum, Lotus grandiflorus, Monardella linoides,* and other species (photo 11). Relatively open ridgetops and deeper soils were frequently dominated by the large *Turricula parryi* and *Malacothamnus orbiculatus*.

Pinyon Woodland (72210):
This type, one of the target elements of the LCRNA, occupies the higher elevation, northerly facing slopes and occurs sporadically in sheltered canyons down to 4600 ft. (1 402 m). It is dominated by single-leaf pinyon pine (hereafter known simply as pinyon). This species is the only regularly occurring tree in the association at the higher elevations. However, at the lower, inner canyon sites, canyon live oak and Digger pine may codominate.

Vegetation sampling consisting of ten 100 m² plots was conducted at the highest elevation portion of the pinyon woodland near the summit of Heald Peak on west to northwest-facing slopes. Pinyon had an average density of 580 trees/ha while canyon live oak had a density of 90/ha, Pinyon occurred on all plots ranging from 2 to 9 stems/100 m² (200-900/ha). Canyon oak occurred on 10% of the plots. The pinyon forest on the western slopes of Heald Peak has a relatively closed canopy averaging about 25-30 ft. (7.6-9.1 m) in height (photo 12). The largest tree diameters are about 20 inches (51 cm). Some of the trees on the summit are prone and gnarled, but most appear to be fairly young (under 200 years). Sapling and seedling density is low in this closed forest averaging only 30/ha.

Understory cover is relatively low, averaging about 11% on the 10 plots. Thirty-two understory species are associated with the 10 sample plots, however, only three species contribute more than 1% average cover (Table 3).

At lower elevations on northerly facing slopes other trees such as canyon live oak and to a lesser extent, Digger pine, contribute regularly to the canopy cover, Small fragmented patches of the lowland type of pinyon forest occur on steep slopes, rocky drainage bottoms, or other sites relatively well protected from fire. At such sites trees are usually small (between 12 and 15 Inches (30-57 cm) for pinyon and 10-12 inches (25-30 cm) for canyon oak). Seedlings and saplings of pinyon are often fairly common. The understory is usually somewhat more developed than on the upper slopes, averaging about 15-209 cover with the following species predominating:
*Balsamorhiza deltoidea, Symphoricarpos parishii, Galium munzii, Poa scabrella, Lomatium dissectum, Ribese roezlii, Erigeron foliosus, and Galium aparine.*

Another variant of the pinyon forest occurs at the southern end of the drainage on granitic north-facing slopes below peak 6850. This is the only area where Jeffrey pine forest and shin oak scrub occur in the drainage. Adjacent to these vegetation types at slightly lower elevations is a pinyon forest with a strong admixture of canyon live oak, shin oak (*Quercus garryana var. breweri), and* California black oak *(Quercus kelloggee)*. This is an unusual mixture of dominants

**Table 3**: Frequency and average cover of understory species on ten 100 M2 plots in pinyon pine forest on the upper western slopes of Heald Pk., Long Canyon Candidate RNA.

| *species* | *frequency* | *mean % cover* |
|---|---|---|
| *Ribes velutinum var glanduliferum* | *0.8* | *3.4* |
| *Lomatium dissectum multifidum* | *0.3* | *2.0* |
| *Phlox diffus subcarinata* | *0.7* | *1.4* |
| *Holodiscus boursieri* | *0.2* | *0.7* |
| *Chrysothamnus viscidiflorus* | *0.4* | *0.6* |
| *Bromus tectorum* | *0.5* | *0.5* |
| *Poa scabrella* | *0.5* | *0.5* |
| *Artemissia tridentata* | *0.4* | *0.4* |
| *Ephedra viridis* | *0.6* | *0.3* |
| *Sitanion hystrix* | *0.5* | *0.3* |
| *Galium munzii* | *0.6* | *0.3* |
| *Arenaria macradenia arcuifolia* | *0.2* | *0.2* |
| *Keckiella breviflorus* | *0.1* | *0.2* |
| *Phacelia mohavensis* | *0.3* | *0.1* |
| *Crypthantha circumscissa hispida* | *0.3* | *0* |
| *Monardella linoides oblonga* | *0.3* | *0* |
| *Crypthantha circumscissa hispida* | *0.3* | *0* |
| *Melica stricta* | *0.3* | *0* |
| *Dichelostemma pulchella* | *0.2* | *0* |
| *Garrya flavescens pallida* | *0.2* | *0* |
| *Melica imperfecta* | *0.2* | *0* |
| *Phacelia davidsonii* | *0.2* | *0* |
| *Bromus rubens* | *0.1* | *0* |
| *Corethrogyne filaginifolia glomerata* | *0.1* | *0* |
| *Erigeron foliosus* | *0.1* | *0* |
| *Eriogonum wrightii* | *0.1* | *0* |
| *Gilia interior* | *0.1* | *0* |
| *Linanthus nudatus* | *0.1* | *0* |
| *Opuntia basilaris* | *0.1* | *0* |
| *Penstemon laetus* | *0.1* | *0* |
| *Unidentified herb sp* | *0.1* | *0* |
| *Viola purpurea* | *0.1* | *0* |
| *Yucca whipplei caespitosa* | *0.1* | *0* |

from cismontane and transmontane California and underscores the transitional nature of the vegetation of LCRNA.

On the exposed, broad ridge marking the southern boundary of the Long Canyon drainage, pinyon occurs in an open woodland, dominated by young, scrubby trees. The understory in this subtype is reminiscent of typical Great Basin pinyon associations (photo 13). There are openings between the low shrubs of *Artemisia tridentata Haplopappus linearifolius*, and *Eriogonum wriqhtii.* In these openings are patches of *Castilleja jepsonlii, Calochortus subvenustus, Penstemon speciosus, Delphinium hanseni, and Eriogonum nudum var. indictum.* Judging from the youth of most of the pinyons in this area it appears that they have recently invaded this area. This is also apparently true for adjacent north-facing slopes where pinyon is scattered among desert chaparral with a high cover of *Artemisia tridentata* (see photo 6).

A portion of the pinyon forest on the northwest-facing slope of Heald Peak burned in

1984 (photo 14). The pinyons were completely killed in this area and no seedlings or saplings were seen in most of the area (although a few occurred at the edges of the burn). Four-and-a-half years after the fire the *Bromus tectorum* with a understory of this burned forest was dominated number of herbs uncharacteristic of mature pinyon forest Including: *Phacelia fremontii, Eriophyllum ambiguum, Phacelia egena, Layia glandulosa, Lupinus excubitus austromontanus, Mentzelia albicaulis, and Eriogonum vimineum var. davidsonii.* Other species of unusually high abundance included *Yucca whipplei ssp. caespitosa and Chrysothamnus viscidiflorus*.

In general, the pinyon pine at LCRNA has begun to re-invade upper elevation desert chaparral in many places. Although pinyon is susceptible to fire, the main core areas of pinyon forest occupy steep rocky sites, or relatively mesic north slopes protected from fires. Here stands of older pinyon pines are surrounded by larger areas of younger trees. These refugia serve as seed pools for colonization of the adjacent desert chaparral following fires. There is a dynamic boundary between pinyon forest and desert chaparral. Despite varying fire frequencies in the drainage and differing responses to fire, these two extensive vegetation types appear to have maintained an equilibrium over the long term.

Annual Grassland (42200):
This herb and grass-dominated vegetation called by Holland (1986) nonnative grassland, occupies xeric southerly facing slopes up to 5600 ft. (1707 m). Substrate is generally rocky and not particularly deep, as is the case for some annual grassland areas in California (photo 15), Also, unlike many grasslands in the state, this local form has a regular minor component of shrub species.

The most widespread dominant species are *Avena fatua, Bromus rubens, and Bromus tectorum*. These three annual introduced grasses constitute about 40-75% cover of most of the stands on southerly facing slopes. Other common herbaceous species are *Erodium cicutarium, Calochortus veustus, Eschscholtzia minutifolia, Calystegia hanseni, Coreopsis bigelovei, Streptanthus heterophyllus, Emmenanthe penduliflora, Salvia columbarae, Mentzelia albicaulis, Chorizanthe sp., Clarkia rhomboidea, Clarkia sp., Linanthus ciliatus, and Phacelia distans.* Several native perennial grasses also occur, although they typically only compose a small percentage of the vegetation cover. These include *Sitanion hystrix, Poa scabrella, Stipa coronata, and Melica imperfecta.*

Woody perennial species are a regular component of all annual grasslands in the area. They may make up from less than 1 0 to 50% of the total vegetation cover. On most steep south facing slopes the most characteristic of these include *Yucca whipplei ssp. caespitosa, Ephedra viridis, Eriogonum fasciculatum, Fremontodendron californicum, Ceanotlus gregii spp. Vestitus, Keckiella breviflorus, and Mimulus longiflorus ssp. calycinnus.* At low elevations on east and south facing slopes other woody species occur including especially *Encelia virginianus, Lotus scorparius, and Eriophyllum confertiflorum.*

Much of the annual grassland has burned in the past 15 years although only a small

portion was burned in the 1984 fire. Prior to the penultimate burn, *Juniperus californica* was relatively common on some of the rocky slopes. Skeletons of the old shrubs may be seen in several areas. The current abundance of *Yucca whipplei* in these areas may also be the result of fire (photo 16). The effects of the recent 1984 burn on annual grassland are not as great as they are on the desert chaparral. In some areas Lotus florus, Calystegia longpies, and Streptanthus heterophyllus appear to have increased as a result of the fire. The dodder, Cuscuta californca, is often abundant on Calystegia on these burns. As shown by the presence of the large skeletons of duniperus, the annual grassland has had a varied fire history with some areas not being burned for many years.

At the lowest elevations on the bajada adjacent to the northern RNA boundary) the annual grassland is of a different character. This area receives more heavy grazing, is at the lowest elevation and has deep porous soil. Growing conditions are particularly harsh here) as average annual rainfall may be the lowest in the drainage. Annuals predominate in these areas with Bromus rubens and Erodium cicutarium dominant. Lasthenia chrysantha, Platystemon californicus, Nicotiana attenuata, Emmenanthe penduliflora, Eriogonum gracillimum, E. nudum, Lupinus concinnus, L. subvextus, and Trichostemma lanceolatum are scattered throughout. Perennials Include: Opuntia basilaris, and scattered shrubs of Eriogonum, fasciculatum, Juniperus californicus, Haplopappus linearifolius, and Ceanothus leucodermis. Three bulbiferous species; *Calochortus venustus, Allium fimbriatum var. denticulatum and A. devisiae* are relatively common.

Grey (Digger) Pine Woodland (71300):
On the alluvial deposits of the bajada slope at the mouth of Long Canyon, Digger pine dominates an open woodland. As with most other associations in the drainage, this is a mixture of cismontane and transmontane species and is not directly analogous to other described Digger pine woodlands such as Holland's open Digger pine or Digger pine-chaparral woodlands (codes 71310, 71320). The dominant Digger pines are relatively small and young, the whole association appearing to have been burned within the past 30-35 years. Most of the pines are under 35 ft. (10.6 m) tall with the average height about 20 ft. (6 m) (photo 17). Beneath the open canopy averaging between 10 and 30% cover, is a variable mixture of large and small shrubs. These shrubs may be divided into two layers. The taller layer is dominated *by* California juniper*, Ceanothus leucodermis, C. gregii spp. Vestitus, and Fremontodendron californicum.* It averages 6-8 ft. (2-2.5 m) in height, Other species in this tall shrub layer such as *Quercus wislizenii var fluctescens, Arctostaphylos qlauca, and Foresteria neomexicana* are rare except along arroyos. This large shrub layer may also include occasional small trees of pinyon pine. This layer is not continuous and like the Digger pines, covers about 10-20% of the area.

Beneath the larger shrubs is a more continuous layer of smaller shrubs andsub-shrubs. This stratum is dominated by such species as *Haplopappus linearifolius, Lepidospartum squamatum, Artemisia tridentata, Eriogonum fascicculatum ssp. Polifolium, Chysothmanus nausiosus, and Senecio douglasii.* These species may form a relatively dense understory, especially in sandy arroyo bottoms where cover averages up to 60%. These soft woody shrub species are mostly gray-pubescent, or glaucous, lending a distinctive desert scrub-like look to the understory (photo I 8).

The herbs of this association are similar to those occurring in the adjacent low elevation annual grassland (see previous section).

Prior to the 1984 fire, Digger pine ranged as a woodland dominant up the northeast-facing slopes to the summits of the western boundary ridge to above 5000 ft. (1524 m). Judging from Its current successional state, the understory in this upland subtype was dominated by typical desert chaparral species. Intermixed with the Digger pines on the slopes and ridges were California juniper and occasional pinyon pine. This tree overstory has been virtually destroyed in all but a few small-pockets.

Shin Oak Brush (37541):
Shin oak dominates a small area of high elevation northwest-facing granitic slopes. The area is adjacent to the small burned and unburned stands of Jeffrey pine and like them was partially burned in the 1984 fire (photo 19).

Shin oak is a clonal re-sprouter and tends to occur in large patches with small intervening openings. These patches average 4-6 ft, (1.2-2 m) tall and are relatively dense and impenetrable. In addition to the dominant shin oak, *Garrya flavescens* ssp. *Pallida, Ceantothus greggii* ssp. *Vestitus,* and occasional *Fremontodendron californicum* also occur in the canopy. The understory beneath the shrubs is poorly developed with *Symphoricarpos parishii, Solanum xantii, and Rites roezlii* as the principal woody associates. The granitic soil between the shrub patches supports several annual and perennial herbs including *Phacelia mohavensis, P. davidsonii, Mimulus fremontii, Senecio breweri, Zigadenus exalticus, Penstemon laetus, Eriastrum ssp., Gayophytum diffusum ssp. Parviflorum, and Erysimum capitatum.*

Jeffrey pines are small California black oak, canyon oak, and occasional pinyon pine. The understory is relatively open and includes low densities of saplings and pole size Jeffrey pines along with scattered shrubs of *Artemisiatridentata, Chrysothamnus viscidiflorus, Ceanothus greggii vestitus, shin oak, and Syphoricarpos parishii.*

Limestone Outcrop (no Holland Equivalent):
The xeric southwest-facing marble outcrop that forms the northeastern boundary supports a unique assemblage of plants. More so than any other association in the LCRNA, this type is dominated by species characteristic of transmontane flora. Vegetation cover is low due to the xeric rocky substrate. Soil accumulation is limited to cracks and crevices in the fractured rock. Average vegetation cover is about 5-15%.

Dominant species include California juniper, *Ephedra viridis, Yucca whipplei ssp. Caespitosa, Salvia dorrii, Stipa speciosa, Haplopappus linearifolius, Eriogonum fasciculatum, Purshia glandulosa, Opuntia basilaris, and Encelia virginensis ssp. Actoni.* Widespread herbs include *Selaginella asprella, Salvia columbarae, Eriogonum saxatile, Dudleya calcicola, and Poa scabrella.*

At lower elevations *Tedradymia spinosa var. longispina, Senecio fremontii, Chrysothamnus nauseosus, Ceanothus leaucodermis, Fremontodendron californicum, Bromus rubens, Cirsium coulteri, Erodium cicutarium, Calochortus venustus, Erysiminum moniliforme, and Astragalus gambellianus* occur.

At higher elevations the unusual desert shrub *Forsellesia nevadensis* becomes common. Other species more common at higher elevations include the endemics *Delphinium purpusii, Streptanthus (cf.) cordatus var. piutensis, Eriogonum plumatella.* Other species more common at mid to upper elevations include: *Halopappus cf. Palmeri ssp. Pachylepis* (if so, a range extension from the San Emigd Mtns. in SW Kern County), *Gallum hallii, Cheilanthes jonesii, Oryzopsis hymenoides, Cryptantha cconfertiflora, Melica stricta, Leptodactylon pungens ssp. Pulchriflorum, Heuchera rubescens var. alpicola, Ceanathus greggii and pinyon pine.*

At the upper elevations this vegetation grades into desert chaparral and pinyon forest. The highest marble outcrop is at point 6341 (see map 3). A few other small marble outcrops occur in the drainage. These are mostly at low elevations. They tend to support a subset of the species listed above, with few of the unique species. These smaller outcrops are generally better described as vegetated with annual grassland or desert chaparral.

Piute Cypress Forest (83330):
The Piute cypress population at LCRNA is made up of two stands separated by a southeast-facing band of annual grassland about 150 m wide (see map 3). The majority of the northern stand was burned In the 1984 fire, while the smaller southern stand was last burned in the late 1940's. Both stands occupy slopes ranging from due north to due east. Exposures south of due east do not support the species except for a few scattered individuals on southeast slopes adjacent to the ridgecrest or ravine bottom.

Sampling of both stands was conducted using 100 m² quadrats. Five of these plots were laid out in the recently burned stand, while six were sampled in the unburned stand. The burned stand occupies about 14 acres (5.6 ha) ranginng from the crest of the ridge dow n to about 4600 ft., ( 1 402 m) on the north-facing slope. Two small remnants of this stand occur. One consisting of about 6 trees on a due east exposure, near the former edge of the stand) and another more extensive stand lining a small north-facing ravine on the western edge of the stand. The latter remnant contains about 50 trees.

The number of dead cypress stems on the five burned plots ranged from 7 to 21 (700-2100/ha). Cypress seedlings were present on all plots and ranged from densities of 7 to 73 (700-7300/ha). Stem height of the dead cypress varied from 3 to 15 ft. (1-46 m) Mean height of dead cypress on the plots ranged from 4 to 12 ft. (1.2-3.6 m) (mean 7 ft.) 2.1 m). The seedling height varied from 3 to 18 inches (8-46 cm) with an average of about 12 inches (30 cm).

The smallest seedlings and shortest dead stems occurred on the same plot. This plot was the only one where dead seedlings were noted. No obvious environmental conditions

appeared responsible for the short stature and stressed seedlings. The lowest number of seedlings occurred on the plot with the highest pre-fire density of cypress. This fact may relate to the reduced number of cones produced per tree under crowded conditions. The ages of the trees In this stand at the time of the 1984 fire was probably about 35 years. It is likely that these trees do not reach their maximum reproductive output until much older (perhaps 50-100 years, see non-burned stand discussion).

In addition to the cypress, 30 species of plants were noted on the burned plots (photo 2 1). Most of these species are typical of the buried desert chaparral on similar exposures. Judging from the number of seedlings of Ceanothus greggii ssp. vestitius 4 and resprouts of Fremontodendron californicum, it appears that these were the two dominant shrubs beneath the cypress canopy prior to the fire. Total ground cover on the plots ranged from 30 to 60% (mean 51.5%). Table 4 shows the frequency and average percent cover of these species.

The un-burned stand of Piute cypress is less than half the size of the burned stand. It occupies a discrete area on the northern half of a small knob about half way up the west side of Long Canyon. This knob is topped by granitic rock, but, as with the burned stand, the cypress occupy slopes underlain by schistose metamorphics. Most of the trees In this stand are about 40 years old and thus, date back to a fore in the lat 1940's . A few older trees are scattered along, the bottom of the ravine at the base of the stand. It seems clear that this stand and the stand that suffered the bum in 1984 were both the same age.

Stature of the trees in this stand varies with slope position. Those trees at the lower end of the slope are substantially larger than those at the upper edge near where the granitic contact zone is. Here the cypress average about 4 ft, (1.2 m) tall, no taller than the surrounding *Arctostaphlylos glauca and Ceanothus gregii.* At the bottom of the ravine trees are substantially broader and taller with average heights of about 15 ft. (46-m) (see photo 1). Interestingly, cone size appears to vary with tree size, the larger ravine trees tending to have larger cones than the more stunted upper slope individuals. I did not determine if this cone size reflected differences in seed size or seed number per cone.

In general, the number of cones on the trees was relatively few (photo 22). In the forty or so years since their I Ives began, these trees have only had a few years where any cones have been produced. As Scheid and Zedier (1989) have noted for Cuyamaca cypress *(Cupressus arizonica ssp. stephensoili))* less crowded trees in relatively mesic situations produce

Table 4: Average percent cover and frequency for shrubs and herbs on five 100 M² plots within the Piute cypress stand burned in 1984.

| species | frequency | mean % cover |
|---|---|---|
| *Bromus rubens* | *1.0* | *14.0* |
| *Ceanthus greggii vestitus* | *1.0* | *8.5* |
| *Bromus tectorum* | *0.6* | *6.4* |

| | | |
|---|---|---|
| *Penstemon grinnelli scrophularoifes* | *0.6* | *5.0* |
| *Fremontodendron californicum* | *0.8* | *4.8* |
| *Haplopappus alboreus* | *0.6* | *2.8* |
| *Calystegia longpipes* | *0.8* | *2.4* |
| *Eriophyllum contertiflorum* | *0.2* | *2.0* |
| *Solanum xantii montanus* | *0.6* | *1.6* |
| *Dicentra chrysantha* | *1.0* | *1.2* |
| *Malacothamnus orbiculatus* | *0.6* | *1.0* |
| *Turricula parryi* | *1.0* | *1.0* |
| *Ceanothus leucodermis* | *0.4* | *0.4* |
| *Ephedra viridis* | *0.4* | *0.4* |
| *Eriogonum fasciculatum* | *0.4* | *0.2* |
| *Arctostaphylos glauca* | *0.6* | *0* |
| *Sitanion hystrix* | *0.6* | *0* |
| *Calochortus venustus* | *0.4* | *0* |
| *Corethrogyne filaginifolia* | *0.4* | *0* |
| *Eriophyllum pringlei* | *0.4* | *0* |
| *Yucca whipplei caespitosa* | *0.4* | *0* |
| *Artemisia tridentata* | *0.2* | *0* |
| *Chysothamnus nauseosus* | *0.2* | *0* |
| *Chysothamnus teretifolius* | *0.2* | *0* |
| *Coreopsis bigelovei* | *0.2* | *0* |
| *Linanthus nudatus* | *0.2* | *0* |
| *Lomathum dissectum* | *0.2* | *0* |
| *Petrocarya setosa* | *0.2* | *0* |
| *Sisimbrium altissimum* | *0.2* | *0* |
| *Stephanomeria chicoricaea* | *0.2* | *0* |

more cones and seed than crowded individuals of xeric habitats. Assuming that these trees in this stand are temporal analogs to the trees burned in 1984, the relatively few cones produced were sufficient to restock the population, given the favorable germination conditions prevalent in the fall-winter of 1984-85. On the six sample plots cypress density ranged from 6 to 61 1iving trees/100 m² (600-6100/ha, mean=3540/ha). These figures reflect closely densities of seedlings on the five plots on the burned stand.

Clearly, as with other cypress species, (e.g. Keeler-Wolf 1990a, 1990b), the Piute cypress is very tolerant of competition. Shade-suppressed individuals of sapling size occurred regularly within the stand. However, even trees only 3 ft. (1 m) tall and 0.5 inch (1 cm) diameter proved to be the same age as the larger dominants.

Beneath the dominant trees occasional fallen trunks up to 10 inches (25 cm) in diameter occurred, indicating that prior to the fire that initiated this current stand, a much longer-lived cohort grew here. Currently the average size of trees was 1-2 Inches (2.5-5cm) dbh and the average height was 810 ft (2.5-3 m). The tallest ravine bottom species were 15-17 ft. (46-5.1 m) and 5-6 inches (12.7-15.2 cm) dbh.

The understory of the unburned cypress stand is dominated by *Ceanothus greggi ssp. vestitus.* The vigor and density of these shrubs is negatively correlated with that of Piute cypress. In the low ravine bottom stands C. *greggii* appeared senescent and patchy in comparison to upper slope stands. Understory species number of the non-bumed stand is half that of the recently burned plots with only 15 species represented. Table 5 indicates cover and frequency of species associated with the cypress in the nonburned stand. Species such as *Claytonia spathulata and Galium aparine* indicate the relatively shady, and mesic conditions of the cypress stand,

California Juniper Scrub: (72400):

The 1984 fire destroyed many of the best stands of California juniper in the area. Prior to this fire juniper ranged up to the summit of the western ridge and was common throughout much of the more open desert chaparral and annual grassland communities. There are still small stands of juniper scattered at low elevations on the bajada slope near the northern boundary. These are surrounded by annual grassland and Digger pine woodland. There

Table 5: Frequency and mean percent cover of understory species in six 100 m² plots in unburned Piute Cypress stand.

| species | frequency | mean % cover |
|---|---|---|
| *Ceanthus greggii vetitus* | *1.0* | *31.3* |
| *Fremontodendron californicum* | *0.67* | *1.3* |
| *Artemisia tridentate* | *0.33* | *0.83* |
| *Eriogonum fasciculatum* | *0.17* | *0.83* |
| *Claytonia spathulata* | *0.50* | *0.17* |
| *Eriophylum pringlei* | *0.67* | *0* |
| *Cryptantha sp.* | *0.33* | *0* |
| *Ephedra viridis* | *0.33* | *0* |
| *Mimulus fremontii* | *0.33* | *0* |
| *Bromus rubes* | *0.17* | *0* |
| *Calochortus venustus* | *0.17* | *0* |
| *Dichelstemma pulchella* | *0.17* | *0* |
| *Eriophyllum confertiflorum* | *0.17* | *0* |
| *Galium aparine* | *0.17* | *0* |
| *Phacelia sp.* | *0.17* | *0* |

are also stands of several trees and scattered individuals spared from the fire up to almost 6600 ft. (2012 m) along the crest of the western boundary ridge. However, none of these stands covers more than a few hundred square meters. The only area where extensive California juniper woodland remains is at mid- to low elevations along the marble outcrop (photo 23). The vegetation in this area is really a form of the limestone outcrop association (see previous) with California juniper as the dominant. Associated species

are identical to those of the modal limestone association.

The conditions that favor the high density of juniper on marble appear to be a rocky but not excessively broken and jumbled topography, xeric southwestern exposures, and small patches of soil development. The dominant junipers are middle aged, with rounded profiles and a low volume or dead wood. There is some indication that a fire, perhaps 30-40 years ago, may have reduced the stands on marble. At highest density, the juniper woodland reaches about 25-30% cover by the juniper shrubs. In most areas the juniper cover is 10-15%. The most common and consistent members of the understory are *Stipa speciosa, Yucca whipplei ssp. caespitosa, and Haplopappus linearfolius*

Despite the large number of typical desert species associated with this and the Previous associations, the description of juniper-dominated communities in Holland (1986) that most closely fits this particular association is the Cismontane juniper woodland and scrub (72400), typical of the inner South Coast Ranges. According to Holland, Mojavean juniper woodland and scrub (72220), although characterized as occurring in the Southern Sierra Nevada and Tehachapi Mountains, does not share any characteristic species other than the juniper with the local juniper association.

White Alder Riparian Forest (615 1 0):
This association is restricted to permanently moist areas along the Long Canyon streambed (photo 24). These areas are scattered along the length of the stream course for about 1.5 miles (2.4 km), often with long seasonally dry intervening stretches. The longest continuous stretch of white alder-dominated vegetation is about 500 m. The stream is very low volume with the alder vegetation dominating a strip no wider than about 10 ft. (3.1 m).

The dominant white alders *(Alnus rhombifolia)* are typically small trees not over 20 ft. (6 m) tall. The Individual stems are usually short-lived as a result of the fluctuating water availability as well as the effect of the 1984 fire, which killed several patches in the lower and mid-sections if the stream channel.

Characteristic species of the riparian zone in addition to white alder include: *Salix lasiolepis var. bracelinae,* Fremont cottonwood *(Pupulus fremontii), Ribes nevadense, Mimulus guttatus, Mimulus cardinalis, Nasturtum officinale, Juncus xiphioides, Juncus macrophllus, Helecharis sp., Epilobium adenocaulon, Carex alma, Typha angustusifolia, Oxypolis occidentalis, Lemma sp., Equisetum arvene and E. laevigatum.*

Additional species occur in the Intermittent stream channels between the perennially moist sites. These include: *Baccharis viminea, Polypogon monspeliensis, Brickelia californica, Crodylanthus rigidus ssp. brevebracteatus, Artemisia dracunculus, and Lupinus excubitus.*

FAUNA

The area is relatively rich in vertebrate species with 65 species noted during the three day

stay for the ecological survey (Appendix 2). Several of these species are typically sera] and are likely to have entered the area as a result of the recently burned vegetation. Lazuli buntings, lark sparrows, and black-chinned sparrows are three species which seem to have increased or expanded their local range as a result of the 1984 fire. Despite the transitional vegetation between transmontane and cismontane, most of the vertebrate species are either widespread in both areas or are more typical of cismontane California. The most characteristic desert species inhabiting the area are the desert (Black-throated) sparrow, the lesser nighthawk, and the Gray ~Vireo, Each of these species were seen In (or over) the extensive desert chaparral at the lower elevations.

The area has its complement of large mammals in accordance with its largely humanly undisturbed state. Signs or sightings of black bear, mountain lion, mule deer, gray fox, and coyote were noted in the area. The most abundant small mammals included California ground squirrel, Dusky-footed woodrat, Merriam chipmunk, and Botta pocket gopher.

GEOLOGY

The LCRNA is underlain by two principal lithologic units. The most extensive of which is the undifferentiated pre-Cretaceous metamorphics. However, Schweikert (1981) more specifically considers them part of the Isabella Metamorphic Group. They include primarily metamorphosed quartzite, limestone, and shale. These include all references to schistose rocks and marble in this report. These rocks also outcrop in several areas to the northwest, north, and south of Long Canyon, all outcrops are surrounding the junction of the South Fork and the main Kern River valleys now submerged beneath Lake Isabella, hence the name. The history of these rocks is uncertain. Schweiert (1981) and Bateman (1981) both consider them of unknown age. These rocks lie just west of the western margin of rocks with Mesozoic age fossils, but no fossils have been found in these rocks. Schweikert (1981) believes at least some of the rocks in this metamorphic zone are lower Paleozoic in age. However) other workers suggest that the rocks are mostly Triassic and Jurasic.

The marble outcrop on the eastern side of the area is composed of relatively coarse-grained marble with several areas of relatively large (2.5 cm) calcite crystals. It is a light gray color. It shows little evidence of water etching and no apparent caverns. This marble band is broken by narrow dikes of granitic rock and also by bands of dark schistose rock.

Probably the most extensive rock in the RNA is the schistose meta-shale. This is a dark fine-grained rock with numerous quartz bands. It outcrops in many places including the highest summit of Heald Peak, and along virtually all of the western boundary ridge up to about 6000 ft. (1829 m) elevation.

The other principal rock unit is the granitic rock which makes up the northern summit and portions of the western slope of Heald Peak, as well as the southwestern corner of the drainage, The granitics are a part of the great Sierra Nevada Batholith and are Mesozoic

in age (Jennings et al, 1977). In areas where the granitic have intruded the older metamorphics, there are gneisic intergrades. These gneissic rocks typically occur as narrow dikes and intrusions surrounded by the metamorphics.

SOILS

The soils of the LCRNA may be broken down into three main complexes (USDA Forest Service 1980). These are the, Livermore family--Rock outcrop complex, the Rock outcrop--Tollhouse complex, and the Xerofluvents-Xerothents association. The most extensive of these is the Livermore family--Rock outcrop (map 4). This complex may be broken down into two mapping units, both with similar characteristics except average slope steepness (see map 4). Both mapping units can be generally characterized as follows:

They generally contain about 60% Livermore family and 30% rock outcrop with 10% inclusions of Chular family soils. The Livermore family soil is moderately deep and well-drained. It is formed from metamorphic rock. The soil is 35-90% gravel and cobbles. Typically, the surface layer is dark brown cobbly and stony sandy loam about 46 cm thick. The subsoil is strong brown very gravelly sandy loam about 19 cm thick. The substratum is brown very gravelly sandy loam about 1 0 cm thick over fractured metasedimentary rock. Depth to rock ranges from 50-120 cm. The rock outcrops occur as both small isolated and massive exposures of metasedimentary rock. The steeper of the two units (mapping unit 238) averages a lower effective rooting depth (15-30 cm) than the other unit (rooting depth 30-65 cm).

The next most extensive soil complex is the Rock outcrop--Tollhouse complex. This is represented by one mapping unit in the RNA. This unit is 55% rock outcrop and 35% Tollhouse soils. Included in this unit are about 10% Cieneba soils. Rock outcrop occurs mainly as isolated outcropping and massive exposures of granitic or metamorphic rock. Runoff is very rapid. Large quantities of water concentrate downslope, which increases the erosion hazard of the soils. The Tollhouse soil is shallow and somewhat excessively drained. It forms either from granitic or metamorphic rock. Typically, the soil is brown coarse sandy loam about 43 cm deep over highly weathered granitic rock. In some areas the surface layer is sandy loam or silt loam. Permeability of the Tollhouse soil is moderately rapid. Available water capacity is low. Effective rooting depth is 20-45 cm. Runoff is rapid and the maximum erosion hazard is high.

The final Soil type occurs on the bajada slope at the northern end of the RNA. This is the Xerofluvents--Xerothents association. This type is made up of one mapping unit locally. It is composed of 45% Xerofluvents and 45% Xerothents. Included in this unit are small areas of Riverwash. Xerofluvents formed in alluvium. They are deep gravelly, cobbly, and stony sandy and sandy loams and have many bounders and stones on the surface. Xerofluvents are subject to change by stream overflow, erosion, and deposition.

Xerothents formed in unconsolidated recent colluvium. They are varying textures of Soil material and rock fragments. Xerothents do not have distinct soil horizons.

In addition to the three complexes described above, an additional mapping unit is shown on map 4. This is simply rock outcrop and shows up extensively only along the northeastern boundary, corresponding to the marble outcrop, discussed previously.

## CULTURAL VALUES

The LCRNA was part of the territory of the Tubatulabal group. The name means "pine-nut eaters" (Smith 1978). The primary staple crops of these people were acorns (mostly from the lower Kern River valleys, and pinyon nuts (mostly from the eastern slopes of the Sierra and the Piutes).

According to the map in Smith (1978) several village (or hamlet) sites existed within a few miles of the mouth of Long Canyon along the main South Fork of the Kern River. It is likely that Long Canyon was entered regularly on food gathering expeditions and perhaps the upper slopes of the drainage were visited occasionally during pinyon nut harvests.

## IMPACTS

Direct Human impact:
The mouth of Long Canyon at the northern boundary of the RNA is within 0.5 miles (0.8 km) of several permanent homes and within two miles (3.2 km) of numerous dwelling5 along State Highway 178. Despite this close proximity to human development, impacts to the LCRNA are relatively few. Understandably these are largely restricted to the relatively flat and accessible bajada slope at the mouth of the canyon. One lightly used dirt road enters the area and continues south into the RNA for ca. 0.5 miles (0.8 km), branching in several places. This road is shown on map 2. Associated with this road are a few camp sites (the southern-most being the most heavily used) with litter including broken bottles and cans. Also associated with this road is a cluster of old bee boxes, broken and no longer in use. The western-most branch of this road ends at a mining excavation in metamorphic rock. This site was not closely inspected during the field work for this report, but from a distance appeared to not have been recently used and not to have any mining equipment associated with it. Dirt bikes and other OHVs appear to have used the road system occasionally, but not to have noticeably affected the terrain off of the road system.

The trial 34E31 does not show on the most recent Sequoia National Forest recreational map (1987). It still is easily passable and does have some regular dirt bike use all the way to the southwestern comer of the RNA at 6600 ft. elevation. As the trail closely follows the crest of the ridge along the proposed boundary, this use does not appear to carry over to the east into the RNA itself. The only place dirt bike use is actually within the RNA is where this trail traverses the western ridge slope in the NW 114 Section 4 (see map 2).

Aside from the dirt bike use along the main trail, the upper reaches of Long Canyon have

little or no noticeable human impact. A sporadically ducked route ascents the summit of Heald Peak and one torn shirt sleeve was seen on the granitic summit of Heald Peak. However, no other evidence of human presence was seen in the drainage.

Cattle Grazing:
During the field work for this report approximately IO head of cattle were seen in or adjacent to the RNA, All of these were near the northern boundary adjacent to BLM land. These included about 5 adults and 5 calves. Fresh droppings were seen in the lower bajada area along the boundary of Forest Service land. However, no grazing impact was noted more than about 0.5 miles (0.8 km) south of the boundary. None of the permanent water areas along the stream bed were affected by cattle. Grazing appeared to be limited primarily to the annual grassland with little or no impact on the shrubs of the adjacent Digger pine woodland. A dilapidated fence line runs just north of the Forest Service boundary. Cattle can and do easily cross this fence at the present time. However, it could be repaired and if so would be effective in excluding cattle from the area.

## MANAGEMENT CONCERNS AND RECOMMENDATIONS

The Piute cypress population in LCRNA is the most sensitive management concern In the proposed RNA, Because It was partially burned in 1984, another fire in the near future will cause the extirpate on of all of the recently germinated cypress seedlings. This would effectively reduce the population by more than half its present number. In addition, the part of the population which was unburned in 1984 has a relatively low cone crop and would not be expected to produce a large number of seedlings if it was burned in the near future. I recommend that the Piute cypress stand be protected from any fire for at least the next 30 years (about twice the current age of the surviving stand).
Beyond the above situation, the LCRNA does not require a great deal of intensive management. Repair of the fence along the northern boundary will exclude cattle and may reduce the number of OHVs entering the area.

The boundaries as they were defined in a verbal description by James R. Shevock (Pacific Southwest Regional Botanist) in April 1989 are those adhered to in this report. They are topographically delineated except for the political northern boundary corresponding to the edge of Forest Service land.

One of the original target elements selected for this RNA was California juniper woodland. As described above) the coverage of this vegetation has been greatly reduced as a result of the 1984 fire. Currently juniper-dominated vegetation is a very minor part of the area. There is little evidence of reseeding over most of these burned stands, and thus, I recommend that the LCRNA be no longer considered as a viable candidate for California juniper in the Southern Sierra Nevada Province. Other more extensive stands of California juniper more closely resembling Holland's Mojavean juniper woodland and scrub occur on Forest Service Land a few miles to the southeast in the Scodie Mountains in the vicinity of Cane Canyon and Bird Spring Pass.

The LCRNA was also originally proposed as a single leaf pinyon pine target site.

Although extensive pinyon forest still exists at the upper elevations of the drainage its inaccessibility makes LCRNA somewhat undesirable as 8 pinyon target site. The most extensive and well developed pinyon forest occurs on the slopes of Heald Peak. These stands are either on very steep slopes (upwards of 45" in many areas) or located at the end of a difficult and time-consuming uphill walk of several hours, thus constraining the scientific use. The transitional nature of the pinyon forest with desert chaparral, shin oak brush and other vegetation is valuable to the understanding of the pinyon vegetation in the Southern Sierra Nevada. However, I recommend selecting an additional pinyon pine target site for this province, one that is not only more accessib1e, but also perhaps more representative of the transmontane characteristics of the pinyon woodland. Again only a few miles to the east, accessible and compositionally different pinyon woodlands occur on the desert slopes of the Scodie Mountains in the vicinity of Sage and Cow Heaven canyons.

One of the greatest values of the LCRNA is its diverse representation of desert chaparral vegetation. This vegetation type is considered a target type for the Pacific Southwest Region's RNA system, yet no established or candidate RNAs have been selected to represent it. I propose that LCRNA be selected to represent this target element for the Southern Sierra Nevada Province.

The Long Canyon candidate RNA contains a diverse and unusual blend of natural values. These Include the only stands of Piute cypress and desert chaparral in the regional RNA system as well as a number of rare and unusual plants associated with limestone, and an extensive and diverse pinyon pine woodland. Human impact is low to negligible throughout the most of the area and effective management options are available to reduce impact along the northern border. I strongly recommend the establishment of this candidate RNA.

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chaparral and granitic outcrops

*Argemone munita ssp. rotundata:* occasional all elves, arroyos, bajadas to burned p.p.
*Artemisia dracunculus:* occas. riparian
*Artemisia tridentate:* occas. lower elevs. on bajada, common at upper saddle head of drainage and in more xerix d.c
*Asclepias fascicularis:* occas. In arroyo bottom, etc.
*Astragalus gambellianus:* tiny annual on marble low elevs.
*Atriplex semibarbata:* annual, uncommon at lower elevs.
*Avena barbata:* minor component of a.g. at low elevs.
*Avena fatua:* dominant on s-facing slopes a.g.
*Baccharis viminea:* arroyo bottoms lower elevations, intermittent stream flow.
*Balsamorhiza deltoidea:* common in d.c. low to mid elevs., also p.p., burned s.o. and j.p. to high elevs.
*Brassica nigra:* occas. a.g. on low bajada
*Brickelia californica:* common along arroyo and riparian edges
*Bromus breviaristatus:* uncommon p.p. summit Heald Pk.
*Bromus rubens:* lower elebs. a.g. arroyo bottoms, common on burn in d.c., p.p. etc. up to 6400 ft.
*Bromus tectorum:* common at higher elevs. Above 5000 ft.
*Calochortus invenustus:* locally common in saddle in burned d.c. at head of drainage 6300-6600 ft.
*Calochortus venustus:* common low-mid elevs. open dry soil a.g., burn etc.
*Calyptridium parryi:* common on decomposed granitic soil at Heald Pk. Summit area.
*Calystegia longipes:* abundant on burns and common elsewhere low to high elevs.
*Camissonia micrantha var. jonesii*: occas. a.g. *(C. hirtella)*
*Carex alma:* riparian, occasional
*Castilleja jepsonii:* fairly common at low to high-elevs. on *Eriogonum fasciculatum ssp. polifolium* and other *Eriogonum.*
*Castilleja* sp. Near moisture, riparian
*Ceanothus cuneatus:* uncommon, not hairy even on young leaves, d.c.
*Ceanothus greggii var. vestitus:* dominant of the d.c. on N slopes
*Ceanothus leucodermis:* common in d.c.
*Cercocarpus betuloides:* occas. d.c. n slopes up to 6200 ft.
*Chanenactics santolinoidese:* fairly common higher elevs. especially on granitics > 6000 ft.
*Cheilanthes jonesii:* uncommon upper marble outcrop 5000-6000 ft.
*Chorizanthe staticoides? (maybe C. membranacea):* common dry s. slopes a.g., not mentioned for S. Sierra
*Chysothamnus nausiosus:* occasional on bajada and arroyo bottoms lower elevs.
*Chysothamnus teretifolius:* xeric exposures edges of a.g. and d.c. burn area.
*Chrysothamnus viscidiflorus:* occas. p.p. upper elevs. Heald Pk. Ridge, common on burned p.p.
*Cirsium coulteri:* occasional arroyo bottoms, d.c. lower to mid-elevs.
*Clarkia rhomboidea:* occasional s slopes a.g.
*Clarkia sp.:* a.g. mid elevs.
*Claytonia (Montia) spathulata:* common on n-slope d.c. and in p.c. groves
*Clematis liggusticifolia:* riparian
*Cordylanthus rigidus ssp. brevibracteatus:* common at low elves. on granite a.g., arroyo bottoms, etc.
*Coreopsis bigeloveii:* occasional S slopes a.g. low-mid elevs.
*Corenthrogyne filaginigolia var glomerata:* common low to high elevs., esp common on SW ridge of Heald Pk.
*Cryptantha barbigera:* common, xeric mid-elev slopes, bur, d.c. a.g.
*Cryptantha circumscissa var.* hispida: p.p. upper slopes Heald Pk.
*Cryptantha confertiflora:* perennial yellow flowere species, a limestone endemic, on marble outcrop, not in Twisselmann
*Cryptantha micrantha:* purple dye in roots, on burn at lower elevs.
*Cryptantha pterocarya:* upper slopes, burn on Heald Pk.
*Cucurbita foetidissima:* uncommon lower bajada a.g.
*Cupressus nevadensis:* local on W side of drainage in p.c., recently burned and unburned stands.
*Cuscuta californica* occasional on *Eriogonum fasciculatum* on dry slopes, common on Calystegia longpines

on burn.
*Cystopteris fragilis*: rocks upper elevs. in j.p.
*Datura meteloides:* rare, lower bajada a.g.
*Delphinium hanseni:* fairly common, d.c., a.g. blue flowers up to 6600 ft early flowering.
*Delphinium purpusii:* fairly common on N slopes at lower elevs., more widespread on schist and marble at upper elevations up to 6500 ft.
*Descurania pinnata ssp. menziesii:* locally common on burn mid-elevs.
*Distichlis spicata:* uncommon, riparian moist areas
*Dudleya calicola:* common rock crevices marble, schist, granite, not restricted to limestone, an endemic to the Kern River drainage.
*Eleocharis sp.:* moist riparian
*Emmenanthe penduliflora:* occas. dry arroyo banks, a.g. etc.
*Encelia sp.:* one seems larger than other, common on w side on burn
*Encelia virginensis ssp. actoni:* common, lower elves on marable and metamorphics, also on burn
*Ephedra nevadensis:* uncommon bajada lowest elevs.
*Ephedra viridis:* common a.g., d.c. up to summits
*Epilobium adenocaulon:* wet riparian
*Epilobium paniculatum:* locally on burns, d.c.
*Equisetum arvense:* moist riparian, low elevs.
*Equisetum laevigatum:* wet riparian, uncommon
*Eriastrum sp:* fairly common mid-elev. to Heald Pk summit, in openings, keys t*o E. hooveri,* a rare species known from low elevations in the San Joaquin Valley.
*Erigeron foliosus:* fairly common in low elev. p.p. up into j.p. and s.o.
*Erigeron foliosus var. stenophyllus:* occasional in d.c., a.g., p.p.. tall multiple stems.
*Eriodictyon californica:* occas. lower elevs a.g. d.c. edge.
*Eriogonum fasciculatum ssp. polifolium:* common low to mid elevs, esp. on burns and edges of a.g.
*Eriogonum gracillimum:* annual common low to mid-elevs. a.g.
*Eriogonum nudum var. indictum:* inflated base like *E. inflatum*, occas. upper elevs. at head of drainage (saddle)
*Eriogonum nudum var. publiflorum:* fairly common dry slopes-rocky areas low and mid elevs.
*Eriogonum plumatella:* sub-shrub in p.p. of Heald Pk. Ranging down to mid-elevs.
*Eriophyllum confertiflorum:* common and showy on burn ar low to mid elevs.
*Eriophyllum pringlei:* tiny annual in gravely openings mostly on ridges, d.c., p.p. p.c., burned j.p., s.o.
*Eriodum cicutarium:* abundant in a.g. and other xeric exposures up to 6500 ft.
*Erysimum moniliforme:* fairly commonmid-to higg-elevs. yellow flrs, slender pods (Munz says conspecific w/ capitatum).
*Eschscholtzia minutifolia:* xeric slopes of a.g., occasional
*Foresteria nevadensis:* common shrub of xeric marble outcrop low to mid elevs. Not listed by Twisselmann for Kern Co.; a limestone endemic
*Fremontodendron californicum:* a dominant of the d.c. from low to high elevs.
*Galium aparine:* occas. N-slope d.c. and p.p.-c.o. woods
*Galium hallii:* a semi-desert woody species in d.c. and marble outcrop with large hairy fruits, may be N limits, not listed for Piutes by Twisselmann and Munz
*Galium munzii:* smaller pubescent fruits than G. hallii on marble, p.p, occas.
*Galium pubens:* occasional, fleshy glaborous fruit, woody bases of stems, d.c.
*Garrya flavescens var. pallida:* common N and E-facing slopes d.c. sub-dominant up to 6800 ft.
*Gayophytum diffusum ssp. parviflorum:* granitic openings in s.o., d.c., and j.p.
*Gilia interior:* common pink flowered species low to mid elevations d.c., a.g. burn.
*Gilia sp.:* small annual low elevs. a.g.
*Gallium luteo-album*: riparian borders
*Haplopappus arborescens*: fairly common on burn w/ cypress occasional on e side of drainage mid-to low elevs. A cismontane species.
*Haplopappus cuneatus*: occasional granitic outcrops low to mid elevs.
*Haplopappus (cf.) palmeri ssp. Pachylepis*: uncommon on marble outcrop mid-elevs. not know from this part of Kern Co., late flowering.
*Haplopappus linearfolius* var. *interior:* resinous single heads w/ ray flowers, common in open a.g., d.c., in

burns, etc. high to low elevs.
*Heliotropium curassivicummm var. oculatum:* moist riparian edge, uncommon
*Heuchera rubescens var. alpicola*: occasional on marble and granitic outcrops 5600-6800 ft. east boundary
*Holodiscus boursieri:* common granitic rocks, p.p., Heald Pk. Summit area.
*Juncus macrophllusss*: riparian, occasional
*Juncus xiphioides*: moist riparian, lower elevs.
*Juniperus californica*: locally common in lower valley and on marble outcrop up to 6300 ft. more widespread prior to fire on w ridge.
*Keckiella breviflorus:* fairly common in rock outcrop areas in a.g., etc., low to high-elevations
*Lasthenia chrysostoma*: early flowering on bajada low elevs.
*Layia glandulosa*: burn p.p. upper elevs sw shoulder Heald Pk. 6600 ft.
*Lemna* sp.: wet riparian
*Lepidospartum squamatum*: common arroyo bottom, and alluvial fan, lower elevs.
*Leptodactylon pungens ssp. Pulcriflorum*: common in rocky areas of upper elevs dc.c. pp etc.
*Linanthus nudatus:* on p.c. burn , p.p
*Linanthus ciliatus*: fairly common, a.g. and burned d.c.
*Lithophragma boladeri*: entire petal form n-facing d.c. mid-elevs.
*Lithophragma parviflorum*: occas. pp. – c.o., fairly common burned j.p.
*Lomatium dissectum var. multifidum*: common on N. slopes d.c. to p.p.. up to Heald Pk. Summit
*Lomatium nevadense var. parishii*: occas. at upper elevs >6200 ft. s.o. j.p.
*Lonicera interrupta*: occas. in d.c. N- slopes.
*Lotus grandifolius*: common and showy flowering species of burn, up to 6500 ft.
*Lotus nevadesis:* uncommon, upper d.c. yellow flowers, curved pods.
*Lotus scoparius*: common lower elevs and on burn
*Lotus scoparius*: occasional on dry slopes, a.g.
*Lupinus albicaulis var. shastensis*: burned j.p. 6600 ft.
*Lupinus bicolor*: occasional a.g.
*Lupinus concinnus*: uncommon lower elevs. mouth of canyon a.g.
*Lupinus concinnus*: var. orcuttii: low elevs bajada
*Lupinus excubitus*: fairly uncommon lower dry slopes and cutbanks of arroyos lower elevs.
*Lupinus excubitus var. alustromontanus*: flowering in burned p.p. Heald Pk.
*Lupinus subvextus*: common on open bajada flats. a.g.
*Malachothamnus orbiculatus*: abundant on burn from 3550 to 6800 ft.
*Marah horridus*: occasional d.c. in lower elev canyons
*Melica imperfecta*: occasional lower to mid elevs. in d.c. arroyos, etc.
*Melica stricta*: rocky areas in d.c., etc. mid-to high elevs.
*Mentzelia albicaulis*: occasional, a.g., burned p.p.
*Microseris sylvatica*: occasional in d.c. at mid elevs.
*Mimulus cardinalis*: moist riparian area low elevs.
*Mimulus fremontii*: common upper elevs. burned j.p.
*Mimulus fremontii x visciuds*: common at summit of Heald Pk on granite on d.g. between chaparral shrubs. Characters intermediate between the two species
*Mimulus guttattus:* riparian moist areas,
*Mimulus longiflorus ssp. calycinnus::* occasional rock outcrops in a.g.. etc., low to mid elev.
*Mimulus* sp.: reddish flowered annual low elevs.
*Monardella linoides ssp. oblonga*: fairly common 4000-6900 ft. s- to w- facing slopes a.g. p.p. burned d.c.,
*Muhlendbergia rigens:* riparian border
*Nesturtium officinale:* common in wet riparian
*Nemacladus sismoides*: uncommon upper slopes near saddle on burn.
*Nemophila pendunculata*: uncommon on N slope d.c., understory ca. 5000 ft.
*Nicotiana attenuata:* occas. open d.c. burns, etc, low to high elevs.
*Ninuntia basilaris:* occas. low to high elevations rocky xeric sites a,g. to p.p.
*Oreochaenactis thysanocarpha::* open summit area of Heald Pk. on granitics
*Orobanche grayana var. feudgi:* occasional on Artemisia on w boundary trail mid-eloevs.
*Oryzopsis hymenoides:* rock crevices on marble outcrop

*Oxypolis occidentalis:* uncommon, wet riparian
*Pellaea mucronata:* occas. rocky d.c. up to 5000 ft.
*Penstemon grinnellii ssp. schrophulariodes:* common low to high elevs. esp. on burn
*Penstemon laetus:* common blue-purple penstemon of burned areas.
*Penstemon newberryi:* Granitic rocks summit area Heald Pk.
*Penstemon speciosus:* occ. higher elevs. in burn s.o., j.p.
*Petrocarya penicellata:* occas. low elevs, bajada, a.g.
*Petrocarya setosa:* fairly common low to mid-elevs. openings a.g. etc.
*Phacelia davidsonii: o*ccas on upper elevs, , s.o., p.p., etc. less common than *P. mommsis.*
*Phacelia distans:* occas. mid-elevs on burn or open a.g. up to s.o. association.
Phacelia egena: common on burn of upper elevs, sw shoulder Heald Pk. 6300-6700 ft.
*Phacelia fremontii:* uncommon in burned p.p. sw shoulder Heald Pk. 6200-6700 ft.
*Phacelia mohavensis:* common small lavender firs. annual s.o. and p.p. above 6000 ft.
*Phacelia ramoisissima var. suffructescens:* scattered low-mid elevs. around rock outcrops adjacent to a.g.
*Phlox diffusa ssp. subcarinata:* matted species of upper elevations on Heald Pk. p,p.
*Phoradendron bolleanum var. densum:* common on *Juniperus*
*Pinus jeffreyi:* scattered groves mostly on N slopes at head of drainage above 6600 ft., a few old snags on granitic part of Heald Pk. summit
*Pinus monophylla:* common in p.p. woodland and also scattered on N slopes at lower elevs down to 3600 ft
*Pinus sabiniana:* common on bajada, low elevs., fire killed most an w ridge, up to 5300 ft
*Pityrogramma triangularis::* occas. under rocks lower elevs.
*Platystemon californicus:* occas. a.g. <5500 ft.
Poa scrabella: common in d.c. and p.p. throughout
*Polypogon monspeliensis:* open sunny riparian.
*Populus fremontii:* wet riparian, uncommon,
*Prunus briginianus var. demissa*: riparian border low elev.
*Psoralea macrostachya:* occas. riparian moist sites, not mentioned in Twisselmann.
*Purshia glandulosa:* local low elevs. in arroyo and on marble outcrop
*Quercus chrysolepis:*common on N slopes d.c., p.p. low to high elevs.
*Quercus kelloggii:* upper elevs., j,p., s.o.
*Quercus wislizenii var. fructescens:* occasional along arroyos lower elevs. fairly common up to 5000 ft, in d.c. on n slopes.
*Ribes nevadense:* rare in riparian of upper drainages
Ribes roezlii*:* occas.. throughout in d,c. and riparian edges
*Ribes velutinum var. glanduliferum:* fairly common upper elevs. p,p., d.c., Heald Pk., occas. at lower elevs in d,c.
*Rorippa curvisiliqua:* in riparian zones w/ permanent, moisture, lower elevs.
*Rumex sp.*: perennial, riparian border
*Salix lasiolepis var. bracelinae*: fairly common riparian zone
*Salvia columbariae:* occasional , arroyo banks, d.c., a.g. to mid elevs.
*Salvia dorrii:* occasional xericd.c. common on marble out crop low to mid elevs.
*Scrophularis californica var. floribunda*: occas riparian areas among rocks, lower elevs.
*Selaginella asprella:* on marble outcrop low-mid elevs.
*Senecio breweri:* uncommon burned s.o. 6200 ft.
*Senecio douglasii:* common shrub in valley alluvium, occas. up to mid elevs. on slopes.
*Silene verecunda ssp. platyota:* uncommon on granite so. and burned j.p.
*Sisimbrium altissimum:* on burn w side of drainage on ridge.
*Sitanion hystrix:* fairly common rocky areas throughout
*Solanum xantii var. montanum:* very common on burn 4500-6500 ft.
*Solidago californica*: occasional d.c. to p.p., some in flower in May.
*Solidago canadensis ssp. elongata:* occas. in riparian lower elevs.
*Sonchus asper:* rare, riparian, moist area
*Stephanomeria chicoricaea:* uncommon in burn and so. at upper elevations
*Stephanomeria exigua:* common xeric a.g. low to mid elevs.
*Stipa speciosa*: common plumose-awned grass of rock outcrops and steep slopes, most common on marble
*Stipa thurberiana*: occasional N slope d.c. known from Ventura and Inyo but not Kern Co.

*Streptanthus (cf.) cordatus var. piutensis:* fairly common on marble outcrop mid- to upper elevs., a rare taxa

*Steptanthus heterophyllus:* on burned area, annual , deep purple sepals pendent siliques 2-lobed stigma. local in burned chaparral and a.g. lower elevs. not mentioned in Twisselmann or Munz for Kern Co.

*Symphoricarpos parishii:* s.o., j.p., upper elevations.

*Tetradymia spinosa var. longispina:* occasional on bajada at lower elevations and on lower xeric marble outcrop.

*Thysadocarpus curvipes:* burn on w ridge

*Trichostoma lanceolatum:* lower elevs on bajada e.g., c.j.

*Trifolium wormskioldii:* riparian, moist soil

Turricula parryi*:* common in burned areas and in arroyo bottoms low to high elevs.

*Typha angustifolia:* wet riparian, rare.

*Urtica holisericea:* wet riparian , low elevs.

*Viola purpurea:* upper elevs. j,p., p.p., rocky areas

*Vulpia (Festuca) myuros:* occasional a.g., bajadfa and lower slopes

*Yucca whipplei ssp. caespitosa:* common on s and w-facing slopes a.g., rock outcrop, marble and other types

*Zauscheneria californi*a:: *:* occas. xeric rock outcrops low to high elevs.

*Zigadenus exalticus:* granitic and metamorphics, burned d.c., s.o., 5000-6000 ft.

# APPENDIX 2
# VERTEBRATES DETECTED IN THE LONG CANYON CANDIDATE RNA MAY 28-31, 1989

Reptiles W Amphibians[3]:

Western *Fence Lizard (Sceloporus occidentalis):* occasional in lower elevations, arroyo, bajada.
Sagebrush Lizard *(Sceloporus graciosus):* common at upper elevations as on Heald Pk in p.p.
Side-blotched Lizard *(Uta stasburiana)***:** uncommon in d.c. and other open associations up to summit of Heald Pk.
California Whiptail *(Cnemodophorus tigris):* uncommon, lower elev. d.c. a.g., d.w.
Common Kingsnake *(Lamprpeltis getulus):* two seen in riparian low elevs.

Birds[4]

California Quail *(Calllipepla californica):* Uncommon, low elev. d.w,)
Mountain Quail *(Oreortyx pcitus):* fairly common
Red-tailed Hawk *(Buteo jamaicensis):* occasional throughout
Golden Eagle *(Aquila chrysaetos):* sighted several times over upper elevations of RNA
Turkey Vulture *(Cathartes aura):* occasional overhead
American Kestrel *(Falco sparverius)*: uncommon along N. boundary
Great Horned Owl *(Bubo virginianus):* uncommon, heard in low elev. d.w.
Mourning Dove *(Zenaida macroura):* uncommon in d.c.
Lesser Nighthawk *(Chordeiles acutipennis):* heard calling at lower elevations in pre-down.
Common Poorwill *(Phalaenoptilus nuttallii):* occasional, calling in evenings from d.c.
White-throated Swift *( Aeronautes saxatilis):* fairly common overhead throughout, esp, near outcrops
Anrta's Hummingbird *(Calypte anna:* occasional throughout
Black-chinned Hummingbird *(Archilochus alexandri):* occasional d.c., riparian
Hairy Woodpecker *(Picoides villosus):* uncommon in burned j.p. , where nesting.
Northern Flicker *(Colaptes auratus):* fairly common in d.w., p.p.
Red-breasted Sapsucker *(Sphyrapicus):* holes filled in p.p. atop Heald Pk.
Nuttell's Woodpecker*(Picoides nuttallii):* uncommon in d.w.
Western Kingbird *(Tyrannus verticalis)*: Uncommon low elev. a.g.
Ash-throated Flycatcher *(Myiarchus cinerascens):* uncommon d.c., d.w., etc.
Western Wood Pewee *(Contopus sordidulus):* occasional: burned j.p, p.p.
Say's Phoebe(*Sayornis saya*), Uncommon, open d.w. low elevs.
Horned Lark *(Eremophila alpestris):* occasional at lower elevs. a.g.
Violet-green Swallow *(Tachycineta thalassina):* common throughout, esp. upper elevs., overhead.
Common Raven *(Corvus corex):* occasional overhead throughout
Scrub Jay *(Apehlocoma caerulescens):* common d.c., p.p. throughout
*Bushtit (Psaltriparus minimus):* occasional in flocks at lower elevs. d.c., d.w.
HouseWren *(Troglodytes aedon):* uncommon, burned j.p., d.c. upper elevs.
Bewick's Wren *(Thryomanes bewickii),* fairly common in d.c.
Rock Wren *(Salpinctes oboletus)* common around rock outcrops throughout, esp. marble
Wrentit *(Chamaea fasciata)* fairly common d.c.
Northern Mockingbird *(Mimus polyglottos):* Uncommon low elevs. d.w., d.c.
Blue-gray Gnatcatcher *(Polioptila caerulea):* common in d.c. and p.p, throughout
California Thrasher *(Toxistoma redivivum)*: uncommon d.c.
Western Bluebird *(Sialia mexicana):* uncommon burned j.p.
Loggerhead Shrike *(Lanius Tudovicianus)*: Uncommon lower elevation a.g., d.w.

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[3] reptile taxonomy follows Stebbins, R. 1985. A field guide to western reptiles and amphibians,Houghton Mifflin, Boston

[4] taxonomy for birds follows Peterson, R.T. 1990. A field guide to Western birds, third edition.Houghton Mifflin, Boston.

Gray Vireo *(Vireo vicinoir)*: Uncommon in mid elev d.c. on east side of drainage
Yellow-rumped (Audubon's) Warbler (*Dendroica coronata*): occasional migrant riparian.
Northern (Bullock's) Oriole *(Icterus glabula bullocki):* uncommon in d.w.
Scott's Oriole *(Icterus parisorum):* one seen at low elevations near northern boundary in juniper.
Brown-headed Cowbird *(Molothrus aters):* common at low elevs. eg. (with cattle).
Lark Sparrow *(Chondestes grammacus):* local in burned d.c. and e.g.
Sage Sparrow *(Amphispiza belli):* uncommon in d.c. at mid-elevations
Black-throated Sparrow *(Amphispiza bilineata),*. occasional d.c. and e.g. borders, lower elev.
Black-chinned Sparrow *(Spizella atrogularis):* common d.c. up to burned j.p.
Rufous-sided Towhee *(Pipilo erythrophthalmus):* common d.c.
California (Brown) Towhee *(Pipilo crissalis):* fairly common edge d.c., a.g., d.w. low elevs.
Black-headed Grosbeak *(Pheucticus melanocephalus)*: fairly common d.c. low elevs.
Lazuli Bunting *(Passerica amoena):* common in burned d.c., j.p. and p.p low to high elevs.
House Finch *( Carpodacus mexicanus):* uncommon low elev. riparian, d.w.
Lesser Goldfinch *(Carduelis psaltria):* common throughout.
Lawrence's Goldfinch *(Carduelis lawrencei):* uncommon, lower drainage.

Mammals[5]

Black Bear *(Ursus americanus):* fresh tracks and seat upper elevs.
Coyote *(Canus latrans):* scat and prints on trails,
Gray Fox *(Urocyon cinereoargenteus):* scat on trails
Mountain Lion *(Felis concolor):* tracks seen on ridge with recent scat.
Mule Deer *(Odocoileus hemionus):* fresh tracks seen throughout.
*Microtus* sp. uncommon, seen in a.g. mid- elevs.
California Ground Squirrel *(Spermophilus beecheyi):* fairly common d.w., low elev. a,g.
Merriam's Chipmunk *(Tamis merriami):* fairly common in d.c., d.w. riparian, etc.
Botta Pocket Gopher (*Thomomys bottae*): common throughout
Dusky-footed Woodrat (*Neotoma fuscipes*): fairly common in d.c. and rock outcrops
Audubon's Cottontail *(Sylvilagus auduboni)*: uncommon, d.c., p.c.

[5] Taxonomy for mammals follows Jameson, E.W., and H.J.Peeters. 1988. California Mammals.U.C. Press, Berkeley and Los Angeles