2.5.04

SIGNATURE PAGE

For

RESEARCH NATURAL AREA ESTABLISHMENT RECORD

Long Canyon Research Natural Area

Sequoia National Forest

Kern County, California

The undersigned certify that all applicable land management planning and environmental analysis requirements have been met and that boundaries are clearly identified in accordance with FSM 4063.21, Mapping and Recordation and FSM 4063.41 5.e (3) in arriving at this recommendation.

Prepared by _____ Date _____
CONSTANCE MILLAR, Research Geneticist, Pacific Southwest Research Station

Recommended by _____ Date _____
DAVE FREELAND, District Ranger, Greenhorn Ranger District

Recommended by _____ Date _____
ARTHUR GAFFREY, Forest Supervisor, Sequoia National Forest

Concurrence of _____ Date _____
JAMES SEDELL, Station Director, Pacific Southwest Research Station

Established by _____ Date _____
JACK BLACKWELL, Regional Forester, Pacific Southwest Region

TITLE PAGE

Establishment Record for

Long Canyon Research Natural Area

within

Sequoia National Forest

Kern County, California

LONG CANYON RESEARCH NATURAL AREA

MAPS

A. INTRODUCTION

The Research Natural Area (RNA) system is a national network of ecological areas designated in perpetuity for research, education, and to maintain biological diversity on National Forest System and other federal ownerships lands. The selection of RNAs is by the identification of target elements, which are determined by vegetation associations within physiographic provinces. The RNA system is intended to include representative examples of common or widespread vegetation associations in each province, as well as any associations unusual or unique to that province. The Long Canyon Research Natural Area (LCRNA) was chosen as a representative of the single-leaf pinyon pine (*Pinus monophylla*[1]), Piute cypress (*Cupressus nevadensis* and desert chaparral associations for the Southern Sierra Nevada Province forest type[2]. Stands of California juniper (*Juniperus californica*) also occur in this area, and were more common prior to the Bodfish Fire (described below).

The LCRNA, located in Kern County, California, was nominated in 1983 by the Greenhorn Ranger District of the Sequoia National Forest. The area was reviewed by the Regional Research Natural Areas Committee (RNAC) and the Pacific Southwest Research Station (PSW) Director. Land allocation for the area as a candidate Research Natural Area was made in the Record of Decision for the Sequoia National Forest Land and Resource Management Plan (LRMP) in 1988 (USDA Forest Service, 1988; Appendix A), which also recommended evaluation of the area and preparation of the establishment record for this area if the Regional Committee deemed it appropriate. Acreage in the LRMP, indicated as 1000 ac (405 ha), was based on a cursory estimate of area within the mapped boundaries. The LRMP also recommended continued coordination with the National Park Service be done to conduct on-site evaluations for potential National Natural Landmark status.

The RNAC subsequently contracted an intensive ecological survey, which was completed in 1990 (Keeler-Wolf, 1990). Keeler-Wolf estimated the area within the LRMP boundaries as 2389 ac (967 ha), which is the value used throughout his report. After evaluating the ecological survey report, the RNAC and PSW Station Director recommended establishment of this area pending appropriate documentation. On the basis of findings of the ecological survey, desert chapparal association was added as an important element of this area.

A mineral potential survey and report were completed in 1997 (Dunn, 1997; Appendix D). This report estimated acreage of the LCRNA, using the same LRMP boundaries, as approximately 2300 ac (931 ha).

In early 2003, the GIS office of the Sequoia National Forest (SNF) determined the area within the LRMP boundaries to be 2259 ac (914 ha). After a field review by SNF and Regional RNA staff, a recommendation was made in June, 2003 to alter the boundary for the LCRNA relative to those proposed in the LRMP. Rather than using the SNF boundary as the northern boundary for the RNA, a diagonal line was proposed from the northeast corner of the original area to the ridgeline on the western watershed. As a result, 172 ac (70 ha) were recommended to be

[1] All scientific names for vascular plants in this report follow Munz (1968) except for trees, which follow Little (1979).

[2.] Vegetation types used in this report are based on Society of American Foresters (SAF) Cover types (Eyre, 1980)

removed from the LCRNA in the northwest portion of the candidate area. This change was proposed to remove areas that are ecologically impacted from livestock, contain exotic invasive species, and have been impacted by off-road vehicles. Further, as likely development proceeds in the private lands adjacent to the National Forest, pressure will increase for recreational use in this low elevation area. The current boundaries are placed along natural topographic and ecological barriers where recreational use and cattle stray are unlikely, and where natural vegetation is in little disturbed condition. All reference in the following report assumes this adjusted boundary, which was determined to contain 2128 ac (861 ha) (Steve Anderson, SNF, pers. comm. 9/03).

The LCRNA was originally selected to represent diverse stands of California juniper and pinyon pine associations in addition to Piute cypress. The Bodfish Fire of 1984 burned most of the area recommended for RNA, and much of the older juniper and pinyon pine were lost. Because these areas are highly fire-adapted, the occurrence of the fire was not considered a deterrent to RNA establishment.

The LCRNA is under management of the Sequoia National Forest. The area lies within general forest land, and no special designations other than potential Research Natural Area status exist for any lands within the proposed boundaries.

1) Land Management Planning
The recommendation for establishment of the LCRNA is included in Sequoia National Forest Land and Resource Management Plan (LRMP) (USDA Forest Service 1988, pgs 3-46 to 3-47 and 4-26 to 4-27) and the effects of its establishment are analyzed in the Final Environmental Impact Statement (pgs 2-39; 3-96 to 3-98; 4-78) for this document. Land allocation for the LCRNA was made by the signing of the Record of Decision (ROD) for the LRMP by the Regional Forester, 1988. The RNA is included within the Research Natural Areas Management Prescription which includes the two established RNAs (Church Dome and Moses Mountain) and two RNA candidates (Long Canyon and South Mountaineer Creek). The LCRNA is also contained within the prescription of further study for potential National Natural Landmark status.

The boundaries discussed in this report and recommended for establishment exclude 172 ac (70 ha) from the LRMP boundary, as described above and shown in Map 1.

B. OBJECTIVES

The objectives for establishing the LCRNA are to fulfill the national objectives of the Research Natural Areas program for the target associations and environments, specifically, to 1) conserve minimally disturbed and diverse representatives of California juniper, Piute cypress, single-needle pinyon pine, and desert chaparral associations of the Southern Sierra Ecological Section; 2) to conserve genetic diversity of the keystone species of these target elements, five species specially listed for rare or endangered status, unusual species associated with limestone environments of the site, and 245 plant species identified to date in total; 3) to provide opportunities for non-manipulative research and study of the target types and associated flora and fauna, especially in regard to post-fire successional dynamics; and 4) to function as a control site for comparing with similar lands manipulated under manipulative management treatments.

Establishment of this RNA will also serve the objective of conserving biodiversity of other vegetation types and their interrelationships with the target associations and role as wildlife habitat. These include annual grassland, foothill pine woodland, shin oak brush, white alder riparian forest, Jeffrey pine forest, and limestone outcrop associations.

C. JUSTIFICATION

The proposed LCRNA is a complete, small watershed, with little recent human use. This provides opportunity for protection and study of an intact ecosystem unit, and reduces chances of human-caused disturbance other than fire. The boundaries are well defined by ridgelines and the northern end is a narrow opening that clearly delimits the watershed. The area contains diverse stands of the rare, CNPS-listed[3] Piute cypress, a species known to only about 10 locations, all in the southern Sierra Nevada. Access is good to most portions of the RNA, providing entry for research and observation.

Fire has played an important role in creating compositional and structural diversity in the LCRNA, increasing the value of this area for research on successional trends and fire-dominated processes. The 1984 Bodfish Fire and a previous (ca. 1954) fire created a complex mosaic of landscape conditions within the highly fire-adapted associations. Fire suppression activities are not evident within the RNA, thus creating ample opportunity to observe natural process.

A prominent band of marble runs through the LCRNA and supports diverse and unusual plant associations typical of limestone outcrops, increasing the value of the area for protection of unusual biodiversity.

D. PRINCIPAL DISTINGUISHING FEATURES

Piute Cypress

The LCRNA is one of two Forest Service areas chosen to preserve populations of this rare species endemic to the Southern Sierra Nevada province. The other area is the Bodfish Piute Cypress Botanical Area, which lies approximately nine miles (14.5 km) west-southwest of the Long Canyon stand.

As with other cypresses in California, Piute cypress is a fire-adapted, serotinous-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 (more than 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. at Hobo Ridge (fire 1966) and Stormy Canyon (fire 1924).

The stands at Long Canyon, though small in extent, have a varied fire history. This variation in age is one of the most significant aspects of the local population. More than half of the area

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[3] California Native Plant Society's (CNPS) inventory of rare and endangered vascular plants of California (Skinner and Pavlik, 1994).

dominated by cypress burned in 1984. Most of the remaining trees date to a fire of 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 sq. m plots (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.

Slope exposure is relatively important to the cypress at Long Canyon. Few individuals exist on aspects south of ENE or WNW directions. The largest trees occur in draws on north-facing slopes, with stature progressively declining up-slope away from mesic conditions.

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.

Hanes (1977) lists the following species as dominants of desert chaparral: *Adenostoma fasciculatum, Arctostaphylos glauca, Ceanothus greggii* ssp. *perplexans* and *ssp. vestitus, Cercocarpus betuloides, Dendromecon rigida, Ephedra spp., Eriodictyon trichocalyx, Eriogonum fasciculatum, Fremontodendron californicum, Garrya flavescens* var. *pallida, Juniperus californica, Opuntia* spp.*, Prunus fremontii, P. fasciculatum, Purshia tridentata, Quercus turbenella* var. *californica, Rhus trilobata,* and *Yucca whipplei.* Thorne (1976) also mentions *Cowania mexicana, Arctostaphylos pungens, Ceanothus leucodermis, C. crassifolius,* and *C. cuneatus* as typical species. Beauchamp (1986) considers additional species such as *Thamnosma montana, Ziziphus parryi, Nolina bigelovei, Coleogyne ramosissima,* and *Quercus cornelius-mulleri* as important members of the community in 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 as *Ceanothus greggii* ssp. *vestitus*, *Fremontodendron californicum*, and *Arctostaphylos glauca*. High-elevation ridgecrest 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, Eriogonum fasciculatum,* and *Encelia virginiensis*. Low elevation gently sloping sites have mixtures of cismontane woodland species such as foothill pine (*Pinus sabiniana*) and scrub interior live oak (*Quercus wislizenii* 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.

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 that have cismontane elements such as foothill pine, canyon live oak, and various species of desert 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 complex 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 prior (relative to 1990), 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.

Rare Plants

The following species listed by the California Native Plant Society (CNPS, 2001) are known from within, or in the immediate vicinity of the LCRNA: Piute cypress (list 1b), *Delphinium purpusii* (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). 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 Skinner and Pavlik (1994) however it occurs off limestone on metamorphics and to a lesser extent on granitics throughout the LCRNA.

Eriogonum breedlovei var. *breedlovei* is a rare endemic to the Piute Mountains of Kern County. It has been reported from calcareous substrates in the vicinity of Heald Peak (Smith and Berg, 1988), although this report has not been further verified. With further exploration it is likely to be found on marble in the RNA.

Limestone Values and Geologic Diversity

A prominent band of marble runs up the eastern boundary ridge from the northeastern corner 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*, *Cryptantha confertiflora*, and *Cheilanthes jonesii*; local endemics such as *Delphinium purpusii* and *Dudleya calycina*; as well as several wide ranging species which are in highest local densities on limestone such as *Salvia dorrii*, *Stipa speciosa, Eriogonum plumatella, Selaginella asprella, Haplopappus (*cf.) *palmeri ssp.pachylepis,* and *Oryzopsis hymenoides.*

The LCRNA is principally underlain by metamorphic rocks including schists, phyllites, and gneisses. However, the upper elevations also have extensive outcroppings of granitic rocks. Although not as well defined as the marble, these substrates also have 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 viscidus, 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 schist on the southeast 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*) have been reported in the LCRNA (Keeler-Wolf, 1990). Both species are considered species of special concern by the California Department of Fish and Game (Steinhart, 1990). Gray vireos are presumed to breed in the RNA. 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.

E. LOCATION

(1) National Forest
The LCRNA is located on the Greenhorn Ranger District, Sequoia National Forest, in Kern County, California. No other ownerships or public jurisdictions are involved. The area is entirely included in the USGS Woolstalf Creek 7.5 minute topographic quadrangle map (Map 1). Private lands and lands administered by the USDI Bureau of Land Management (BLM) adjoin the northern boundary of LCRNA.

(2) Latitude/Longitude
The approximate center of the RNA is at 35^{o} 35’53”N latitude and 118^{o} 19'23”W longitude.

(3) Boundary description
The LCRNA includes all or portions of Sections 3, 4, 9, 10, 15, and 16 of T27S, R34E, Mount Diablo Baseline and Meridian, USGS Woolstalf Creek 7.5 minute topographic quadrangle map (Map 1), in Kern County, California.

The LCRNA follows watershed boundaries defining Long Canyon on the west, south, and east sides. The boundaries of LCRNA are delineated by topography, except the northwestern boundary, which is a straight diagonal line connecting the NE corner of Section 4 T27S, R34E to a prominent point along the the west ridge of the watershed in section 4. The western boundary also coincides with a recreation trail.

The following describes the boundary of LCRNA in more detail. Refer to Map 1 for clarification.

a) Beginning at Heald Peak, 35° 35' 28"N, 118° 18' 32"W, marked summit 6901 at elevation 6901 ft (2103 m), SE1 ¼ SE ¼ Sec 10 T27S, R34E, Mount Diablo Baseline and Meridian, at **Pt A**;

b) thence, northwardly along the ridgeline, descending to a saddle, and ascending along the ridgeline to marked summit 6808 at **Pt B**, 35° 35' 43"N, 118° 18' 31"W, elevation 6808 ft (2075 m);

c) thence, northwardly then northwestwardly following the ridgeline to marked summit 6341 at **Pt C**, 35° 36' 07"N, 118° 18' 39"W, which is just north of the section line between Sections 10 and 3 T27S, R34E, Mount Diablo Baseline and Meridian, and approximately 0.25 mile (0.4 km) west of the NE corner of section 10 (6341 ft [2085 m]);

d) thence, northwestwardly along the ridgeline to marked summit 5178 (5178 ft [1578 m]), which is **Pt D**, 35° 36' 31"N, 118° 18' 52"W, just east of the center of Section 3 T27S, R34E, Mount Diablo Baseline and Meridian;

e) thence, northwestwardly along the ridgeline to **Pt E**, 35° 36' 58"N, 118° 19' 31"W, which is the NW corner of Section 3 T27S, R34E, Mount Diablo Baseline and Meridian, and is also the Sequoia National Forest boundary, at 4000 ft (1219 m);

f) thence, southwestwardly in a straight line diagonally to **Pt F**, 35° 36' 30"N, 118° 20' 29"W, at 4280 ft (1305 m) which is a point on the ridgeline delineating the western boundary of the Long Canyon watershed. The boundary meets with Sequoia National Forest recreation trail #34E31 at this point, which traverses the western ridgeline in this section;

g) thence, southward following the ridgeline approximately 0.3 mile (0.5 km) to **Pt G,** 35° 36' 06"N, 118° 20' 32"W, at the section line between Sections 4 and 9 T27S, R34E, Mount Diablo Baseline and Meridian, approximately 0.1 mile (0.2 km) east of the NW corner of section 9;

h) thence, following the prominent ridgeline in a southeastwardly direction to the westerly of two summits near the center of Section 9 T27S, R34E, Mount Diablo Baseline and Meridian at **Pt H,** 35° 35' 39"N, 118° 20' 17"W, which is approximately 5640 ft (1720 m);

i) thence, southeastwardly about 0.1 mi (0.2 km) to the second, higher summit at **Pt I,** 35° 35' 37"N, 118° 20' 10"W, marked 5698 (elevation 5698 ft [1736 m]);

j) thence, southwardly along the ridgeline to the section line between sections 9 and 16 T27S, R34E, Mount Diablo Baseline and Meridian at **Pt J,** 35° 35' 15"N, 118° 20' 09"W, which is approximately 0.45 mile (0.72 km) east of the NW corner of Section 16;

k) thence, southwardly approximately 0.5 mile (0.8 km) along the ridgeline to the prominent summit marked 6850 (elevation 6850 ft [2088 m]), which is **Pt K,** 35° 34' 47"N, 118° 20' 02"W and near the center of section 16 T27S, R34E, Mount Diablo Baseline and Meridian;

l) thence, eastwardly along the ridgeline to a minor summit within section 16 T27S, R34E, Mount Diablo Baseline and Meridian at elevation 6600 ft (2011 m) at **Pt L,** 35° 34' 50"N, 118° 19' 43"W;

m) thence, eastwardly along the ridgeline to **Pt M,** 35° 34' 49"N, 118° 19' 32"W, which is on the section line between Sections 16 and 15 T27S, R34E, Mount Diablo Baseline and Meridian, approximately 0.5 mile (0.8 km) south of the NE corner of section 16;

n) thence, eastwardly along the ridgeline to the toe of the ridge at **Pt N,** 35° 34' 50"N, 118° 19' 12"W, which is approximately 6290 ft (1917 m);

o) thence, northeastwardly to the saddle which marks the base of the main ridge to Heald Peak, at **Pt O,** 35° 34' 55"N, 118° 19' 07"W, elevation 6190 ft (1887 m);

p) thence northeastwardly along the main ridgeline toward Heald Peak, turning northward to cross the section line of section 15 T27S, R34E, Mount Diablo Baseline and Meridian approximately 0.25 mile (0.4 km) west of the NE corner of section 15 at **Pt P,** 35° 35' 14"N, 118° 18' 40"W, which is at elevation 6745 ft (2056 m);

q) thence north-northeastwardly along the ridgeline to the summit of Heald Peak and the beginning at **Pt A.**

(4) Acreage
The acreage for the LCRNA, as described above, is 2,128 acres (861 ha).

(5) Elevation
Elevations range in the LCRNA from 3700-6901 ft (1128-2103m).

(6) Access
The LCRNA is near the southern end of the Sierra Nevada, about 11.5 mi (18.5 km) southeast of Kernville, CA, near the southeast end of Isabella Reservoir. Many roads interconnect public roads across private and BLM land and provide diverse access points to the LCRNA (Map 2).

One access route is to travel on State Highway 178, turning south on Vista Grande Drive, which is 0.2 mi (0.3 km) west of the intersection of State Highway 178 and County Route 521. Proceed 0.8 mi (1.3 km) and turn right on Hill View Acres Rd., go 0.3 mi (0.5 km) and turn left on Buck Road. Proceed 0.5 mi (0.8 km) and turn left on Brooks Road. A jeep trail forks to the left at 0.5 mi (0.8 km). From here, multiple jeep routes access Long Canyon – choose routes that bear toward the canyon. Two jeep trails go a short distance into the LCRNA. Current information on the best access route may be obtained at the USFS Greenhorn Ranger District Office at Lake Isabella, CA. The RNA can also be accessed by turning south (off of Highway 178) on an unmarked BLM road located 0.1 miles of Patterson Lane (which has a Wildlife Vista Sign) just past the cement plant. This unmarked BLM road is also 0.1 miles west of a KOA Campground. Bear right on unmarked roads and follow multiple jeep routes uphill to Long Canyon (as above).

Travel within the RNA is restricted by the steep slopes and the dense chaparral vegetation. The most accessible route to the upper elevations is by way of Forest Service trail #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 (2012 m) elevation. It has not been maintained since the Bodfish Fire of 1984. However, it 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.

Access to the Piute cypress stands is also easiest from trail #34E31. The trail may be walked to Peak 5698, 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.

F. AREA BY COVER TYPES

Table 1. Area by Holland (1986) vegetation types in the LCRNA, with Kuchler (1966) and SAF (Eyre 1980) code equivalents.

	Acres	Hectares	Percent
HOLLAND TYPES (Holland 1986)			
37400 Desert Chaparral (K29, no SAF)	1005	406	47
72210 Pinyon Forest (K21, SAF 239)	525	212	25
42200 Annual Grassland (K41, no SAF)	338	137	16
71300 Foothill Pine Woodland (K26, SAF 250)	44	18	2
37541 Shin Oak Brush (no K or SAF)	89	36	4
85100 Jeffrey Pine Forest (no K, SAF 247)	55	23	3
------ Limestone Outcrop (no H, K, or SAF)	22	9	1
83330 Piute Cypress Forest ((no K or SAF)	20	8	1
72400 California Juniper Shrub (no K or SAF)	15	6	<1
61510 White Alder Riparian Forest (no K or SAF)	15	6	<1
Total	2128	861	100

G. PHYSICAL AND CLIMATIC CONDITIONS

The LCRNA lies at the northeast end of the Piute Mountains, and is highly varied topographically and geologically. The area includes a complete watershed, which covers 2128 acres (861 ha). The overall topographic relief is substantial, ranging from 3700 ft (1128 m) near the mouth of Long Canyon to 6901 ft (2103 m) atop Heald Peak; a total elevational difference of 3201 ft (976 m). Many slope aspects are involved.

The LCRNA is geologically diverse, dominated by pre-Cenzoic metasedimentary rocks including schists, phyllite, and marbles in the north and west parts. Mesozoic granitic (part of the Sierra Nevada Batholith) rock dominates on the southwest and east parts.

No weather stations exist within the LCRNA. The Piutes rise abruptly from the Kern River valley, and, consequently, temperature and precipitation change rapidly with elevation in the LCRNA. The closest climate data are from Wofford Heights, approximately 9 miles (14.5 km) northwest of the southwest edge of the LCRNA, at an elevation of 2625 ft (800 m), which is about 2575 ft (785 m) lower than LCRNA. It is likely that precipitation for the upper elevations in the LCRNA averages about 16 inches (406 mm) per year, while the lowest elevations average about 8 inches (203 mm) per year.

Temperature data are also likely to change strongly depending on elevation. At the upper elevations snow falls regularly and may linger on the ground in protected areas (sheltered north-slopes) for many weeks during the winter. It is estimated that the frost-free period ranges from 240 days at lower elevations to 180 days at upper elevations. There are probably 30-90 days when the maximum temperature exceeds 90 ^{o}F (32 ^{o}C) (projected from Donely et al., 1979)

Estimates further indicate that LCRNA has an average annual water deficit of 7.8-15.7 inches (20-40 cm) and an average annual water surplus of 0 to fewer than 7.8 inches (0-20 cm). The area borders between a Mediterranean climate, characterized by precipitation averaging more than potential evaporation and with the average temperature of the coldest month between 0 and 64 ^{o}F (0-18 ^{o}C) and of the warmest month greater than 72 ^{o}F (22 ^{o}C); and a steppe climate with precipitation more than half but less than potential evaporation and the average of the coldest month > 32 ^{o}F (0 ^{o}C) (Donely et al., 1979). Precipitation isobar maps show average precipitation at the base of Long Canyon as ca. 8 in (203 mm).

Table 2 gives data from the Glennville, California station, which is west of the LCRNA about 25 miles (40 km) distant, at an elevation of 3130 ft (954 m), which is about 570 ft (174 m) lower than the lowest elevation in the RNA. As such, it's climate is likely quite different from the RNA, especially in regards to precipitation – Glennville's average precipitation is likely ca. twice that of Long Canyon's (Steve Anderson, SNF, pers. comm.. 9/03). Fire stations within the region of the RNA (e.g., Havilah, Southlake, Lake Isabella or South Fork) maintain unpublished records of weather from a shorter period-of-record that these may better reflect conditions at the RNA than at Glennville

Table 2. Monthly average weather data from Glennville, CA (station 043463; elev 3130 ft [954 m], 35°43'N 118°42'W) for period of record: 1951-2003. Data available from Western Regional Climate Center: http://www.wrcc.dri.edu/index.html

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature °F (°C)	56.5 (13.6)	57.9 (14.4)	59.3 (15.1)	65.2 (18.4)	73.8 (23.3)	83.2 (28.4)	90.4 (32.4)	89.5 (31.9)	84.0 (28.9)	73.9 (23.3)	62.8 (17.1)	56.9 (13.8)	71.1 (21.7)
Average Min. Temperature; °F (°C)	28.4 (-2.0)	30.8 (-0.7)	32.5 (0.3)	35.1 (1.7)	39.6 (4.2)	44.9 (7.2)	50.7 (10.4)	49.5 (9.7)	45.4 (7.2)	38.1 (3.4)	31.9 (-0.1)	28.1 (-2.2)	37.9 (3.3)
Average Total Precipitation; in (mm)	3.72 (95)	3.19 (81)	3.23 (82)	1.84 (47)	0.75 (19)	0.15 (4)	0.05 (1)	0.13 (3)	0.42 (11)	0.73 (19)	2.19 (56)	2.77 (70)	19.18 (497)
Average Total Snow Fall; in (mm)	2.1 (53)	1.4 (36)	2.9 (74)	0.9 (23)	0.1 (3)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)	0.7 (18)	1.4 (36)	9.4 (239)
Average Snow Depth; in	0	0	0	0	0	0	0	0	0	0	0	0	0

H. DESCRIPTION OF VALUES

(1) Flora

Keeler-Wolf (1990) conducted a detailed vegetation survey and evaluation of the vascular plants of LCRNA. The flora of the area is relatively rich for a xeric site, containing at least 245 taxa of vascular plants (Appendix B). The relatively high number of species is a factor of habitat diversity as a result of variable elevations, topographic complexity, and substrate patchiness. The large burned area also increases diversity due to a number of fire-following ephemeral species that have flourished in the LCRNA.

The majority of the five rare species known from the RNA are partly or wholly associated with the marble outcrop along the northeastern boundary. These species have been discussed in earlier sections.

Following is a description of the major plant associations occurring in the LCRNA, based on the

Holland (1986) vegetation type classification, as described by Keeler-Wolf (1990) (refer to Map 3).

Desert Chaparral (37400): 1005 acres (406 ha). Desert chaparral vegetation contains a mixture of cismontane chaparral shrubs and cool or hot desert species; it is the most widespread vegetation type in the RNA. It exhibits great variation, not only in successional state, but also as a result of slope exposure, elevation, and geological substrate.

Its distribution ranges from 3550 ft (1082 m) along the arroyo banks near the northern boundary to 6800 ft (2073 m) near the summit of Heald Peak. The densest and most extensive stands occur on N.-facing slopes and are dominated by species such as *Ceanothus greggi* ssp. *vestitus*, *Fremontodendron californicum*, and *Arctostaphylos glauca*. High-elevation ridge-crest stands on granitic soil may be dominated by *Artemisia tridentata*, *Ephedra viridis*, and others. South-slope dominants include *California juniper*, *Yucca whipplei*, *Happlopappus linearifolius*, *Eriogonum fasciculatum*, and *Encelia virginiensis*. Low-elevation, gently sloping sites have mixtures of species such as foothill pine (*Pinus sabiniana*) and scrub interior live oak (*Quercus wislizenii* var. *fructescens*) with xerophytic species such as *Senecio douglasii* and *Chrysothmanus nausiosus*. Cover is usually less than 50 percent.

Common understory species include: *Lomatium dissectum*, *Melica stricta*, *Delphinium purpusii*, *Balsamorhiza deltoidea*, *Arenaria macradenia* var. *arcuifolia*, *Castilleja jepsonii*, *Galium hallii*, *Erysimum moniliforme*, *Claytonia spathulata*, and *Gilia interior*. Many of the recently burned stands also contain numerous post-fire herbaceous species such as *Turricula parryi*, *Malacothamnus orbiculatus*, *Eriophyllum confertiflorum*, and *Haplopappus arborescens*.

Pinyon Forest (72210): 525 acres (212 ha). This association occupies the higher elevation, north-facing slopes. It also occurs sporadically in sheltered canyons. It is dominated by single-leaf pinyon pine (occurring almost exclusively at the higher elevations) and codominates with canyon live oak (*Quercus chrysolepis*) and foothill pine at lower elevations. At the highest elevations, pinyon has an average density of 235 trees/acre (580 trees/ha); most of the trees here appear to be less than 200 years old. Sapling and seedling density is low (12/acre [30/ha]). Understory cover is low, with *Ribes velutinum* var. *glanduliferum*, *Ephedra viridis*, *Galium munzii*, and *Phlox diffusasubcarinata* being most common.

At lower elevations, trees are smaller, and seedlings and saplings of pinyon are more common. The understory is more developed and includes *Balsamorhiza deltoidea*, *Symphoricarpos parishii*, *Galium munzii*, *Poa scabrella*, *Lomatium dissectum*, *Ribes roezlii*, *Erigeron foliosus*, and *Galium aparine*.

At the southern end of the LCRNA, a pinyon forest with canyon live oak, shin oak (*Quercus garryana* var. *breweri*), and California black oak (*Quercus kelloggii*) occurs.

As of 1990, the burned portion of the pinyon forest on the northwest-facing slope of Heald Peak contained no pinyon seedlings or saplings and an uncharacteristic assemblage of herbs such as *Phacelia fremontii*, *Eroiphylum abiguum*, *Phacelia egena*, and *Layia glandulosa*.

Annual Grassland (42200): 338 acres (137 ha). This association type occupies xeric, south-facing slopes up to 5600 ft (1701 m). The substrate is generally rocky and not very deep. The most widespread dominant species are *Avena fatua*, *Bromus rubens*, and *B. tectorum*. Several

native perennial grasses also occur scattered in the area. They are *Sitanion hystrix*, *Poa scabrella*, *Stipa coronata*, and *Melica imperfecta*. Woody perennial species occurring include *Yucca whipplei* ssp. *caespitosa*, *Ephedra viridis*, *Eriogonum fasiculatum*, *Fremontodendron californicum*, *Ceanothus greggi* ssp. *vestitus*, *Keckliella breviflorus*, *Mimulus longliflorus* ssp. *calycinnus*, *Encelia virginianus*, *Lotus scoparius*, and *Eriophyllum confertiflorum*.

The annual grassland at the lowest elevations, on the bajada in the northern portion of the RNA, receives heavier grazing. Here, soil is deep and porous and precipitation is low. Annuals, including *Bromus rubens* and *Erodium cicutarium*, predominate.

The annual grassland has a varied fire history that has created patchy abundance of certain species, such as *Yucca whipplei*, *Lotus grandiflorus*, and *Calystegia longipes*.

Foothill Pine Woodland (71300): 44 acres (18 ha). This association is found on the alluvial deposits of the bajada slope at the mouth of Long Canyon and is a mixture of cismontane and transmontane species. The dominate foothill pines are relatively small – average height is about 20 ft (6 m) – and young, appearing to have burned within the past 35-40 years, as of 1990. The canopy is open, with 10-30 percent cover. The shrub cover is dominated by California juniper, *Ceanothus leucodermis*, *C. greggii* ssp. *vestitus*, and *Fremontodendron californicum*. The understory averages about 60 percent cover and includes *Haplopappus linearifolius*, *Lepidospartum squamatum*, *Artemisia tridentata*, *Eriogonum fasciculatum* ssp. *poliofolium*, *Chrysothamnus nausiosus*, and *Sencio douglasii*.

Most of the tree overstory in this association type appears to have been destroyed by the 1984 fire.

Shin Oak Brush (37541): 89 acres (36 ha). Shin oak dominates a small area of high elevation, northwest-facing granitic slopes. It is a clonal resprouter and tends to occur in large, dense patches. In addition to the dominant shin oak, *Garrya flavescens* ssp. *pallida*, *Ceanothus greggii* ssp. *vestitus*, and *Fremontodendron californicum* also are found in the canopy layer. The understory includes *Symphoricarpos parishii*, *Solanum xantii*, and *Ribes roezlii*. Annual and perennial herbs include *Phacelia mohavensis*, *P. davidsonii*, *Mimulus fremontii*, *Senecio breweri*, and *Zigadenus exalticus*.

The majority of the shin oak type was burned in the 1984 fire.

Jeffrey Pine Forest (85100): 55 acres (23 ha). This association type is restricted to two stands, one recently burned and one unburned. Both stands occupy north-facing exposures on granitic soils. The larger stand suffered a crown fire in 1984 that killed all the trees. The stand in 1990 supported saplings (3 ft [1 m]) of Jeffrey pine (*Pinus jeffreyi*), and low resprouts of California black oak and canyon live oak. The understory is dominated by resprouts of shin oak and *Symphoricarpos parishii* along with *Solanum xantii* seedlings. The herbaceous vegetation is well developed and includes *Lupinus albicaulis* var. *shastensis*, *Silene verecunda* ssp. *platyota*, *Lithophragma parviflora*, *Cystopteris fragilis*, and *Arabis repanda*.

The unburned stand is bordered by pinyon forest and shin oak brush and occupies a rockier substrate. Dominants average 50-60 ft (15-18 m) tall, 2-2.5 ft (60-75cm) diameter (dbh), and 200 years old. The understory is relatively open and includes saplings and pole size Jeffrey pines, along with *Artemisia tridentata*, *Chrysothamnus viscidiflorus*, *Ceanothus greggii* ssp. *vestitus*, shin oak, and *Symphoricarpos parishii*.

Limestone Outcrop (No Holland equivalent): 22 acres (9 ha). This marble outcrop forms the northeastern boundary and supports a unique assemblage of plants. Average vegetation cover is about 5-15 percent. Dominant species include California juniper, *Ephedra viridis*, *Yucca whipplei* ssp. *caespitosa*, *Salvia dorrii*, *Stipa speciosa*, *Selaginella asprella*, *Salvia colubarae*, and *Eriogonum saxatile*. At higher elevations the unusual desert shrub *Forsellesia nevadensis* becomes common.

Piute Cypress Forest (83330): 20 acres (8 ha). This association type is made up of two stands occupying slopes ranging from due North to due East. The stands are underlain by schistose metamorphics and separated by a southeast-facing band of annual grassland. The majority of the north stand burned in 1984, while the smaller south stand last burned in the late 1940s. Cypress seedlings were present on all plots and ranged from densities of 7-73 seedlings/100-m^2 plot. In addition to the cypress, 30 species of plants were noted on the burned plots. *Ceanothus greggii* ssp. *vestitus* seedlings and resprouts of *Fremontodendron californicum* were the most common. Total ground cover on the burned plots ranged from 30 to 60 percent.

The trees in the unburned stand varied in size from broad and tall at lower elevations, to stunted at higher elevations. Cone size varies also and is directly correlated with the size of the tree. Tree density on the unburned plots was 6-61 trees/100 m^2, and tree size was 1-2 inches (2.5-5 cm) dbh, 8-10 ft (2.5-3 m) tall. The understory is composed of only half the species (15) as in the burned stand; it is dominated by *Ceanothus greggii* ssp. *vestitus*.

California Juniper Scrub (72400): 15 acres (6 ha). The 1984 fire destroyed many of the best stands of California juniper in the LCRNA. Before the fire, juniper ranged up to the summit of the west ridge and throughout the desert chaparral and annual grassland. The only area where extensive California juniper remains is along the marble outcrop (cover between 10-30 percent). It is also found scattered at lower elevations on the bajada slope near the north boundary and along the west boundary ridge. The most common understory species are *Stipa speciosa*, *Yucca whipplei* ssp. *caespitosa*, and *Haplopappus linearifolius*.

White Alder Riparian Forest (61510): 15 acres (6 ha). This association is restricted to narrow strips of permanently moist areas along the Long Canyon streambed. The white alders (*Alnus rhombifolia*) are small (not more than 20 ft [6m] tall) and short-lived due to fluctuating water availability. Associated species include *Salix lasiolepis* var. *bracelinae*, *Populus fremontii*, *Ribes nevadense*, *Mimulus guttatus*, *M. cardinalis*, *Nasturtum officinale*, *Juncus xiphioides*, and *J. macrophllus*.

This association also was affected by the 1984 fire, which killed several patches of white alder in the lower and middle-sections of the stream channel.

(2) Fauna

The area is relatively rich in vertebrate species with 65 species noted during a three-day field assessment for the ecological survey (Keeler-Wolf, 1990; Appendix C). Several of these species are typically seral and are likely to have entered the area as a result of regeneration following the extensive 1984 fire. Lazuli buntings, lark sparrows, and black-chinned sparrows are three species that seem to have increased or expanded their local range as a result of the Bodfish Fire (Keeler-Wolf, 1990). 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 has been documented in the extensive desert chaparral at the lower elevations of LCRNA.

The area has excellent diversity of large mammals, including direct reports of black bear, mountain lion, mule deer, gray fox, and coyote, and small mammals including California ground squirrel, Dusky-footed woodrat, Merriam chipmunk, and Botta pocket gopher.

(3) Geology

The LCRNA is geologically diverse, dominated by pre-Cenozoic meta-sedimentary 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).

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 considered them part of the Isabella Metamorphic Group. They include primarily metamorphosed quartzite, limestone, and shale, and include all references to schistose rocks and marble in this report. These rocks also crop out in several areas to the northwest, north, and south of Long Canyon, all outcrops that surround 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. Both Schweikert (1981) and Bateman (1981) considered 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) indicates at least some of the rocks in this metamorphic zone are lower Paleozoic in age. However, other specialists suggest that the rocks are mostly Triassic and Jurassic.

The marble outcrop on the eastern side of the area is composed of relatively coarse-grained marble with several areas of relatively large (1 in [2.5 cm]) calcite crystals. It is light gray. It shows little evidence of water etching, and has no apparent caverns. This marble band is broken by narrow dikes of granitic rock and also by bands of dark schistose rock.

The most extensive rock in the RNA is the schistose meta-shale. This is a dark fine-grained rock with numerous quartz bands. It crops out 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.

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.

(4) Soils

The soils of the LCRNA are described in three main complexes: the Livermore family--Rock outcrop complex, the Rock outcrop--Tollhouse complex, and the Xerofluvents--Xerothents association (USDA Forest Service 1980; refer to Map 4). The most extensive of these is the Livermore family--Rock outcrop. This complex is further divided into two mapping units, both with similar characteristics except average slope steepness that can be generally characterized as follows:

(1) Livermore family – Rock outcrop

They generally contain about 60 percent Livermore family and 30 percent rock outcrop with 10 percent 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 percent gravel and cobbles. Typically, the surface layer is dark brown cobbly and stony sandy loam about 18 inches (46 cm) thick. The subsoil is strong brown, very gravelly sandy loam about 8 inches (19 cm) thick. The substratum is brown very gravelly sandy loam about 4 inches (10 cm) thick over fractured metasedimentary rock. Depth to rock ranges from 20 to 47 inches (50 to 120 cm). The rock outcrops occur as both small isolated and massive exposures of meta-sedimentary rock. The steeper of the two units (mapping unit 238) averages a lower effective rooting depth 6 to 12 inches (15-30 cm) than the other unit 12 to 26 inches (30-65 cm).

(2) Xerofluvents—Xerothents family

This soil type occurs on the bajada slope at the northern end of the LCRNA. This comprises one mapping unit locally, composed of 45 percent Xerofluvents and 45 percent 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 boulders 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.

(3) Rock Outcrop – Tollhouse complex.

This map unit is simply rock outcrop and shows up extensively only along the northeastern boundary, corresponding to the marble outcrop.

(5) Lands

All lands within the LCRNA are managed by the Sequoia National Forest; no private inholdings are involved.

(6) Heritage Resources

The LCRNA was part of the territory of the Tubatulabal people. 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 Nevada and the Piutes). 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 (Smith, 1978). 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.

I. IMPACTS AND POSSIBLE CONFLICTS

(1) Mineral Resources

A mineral survey and mineral potential report was conducted for the LCRNA (Dunn, 1997; Appendix D). In recent years Desert Star, a small family-run mining interest, has had an active claim in the northeast corner of the LCRNA (Dunn, 2003; Appendix E) (Map 5). This includes ca. 125 ac (50 ha) of white, high-calcium carbonate-ridge deposit within a marble unit of the Kernville Series of the LCRNA. The claim extends northward onto BLM administered land adjacent to the LCRNA, which provides access to the portion on the RNA. RNA designation will promote protection of the unique edaphic-dependent flora in the area of the claim. There is a high likelihood of this claim remaining low impact.

Past mining in the immediate area of the LCRNA was for tungsten, limestone, and possibly gold. Minor mineral prospecting activity, apparently for tungsten, has occurred on the LCRNA in the past, but field evaluation indicates very little recent activity.

The mineral potential report concludes that the LCRNA, except its northeast side, has a low potential of hosting valuable deposits of locatable, leasable, or salable mineral commodities. Marble along the LCRNA's northeast sides has the potential to host locatable and/or salable deposits of high-calcium limestone, but this material is uneconomical in the current market. Tungsten could occur in small localized bodies of tactite associated with the metamorphism of limestone but is not believed to be in quantities that would be economic to mine.

The formal mineral withdrawal process is parallelling the LCRNA establishment.

(2) Grazing

The area now included in the LCRNA is within an active National Forest grazing allotment, Nichols Peak, which is run in common with the adjacent Bureau of Land Management allotment, Freedom Hill.

Impacts from earlier grazing at the north end of Long Canyon and introduction of exotic plants were the primary reasons that the boundary was changed from the candidate LCRNA (with a northern boundary along the National Forest line) to the current boundaries. The lands now contained within the RNA are little impacted by domestic livestock grazing, and little likely to be used.

(3) Timber

The LCRNA is not contained within a timber harvest management unit, nor is fuelwood cutting offerred in the area. Much of the pinyon pine woodland burned in the Bodfish Fire of 1984, and the remaining juniper and cypress are of little social value for their timber resources.

(4) Watershed Values

The LCRNA includes the entire upper watershed of the Long Canyon, which is a minor order stream entering the S Fk Kern River system in South Fork Valley. Establishment of the LCRNA will protect the watershed of Long Canyon Creek, maintain unique and limited riparian vegetation along the water courses, improving habitat for aquatic biota and wildlife, and enhancing water quality to the Kern River system.

(5) Recreation Values

Although National Forest recreation trail #34E31 traverses parts of the eastern boundary of the LCRNA, little recreational use occurs within the RNA. Rough terrain, lack of water, extreme temperatures, and dense chaparral growth tend to discourage entry. Some seasonal use does occur during hunting season, and potential OHV and 4 wheel-drive (4WD) use may occur on the north end. On August 21, 2003, the point of entry of a 4WD use-trail into the LCRNA was blocked with rocks and brush. Carsonite signs indicating closure of the RNA to vehicle use will be placed along the blocked trail.

(6) Wildlife and Plant Values

Establishment of the LCRNA will protect and conserve the wildlife and plant values of the area. Fire has played an important role in maintaining the diversity within this watershed, and will remain the case for future maintenance of the plant associations and associated wildlife habitat. For example, the 1984 fire created mosaics of woodland, chaparral, and grassland types, stimulated sprouting and regeneration of a diversity of plant species, all of which provided important browse and habitat for wildlife.

7) Transportation plans

Establishment of the LCRNA will have no effect on current transportation systems on the Sequoia National Forest. No future trails or roads are proposed within or near the LCRNA.

8) Heritage Resource sites

Establishment of the LCRNA will be beneficial to the protection and preservation of all the uncovered and potential heritage resource sites in the area, since disturbance, except fire, will be minimized.

J. MANAGEMENT PRESCRIPTION

Management direction is the same for candidate and established Research Natural Areas on the Sequoia National Forest, as described by the LRMP (USDA Forest Service, 1988). Thus, management of the LCRNA continues in accordance with general direction of the LRMP. Management of the LCRNA is to protect vegetation associations and associated biodiversity consistent with the objectives of a Research Natural Area (FSM 4063).

1) RNA Management Strategy
To determine need for specific management actions beyond the general direction in the LRMP, the Sequoia National Forest, in conjunction with the RNAC, will prepare after establishment a management evaluation and strategy for the LCRNA. This document will outline any specific prescriptions, practices, uses, and monitoring necessary for conserving the values of LCRNA.

K. ADMINISTRATION RECORDS AND PROTECTION

The official responsibility for administration and protection of the LCRNA is with the District Ranger, Greenhorn Ranger District, 4875 Ponderosa Drive, P.O. Box 3810, Lake Isabella, CA 93240, telephone 760-379-5646. Attention should be given to the recreational use on the trails bordering the RNA, to livestock use in riparian areas, to vehicle use from private lands to the north, to mining activities within the claim boundary, and to fire response procedures appropriate for the RNA.

The research coordinator is the Director, Pacific Southwest Research Station, USDA Forest Service, 800 Buchanan Street, Albany, CA 94710. This person is responsible for coordinating observational or non-manipulative applied research (through the Research Use Application process), and for maintaining the areas's research data file, and list of herbarium and species samples collected.

L. ARCHIVING

The Station Director shall establish and maintain a system for archiving data and reports from research natural areas in a manner that will facilitate the exchange and transfer of information among Stations, National Forests, and scientists.

M. REFERENCES

Bateman, P. 1981. Geologic and geophysical constraints on models for the origin of the Sierra Nevada Batholith, California. In: Ernst, W.G. ed., The Geotectonic Development of California. Englewood Cliffs, NJ. Prentice-Hall.

Beauchamp, R.M. 1986. A flora of San Diego County, California. National City, CA: Sweetwater River Press.

Clements, F.E. 1936. The origin of the desert climax and climate. p. 87-140 In: Goodspeed, T.H. ed., Essays in Geobotany in Honor of William Albert Setchell. Berkeley/LosAngeles: University of California Press.

CNPS (California Native Plant Society), 2001. Inventory of rare and endangered plants of California (6th edition). Rare Plant Scientific Advisory Committee, David P. Tibor, Convening Editor. California Native Plant Society, CA. 388 pp.

Donley, M, Allen, S., Caro, P., Patton, C., eds. 1979. Atlas of California. Portland, OR: Academic Book Center.

Dunn, M.D. 1997. Mineral Report. Mineral Potential Report for the Long Canyon Candidate Research Natural Area (LCRNA), Sequoia National Forest, Kern County, California. Unpublished report on file at the Sequoia National Forest.

Dunn, M.D. 2003. Mineral Report Update. Mineral Potential Report Update for the Long Canyon Candidate Research Natural Area (LCRNA), Sequoia National Forest, Kern County, California. Unpublished report on file at the Sequoia National Forest.

Eyre, F. (ed.) 1980. Forest cover types of the United States and Canada. Society of American Foresters. 148 pg.

Hanes, T. 1977. California chaparral. In:. Barbour, M.;Major, J., eds., Terrestrial vegetation of California. New York. Wiley-Interscience.

Holland, R. 1986. Preliminary descriptions of the terrestrial natural communities of California. Unpublished mimeo available from California Department of Fish and Game, Sacramento.

Jennings, C.W., Strand, R.G., and Rogers, T.H. 1977. Geologic Map of California. Sacramento: California Division of Mines and Geology.

Keeler-Wolf, T. 1990. Ecological Survey, Long Canyon Candidate Research Natural Area, Sequoia National Forest. Unpublished report on file at USDA Forest Service, PSW Research Station Headquarters, Albany, CA.

Kuchler, A.W. 1966. Potential natural vegetation. National Atlas, sheet no. 90. Washington, D.C. USDI Geological Survey.

Little, E. L., Jr. 1979. Check list of United State trees (native and naturalized). Agricultural Handbook No. 541. Washington D.C.: U.S. Department of Agriculture.

Munz, P. 1968. A California flora and supplement. University of California Press, Berkeley,

Los Angeles, 224 p.

Schweickert, R.A. 1981. Tectonic evolution of the Sierra Nevada Range In: Ernst, W.G., ed. The geotectonic development of California. Englewood Cliffs, NJ: Prentice-Hall.

Skinner, M. W. and B. M. Pavlik (eds.) 1994. California Native Plant Society's inventory of rare and endangered vascular plants of California. California Native Plant Society.

Small, A. 1974. The birds of California. New York; London: Collier Books.

Smith, C.R. 1978. Tubatulabal. Pp. 437-445 in, R.F. Heizer (ed.). Handbook of North American Indians, Volume 8, California. Smithsonian Institution. Washington D.C.

Smith, J.P. and Berg, K. 1988. Inventory of rare and endangered vascular plants of California (fourth edition). Sacramento, California Native Plant Society.

Steinhart, P. 1990. California's wild heritage: threatened and endangered animals in the Golden State. Sierra Club Books, in cooperation with California Dept. of Fish and Game, and the California Academy of Sciences.

Thorne, R.F. 1976. The vascular plant communities of California. In, Latting, J. (ed.). Plant communities of Southern California. California Native Plant Society, Berkeley, CA.

Twisselmann, E.C. 1967. A flora of Kern County, California, Wasmann Journal of Biology 25: 1-395.

USDA Forest Service. 1980. Soil Survey Report and Maps.

USDA Forest Service. 1988. Sequoia National Forest Land and Resource Management Plan. PSW Region.

APPENDICES

A. Excerpt from Sequoia National Forest Land and Resource Management Plan (USDA Forest Service, 1988).

B. Plant List of Long Canyon RNA (from Keeler-Wolf, 1990)

C. Faunal List of Long Canyon RNA (from Keeler-Wolf, 1990)

D. Mineral Potential Report (Dunn, 1997)

E. Mineral Potential Report Update (Dunn, 2003)

APPENDIX A

EXCERPT FROM SEQUOIA NATIONAL FOREST LAND AND RESOURCE MANAGEMENT PLAN (USDA FOREST SERVICE, 1988)

MANAGEMENT AREA PRESCRIPTION RNA

This prescription emphasizes the management of Research Natural Areas. This management area encompasses 1,350 net acres outside of wilderness and 3,315 net acres within wilderness.

Emphasis

These areas have been identified as areas of important vegetative or geologic type, or areas that have special unique characteristics of scientific interest. These areas are set aside for non-manipulative research and education. Uses other than research and education are discouraged.

Opportunities

The recommended and deferred sites, with the exception of Long Canyon and a portion of Moses Mountain, are already in wilderness. The areas will be managed as if they are already established. Future management will follow the establishment reports.

The proposed candidate sites are:

Church Dome	1,380 acres
South Mountaineer Creek	1,325 acres
Moses Mountain	960 acres
Long Canyon	1,000 acres
	4,665 acres

APPENDIX B

VASCULAR PLANT LIST OF LONG CANYON RNA (FROM KEELER-WOLF, 1990)

The following list denotes all species and infraspecific taxa identified in the area during the field work for this report. Taxonomy follows Munz (1968) except where noted. References to "Twisselmann" refer to Twisselmann (1967). This list includes ca. 245 taxa. The following abbreviations are used to denote habitat types:

a.g.....annual grassland
d.c……..desert chaparral
p.p……..pinyon pine forest
j.p…….....….Jeffrey pine forest
p.c.....….Piute cypress forest
s.o.....….shin oak brush

Agoseris heterophylla: burn area a.g., d.c.
Agoseris retrorsa: occasional high elevations pp, s.o. d.c.
Agropyron riparium: w/ creeping rhizomes, not reported from Kern Co., introduced.
Allium burlewii: uncommon granitic soil of summit area Heald Peak
Allium campanulatum: shade of d.c. shrubs NW boundary area low elevations
Allium davisiae: common at lower elevations on bajada near mouth ofcanyon
Allium fimbriatum var. *denticulatum*: single leaf species of lower elevation a.g.
Allophyllum violaceum: tiny annual w/ deep blue flowers. capsules often look 2-loculed burned s.o. and j.p.
Alnus rhombifolia: riparian, permanent moisture.
Amsinkia intermedia: uncommon along riparian edge
Amsinkia tessellata: common burned d.c. W. side
Aniscoma acaulis: occasional on burned summit of W ridge, mostly adesert species.
Arabis dispar: purple flowers. w/ ascending siliques hoary stellatepub. fairly common lower elevation in burn areas
Arabis inyoensis: found once on sunny xeric S slope marble outcrop mid-elevation not known S of Tulare Co. (Munz).
Arabis repanda: erect habit like *retrofracta* (Twisselmann does not cite from Piutes), burned j.p..
Arctostaphylos glauca: common and important member of d.c. N slopes low to high elevation summits, tends to dominate on deeper granitic soils.
Arenaria douglasii: occasional openings in d.c. mid-elevations
Arenaria macradenia var. *arcuifolia*: fairly common mostly mid elevation slopes, openings in chaparral and granitic outcrops
Argemone munita ssp. *rotundata*: occasional all elevations, arroyos, bajadas to burned p.p.
Artemisia dracunculus: occasional riparian.
Artemisia tridentata: occasional lower elevations on bajada, common at upper saddle head of drainage and in more xeric d.c.
Asclepias fascicularis: occasional in arroyo bottom, etc.
Astragalus gambellianus: tiny annual on marble low elevations

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 elevations, als op.p., burned s.o. and j.p. to high elevations
Brassica nigra: occasional a.g. on low bajada
Brickelia californica: common along arroyo and riparian edges
Bromus breviaristatus: uncommon p.p. summit Heald Peak
Bromus rubens: lower elevations a.g. arroyo bottoms, common on burn in d.c., p.p. etc. up to 6400 ft
Bromus tectorum: common at higher elevations above 5000 ft
Calochortus invenustus: locally common in saddle in burned d.c. at head of drainage ca 6300-6600 ft.
Calochortus venustus: common low-mid elevations open dry soil a.g.,burn, etc.
Calyptridium parryi: common on decomposed granitic soil at Heald Peak summit area.
Calystegia longipes: abundant on burns and common elsewhere low to high elevations
Camissonia micrantha var. *jonesii*: occasional a.g. (*C. hirtella*).
Carex alma: riparian, occasional
Castilleja jepsonii: fairly common at low to high-elevations on *Eriog onum 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.
Chanenactis santolinoides: fairly common higher elevations especially on granitics > 6000 ft
Cheilanthes covillei: common in shaded rock crevices throughout
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 Nevada
Chrysothamnus nausiosus: occasional on bajada and arroyo bottomslower elevations
Chrysothamnus teretifolius: xeric exposures edges of a.g. and d.c.burn area
Chrysothamnus viscidiflorus: occasional p.p. upper elevations Heald Peak ridge, common on burned p.p.
Cirsium coulteri: occasional arroyo bottoms, d.c. lower to mid-elevations
Claytonia (Montia) spathulata: common on N-slope d.c. and in p.c.groves
Clematis ligusticifolia: riparian
Cordylanthus rigidus ssp. *brevibracteatus*: common at low elevations on granite a.g., arroyo bottoms, etc.
Coreopsis bigelovei: occasional S slopes a.g. low-mid elevations
Corethrogyne filaginifolia var *glomerata*: common low to high elevations, esp common on SW ridge of Heald Peak
Cryptantha barbigera: common, xeric mid-elevation slopes, burn, d.c.a.g.
Cryptantha circumscissa var. *hispida*: p.p. upper slopes Heald Peak
Cryptantha confertiflora: perennial yellow flowered species, a limestone endemic, on marble outcrop, not in Twisselmann
Cryptantha micrantha: purple dye in roots, on burn at lower elevations
Cryptantha pterocarya: upper slopes, burn on Heald Peak

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 longipes* on burn.
Cystopteris fragilis: rocks upper elevations 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 elevations, more widespread on schist and marble at upper elevations up to 6500ft
Descurania pinnata ssp. *menziesii*: locally common on burn mid-elevations
Dicentra chrysantha: common in burn lower to mid elevations
Dichelostemma pulchella: common a.g., p.p., d.c. low to high elevations
Distichlis spicata: uncommon, riparian moist areas
Dudleya calcicola: common rock crevices marble, schist, granite, not restricted to limestone, an endemic to the Kern River drainage.
Eleocharis sp.: moist riparian
Emmenanthe penduliflora: occasional 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 elevations on marble and metamorphics, also on burn.
Ephedra nevadensis: uncommon bajada lowers elevations.
Ephedra viridis: common a.g., d.c. up to summits.
Epilobium adenocaulon: wet riparian
Epilobium paniculatum: locally common on burns, d.c.
Equisetum arvense: moist riparian, low elevations
Equisetum laevigatum: wet riparian, uncommon
Eriastrum sp: fairly common mid-elevation to Heald Pk summit, in openings, keys to *E. hooveri,* a rare species known from lowr elevations in the San Joaquin Valley.
Erigeron foliosus: fairly common in low elevation 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: occasional lower elevations a.g. d.c. edge.
Eriogonum fasciculatum ssp. *polifolium*: common low to mid elevations, esp. on burns and edges of a.g.
Eriogonum gracillimum: annual common low to mid-elevations a.g.
Eriogonum nudum var. *indictum*: inflated base like *E. inflatum*, occasional upper elevations at head of drainage (saddle).
Eriogonum nudum var. *pubiflorum*: fairly common dry slopes- rocky areas low and mid elevations
Eriogonum plumatella: sub-shrub in p.p. of Heald Peak ranging down to mid-elevations on marble outcrop.
Eriogonum saxatile: common in chaparral, not always rocky sites on n slopes on higher ridges.
Eriogonum vimineum var. *davidsonii*?: annual in burn on SW shoulder Heald Peak
Eriogonum wrightii: summit of Heald Peak p.p. on schist down to 6300ft saddle
Eriophyllum ambiguum: occasional, xeric slopes low to high (6600 ft) elevations
Eriophyllum confertiflorum: common and showy on burn areas low to mid elevations

Eriophyllum pringlei: tiny annual in gravelly openings mostly on ridges, d.c., p.p. p.c., burned j.p., s.o.
Erodium cicutarium: abundant in a.g. and other xeric exposures up to 6500 ft
Erysimum moniliforme: fairly common mid- to high-elevations yellow flowers, slender pods (Munz says conspecific w/ *capitatum*).
Eschscholtzia minutifolia: xeric slopes of a.g., occasional
Foresteria neomexicana: uncommon in arroyo bottom low elevations
Forsellesia nevadensis: common shrub of xeric marble outcrop low to mid elevations Not listed by Twisselmann for Kern Co.; a limestone endemic
Fremontodendron californicum: a dominant of the d.c. from low to high elevations.
Galium aparein: 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., occasional
Galium pubens: occasional, fleshy glabrous 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 elevations a.g.
Gnaphalium luteo-album: riparian borders
Haplopappus arborescens: fairly common on burn w/ cypress occasional on E side of drainage mid- to low elevations a cismontane species
Haplopappus cuneatus: occasional granitic outcrops low to mid elevations
Haplopappus (cf.) palmeri ssp. *pachylepis*: uncommon on marble outcrop mid-elevations not known from this part of Kern Co., late-flowering.
Haplopappus linearifolius var. *interior*: resinous single heads w/ray flowers, common in open a.g., d.c., in burns, etc. high to low elevations
Heliotropium curassivicum 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 Peak summit area.
Juncus macrophllus: riparian, occasional
Juncus xiphioides: moist riparian, lower elevations
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 elevations
Layia glandulosa: burn p.p. upper elevations SW shoulder Heald Peak 6600 ft
Lemna sp. : wet riparian
Lepidospartum squamatum: common arroyo bottom, and alluvial fan, lower elevations
Leptodactylon pungens ssp. *pulchriflorum*: common in rocky areas of upper elves. d.d., p.p., etc.
Linanthus nudatus: on p.c. burn, p.p.
Linanthus ciliatus: fairly common. a.g. and burned d.c.
Lithophragma bolanderi: entire petal form N-facing d.c.mid-elevations
Lithophragma parviflorum: occasional pp.- c.o., fairly common burned j.p.
Lomatium dissectum var. *multifidum*: common on N. slopes d.c. to p.p.up to Heald Peak summit

Lomatium nevadense var. *parishii*: occasional at upper elevations>6200 ft s.o. j.p.
Lonicera interrupta: occasional in d.c. N- slopes.
Lotus grandifolius: common and showy flowering species of burn, up to 6500 ft
Lotus nevadensis: uncommon, upper d.c. yellow flowers, curved pods.
Lotus scoparius: common lower elevations and on burn
Lotus subpinnatus: occasional on dry slopes, a.g.
Lupinus albicaulis var. *shastensis*: burned j.p. 6600 ft
Lupinus bicolor: occasional a.g.
Lupinus concinnus: uncommon lower elevations mouth of canyon a.g.
Lupinus concinnus var. *orcuttii*: low elevations bajada
Lupinus excubitus: fairly uncommon lower dry slopes and cutbanks of arroyos lower elves.
Lupinus excubitus var. *austromontanus*: flowering in burned p.p.Heald Peak
Lupinus subvextus: common on open bajada flats a.g.
Malacothamnus orbiculatus: abundant on burn from 3550 to 6800 ft
Marah horridus: occasional d.c in lower elevation canyons
Melica imperfecta: occasional lower to mid elevations in d.c.arroyos, etc.
Melica stricta: rocky areas in d.c., etc. mid-to high elevations
Mentzelia albicaulis: occasional, a.g., burned p.p.
Microseris sylvatica: occasional in d.c. at mid elevations
Mimulus cardinalis: moist riparian area low elevations
Mimulus fremontii: common at upper elevations burned j.p.
Mimulus fremontii x *viscidus*: common at summit of Heald Pk ongranite on d.g. between chaparral shrubs. Characters intermediate between the two species
Mimulus guttatus: riparian moist areas.
Mimulus longiflorus ssp. *calycinnus*: occasional rock outcrops in a.g., etc., low to mid elevation
Mimulus sp.: reddish flowered annual low elevations
Monardella linoides ssp. *oblonga*: fairly common 4000-6900 ft S- to W-facing slopes a.g., p.p., burned d.c.
Muhlenbergia rigens: riparian border.
Nasturtium officinale: common in wet riparian.
Nemacladus sismoideus: uncommon upper slopes near saddle on burn.
Nemophila pedunculata: uncommon on N slope d.c. understory 5000 ft
Nicotiana attenuata: occasional open d.c. burns, etc. low to highelevations
Opuntia basilaris: occasional low to high elevations rocky xeric sites a.g. to p.p..
Oreochaenactis thysanocarpha: open summit area of Heald Peak on granitics
Orobanche grayana var. *feudgei*: occasional on *Artemisia* on W boundary trail mid-elevations
Oryzopsis hymenoides: rock crevices on marble outcrop
Oxypolis occidentalis: uncommon, wet riparian
Pellaea mucronata: occasional rocky d.c. up to 5000 ft
Penstemon grinnellii ssp. *scrophularioides*: common low to high elevations esp. on burn
Penstemon laetus: common blue-purple penstemon of burned areas.
Penstemon newberryi: Granitic rocks summit area Heald Peak
Penstemon speciosus: occasional higher elevations in burn s.o., j.p.
Petrocarya penicellata: occasional low elevations, bajada, a.g.
Petrocarya setosa: fairly common low to mid-elevations openings a.g. etc.

Phacelia davidsonii: occasional on upper elevations, s.o., p.p.,etc. less common than *P. mohavensis.*
Phacelia distans: occasional mid-elevations on burn or open a.g. upto s.o. association.
Phacelia egena: common on burn of upper elevations, SW shoulder Heald Peak 6300-6700 ft
Phacelia fremontii: uncommon in burned p.p. SW shoulder Heald Peak6200-6700 ft
Phacelia mohavensis: common small lavender flowers. annual s.o. and p.p. above 6000 ft
Phacelia ramosissima var. *suffructescens*: scattered low-mid elevations around rock outcrops adjacent to a.g.
Phlox diffusa ssp. subcarinata: matted species of upper elevations on Heald Peak 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 Peak summit
Pinus monophylla: common in p.p. woodland and also scattered on N slopes at lower elevations down to 3600 ft
Pinus sabiniana: common on bajada, low elevations, fire killed moston W ridge, up to 5300 ft
Pityrogramma triangularis: occas. under rocks lower elevs.
Platystemon californicus: occas. a.g. <5500 ft.
Poa scabrella: common in d.c. and p.p. throughout
Polypogon monspeliensis: open sunny riparian.
Populus fremontii: wet riparian, uncommon.
Prunus virginianus var. *demissa*: riparian border low elevation
Psoralea macrostachya: occasional riparian moist sites, not mentioned in Twisselmann.
Purshia glandulosa: local low elevations in arroyos and on marble outcrop
Quercus chrysolepis: common on N. slopes d.c., p.p. low to high elevs.
Quercus kelloggii: upper elevations, j.p., s.o.
Quercus wislizenii var. *fructescens*: occasional along arroyos lower elevations fairly common up to 5000 ft in d.c. on N slopes.
Ribes nevadense: rare in riparian of upper drainages
Ribes roezlii: occasional throughout in d.c. and riparian edges
Ribes velutinum var. *glanduliferum*: fairly common upper elevations p.p., d.c. Heald Peak, occasional at lower elevations in d.c.
Rorippa curvisiliqua: in riparian zones w/ permanent moisture, lower elevations
Rumex sp.: perennial, riparian border
Salix lasiolepis var. *bracelinae*: fairly common riparian zone
Salvia columbariae: occasional, arroyo banks, d.c., a.g. to mid elevations
Salvia dorrii: occasional xeric d.c. common on marble outcrop, low to mid elevations
Scrophularia californica var. *floribunda*: occasional riparian areas among rocks, lower elevations
Selaginella asprella: on marble outcrop low-mid elevations
Senecio breweri; uncommon burned s.o. 6200 ft
Senecio douglasii: common shrub in valley alluvium, occasional up tomid elevations on slopes.
Silene verecunda ssp. *platyota*: uncommon on granite s.o. and burnedj.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*: occasional in riparian lower elevations
Sonchus asper: rare, riparian, moist area
Stephanomeria chicoricaea: uncommon in burn and s.o. at upper elevations
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 elevations, a rare taxon
Streptanthus heterophyllus: on burned area, annual, deep purple sepals pendant siliques 2-lobed stigma. local in burned chaparraland a.g. lower elvs. not mentioned in Twisselmann or Munz for KernCo.
Symphoricarpos parishii: s.o., j.p., upper elevations.
Tetradymia spinosa var. *longispina*: occasional on bajada at lower elevations and on lower xeric marble outcrop.
Thysanocarpus curvipes: burn on W ridge
Trichostoma lanceolatum: lower elevations on bajada a.g., c.j.
Trifolium wormskioldii: riparian, moist soil
Turricula parryi: common in burned areas and in arroyo bottoms low to high elevations
Typha angustifolia: wet riparian, rare.
Urtica holisericea: wet riparian, low elevations
Viola purpurea: upper elevations j.p., p.p.; rocky areas
Vulpia (Festuca) myuros: occasional a.g., bajada and lower slopes
Yucca whipplei ssp. *caespitosa*: common on S and W-facing slopes a.g. rock outcrop, marble and other types.
Zauschneria californica: occasional xeric rock outcrops low to high elevations
Zigadenus exalticus: granitic and metamorphics, burned d.c., s.o.; 5000-6000 ft

APPENDIX C

FAUNAL LIST OF LONG CANYON RNA (FROM KEELER-WOLF, 1990)

Abbreviations: a.g. (annual grassland); d.c. (desert chaparral); d.w. (desert woodland); j.p. (Jeffrey pine); p.p. (pinyon pine)

Reptiles and Amphibians

Side-blotched Lizard (*Uta stansburiana*): uncommon in d.c. and other open associations up to summit of Heald Peak
California Whiptail (*Cnemodophorus tigris*): uncommon, lower elevation d.c., a.g., d.w.
Common Kingsnake (*Lampropeltis getulus*): two seen in riparian low elevations

Birds

California Quail (*Calllipepla californica*): Uncommon, low elevation d.w.
Mountain Quail (*Oreortyx pictus*): fairly common
Red-tailed Hawk (*Buteo jamaicensis*): occasional throughout
Golden Eagle (*Aquila chrysaetos*): sighted several times over upper elevations of LCRNA
Turkey Vulture (*Cathartes aura*): occasional overhead.
American Kestrel (*Falco sparverius*): uncommon along N.boundary
Great Horned Owl (*Bubo virginianus*): uncommon, heard in low elevation d.w.
Mourning Dove (*Zenaida macroura*): uncommon in d.c.
Lesser Nighthawk (*Chordeiles acutipennis*): heard calling at lower elevations in pre-dawn.
Common Poorwill (*Phalaenoptilus nuttallii*): occasional, calling in evenings from d.c.
White-throated Swift (*Aeronautes saxatilis*): fairly common overhead throughout, esp. near outcrops
Anna'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 ruber*): holes drilled in p.p. atop Heald Peak
Nuttall's Woodpecker (*Picoides nuttallii*): uncommon in d.w.
Western Kingbird (*Tyrannus verticalis*): Uncommon low elevation 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 elevations
Horned Lark (*Eremophila alpestris*): occasional at lower elevations a.g.
Violet-green Swallow (*Tachycineta thalassina*): common throughout, esp. upper elevations, overhead.
Bushtit (*Psaltriparus minimus*): occasional in flocks at lower elevations d.c., d.w.
Rock Wren (*Salpinctes obsoletus*): common around rock outcrops throughout, esp. marble
Wrentit (*Chamaea fasciata*): fairly common d.c.
House Wren (*Troglodytes aedon*): uncommon, burned j.p, d.c. upper elevations
Bewick's Wren (*Thryomanes bewickii*): fairly common in d.c..

Northern Mockingbird (*Mimus polyglottos*): Uncommon low elevation 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 ludovicianus*): Uncommon lower elevation a.g., d.w.
Gray Vireo (Vir*eo vicinior*): Uncommon in mid elevation d.c. on eastside 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 ater*): common at low elevations a.g. (with cattle).
Lark Sparrow (*Chondestes grammacus*): local in burned d.c. and a.g.
Sage Sparrow (*Amphispiza belli*): uncommon in d.c. at mid-elevations
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 elevations
Black-headed Grosbeak (*Pheucticus melanocephalus*): fairly common d.c. low elevations
Lazuli Bunting (Passerin*a amoena*): common in burned d.c., j.p. and p.p low to high elevations
House Finch (*Carpodacus mexicanus*): uncommon low elevation riparian, d.w.
Lesser Goldfinch (*Carduelis psaltria*): common throughout.
Lawrence's Goldfinch (*Carduelis lawrencei*): uncommon, lower drainage.

Mammals

Black Bear (*Ursus americanus*): scat abundant in riparian areas
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-elevations
California Ground Squirrel (*Spermophilus beecheyi*): fairly common d.w., low elevation a.g.
Merriam's Chipmunk (*Tamais 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 audubonii*): uncommon, d.c., p.c.

APPENDIX D

MINERAL POTENTIAL REPORT (DUNN, 1997)

Text only: Original with graphics on file at Sequoia National Forest Office

UNITED STATES
DEPARTMENT OF AGRICULTURE
FOREST SERVICE

MINERAL REPORT

Mineral Potential Report
for the Long Canyon
Candidate Research Natural Area (LCRNA),
Sequoia National Forest,
Kern County, California

LANDS INVOLVED

T. 27 S., R. 34 E., MDM
Sections 3, 4, 9, 10,
15, and 16 - portions

containing approximately 2,300 acres (932 ha)

Prepared By:

_____
Michael D. Dunn
Geologist, Minerals Management Team
December 17, 1997

Technical Approval:

_____
Minerals Management/date

Management Acknowledgement:

_____
Forest Supervisor/date

_____
Bureau of Land Management/date

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METRIC CONVERSIONS

Metric values are shown in parenthesis following the English value. The following English to Metric conversion values and abbreviations are used in this report:

1 acre	=	0.405 hectares (ha)
1 mile (mi)	=	1.609 kilometers (km)
1 foot (ft)	=	0.305 meters (m)
1 inch (in.)	=	2.54 centimeters (cm)
1 inch (in.)	=	25.4 millimeters (mm)

SUMMARY AND CONCLUSIONS

This report presents an evaluation of the mineral resource potential within lands proposed for inclusion in the Long Canyon Candidate Research Natural Area (LCRNA) located on the Greenhorn Ranger District of the Sequoia National Forest. A field examination of the LCRNA and adjacent land was conducted in April 1997. The subject land is situated in the southern end of the Sierra Nevada geologic province about 11.5 mi (18.5 km) south southeast of Kernville, CA. The LCRNA occurs within the steeply incised Piute Mountains which are part of a large, southward sloping horst block with evenly elevated summits. The study area consists mostly of a roof pendant of undifferentiated phyllite, quartzite, and marble mapped as the Carboniferous(?) Kernville "Series". This pendant is engulfed in the late Jurassic(?) Isabella granodiorite. Contact metamorphism of marble during the intrusion of granodiorite has created localized bodies of tactite partly mineralized with tungsten.

There are no current or active mining claims within the LCRNA. Three placer claims are located just to the northwest of the subject area on a white, high-calcium limestone deposit. This deposit occurs within a marble unit of the Kernville Series which extends through the northeast quarter of the LCRNA. Past mining in the immediate area of the LCRNA was for tungsten, limestone, and possibly gold. Minor mineral prospecting activity, apparently for tungsten, has occurred on the LCRNA in the past, but field evidence indicates very little recent activity.

Based on the field examination, a review of available literature, and rock and stream bed sampling, it is my opinion that the LCRNA, except for it's northeast side, has a low potential of hosting valuable deposits of locatable, leasable, or salable mineral commodities. Marble along the LCRNA's northeast side has the potential to host locatable and/or salable deposits of high-calcium limestone but this material is uneconomical in the current market. Tungsten could occur in small localized bodies of tactite associated with the metamorphism of limestone but is not believed to be in quantities that would be economic to mine.

Any resource management action in this area should take into consideration the potential for future marketability of high-calcium limestone resources occurring on Forest Service administered lands.

INTRODUCTION

The purpose of this report is to determine the potential for the occurrence and development of mineral resources on federal lands currently identified as the Long Canyon Candidate Research Natural Area (LCRNA), and to identify any mineral-related issues which may be a factor in the final decision on the Research

Natural Area (RNA) designation. The LCRNA lies within the Greenhorn Ranger District of the Sequoia National Forest (see Maps 1 and 2). Its designation would likely result in the withdrawal of an estimated 2,300 acres (932 ha) of National Forest System (NFS) lands from location and entry under the United States Mining Laws for protection of the biological ecosystem in the Long Canyon area.

RNAs are part of a national network of field ecological areas designated for research and maintenance of biological diversity. Objectives for their establishment are to: (1) conserve pristine representatives of all ecosystems on NFS lands, (2) conserve genetic diversity, (3) provide opportunities for research in unmanipulated habitats, (4) provide on site educational opportunities, and (5) function as control areas for comparing with manipulated sites (USDA Forest Service, 1990). The LCRNA was nominated by the Sequoia National Forest to preserve an example of California juniper, single-leaf pinyon pine, and Piute cypress target elements for the Southern Sierra Nevada Province (Keeler-Wolf, 1990). The LCRNA includes the entire drainage of Long Canyon occurring on NFS land and is defined by a basically elliptical ridgeline which contains this canyon.

Opinions and conclusions in this report are based upon review of available literature and a field examination of the subject lands conducted the week of April 20, 1997. This report should not be used for any purpose other than that for which it was prepared.

LANDS INVOLVED

The lands proposed for inclusion within the candidate Long Canyon RNA are:

T. 27 S., R. 34 E., MDM

Section 3 - portion approx. 336 acres (136 ha)
Section 4 - portion approx. 575 acres (233 ha)
Section 9 - portion approx. 463 acres (188 ha)
Section 10 - portion approx. 590 acres (239 ha)
Section 15 - portion approx. 173 acres (70 ha)
Section 16 - portion approx. 163 acres (66 ha)

Consisting of approximately 2,300 acres (932 ha) in Kern County. The LCRNA is located entirely within the Woolstalf Creek, California 7.5 minute quadrangle map.

LAND STATUS AND RECORD DATA

The land within the LCRNA is reserved public domain which was withdrawn for inclusion in the Sequoia National Forest by Executive Order 2169 on April 13, 1915. Public Law 167 determinations were completed on June 24, 1963 and serialized as

R 01428. All National Forest surface is managed by the U.S. Forest Service. Land within section 16 left federal ownership via a state grant under Act of Congress March 3, 1857. This land was reconveyed back to federal ownership with all minerals on October 24, 1899 by a Forest Lieu Selection deed to the U.S. serialized as LS 3110.

The subject land was nominated as a candidate RNA in 1983. To date, this land has not been withdrawn from location and entry under the United States Mining Laws, temporarily or otherwise, as the result of the RNA nomination. There were no current mining claims on land within the LCRNA during the field investigation and the preparation of this report based on the most recent BLM mining claim microfiche dated November 6, 1997.

The west half of T. 27 S., R. 34 E. MDM, which includes the LCRNA is shown on Bureau of Land Management (BLM) prospectively valuable maps as being "prospectively valuable" for geothermal resources. No other energy or non-energy leasable prospectively valuable mineral commodity designations occur in that township and range (Ken Holden, geophysicist, BLM State Office, CA., personal communication).

PHYSICAL FEATURES AND ACCESS

The LCRNA is in the southern end of the Sierra Nevada about 11.5 mi (18.5 km) south southeast of Kernville, CA., near the southeast end of Isabella Reservoir (see Maps 1 and 2). Numerous interconnecting roads through trailer park communities, and across private and BLM land, create labyrinth-like access routes to the LCRNA. One way to access the area is to travel on State Highway 178 turning south on Vista Grande Drive (.2 mi (.3 km) west of the intersection of State Highway 178 and County Route 521). From there go .8 mi (1.3 km) and turn right on Hill View Acres Road, go .3 mi (.5 km) and turn left on Buck Road, go .5 mi (.8 km) and turn right on Bull Run, and finally, go .5 mi (.8 km) and turn left on Brooks Road. A jeep trail forks to the left .5 mi (.8 km) down the road and, from there on, you have to just find your way through the maze of jeep trails while keeping a bearing towards the canyon. Two jeep trails go a short distance into the LCRNA and one pack trail (34E31) follows along the western boundary (see Map 4).

The LCRNA consists of a moderate to steeply incised drainage basin which flattens out at it's north end into the beginning of a large alluvial fan (see Photos 1 and 2). Elevations range from the 6,901-ft (2,105 m) Heald Peak to about 3,540 ft (1,080 m) along the northern RNA boundary where the main Long Canyon drainage exits Forest Service land. The climate is fairly dry (desert to Mediterranean) having a mean annual rainfall of about 10 to 15 in. (25 to 38 cm) which occurs mostly in the winter months.

Vegetation ranges from annual grassland with occasional cacti at the lower elevations to Jeffrey and pinyon pine forests at the higher elevations. Patches of annual grassland and Desert chaparral occur scattered throughout the LCRNA at all elevations (Keeler-Wolf, 1990).

REGIONAL GEOLOGY

The LCRNA is at the southern end of the 400-mi-long (644 km) Sierra Nevada geomorphic province which roughly extends north to south from Lassen Peak to the Tehachapi Mountains (Norris and Webb, 1990). The LCRNA is within the steeply incised Piute Mountains. These mountains are part of a large horst[1] block that forms a great high platform, sloping gently southward, with evenly elevated summits (Miller and Webb, 1940).

Rocks exposed in the Sierra Nevada consist of a north-northwest-trending Mesozoic granitic batholith core (206-88 m.y.) intruded into a sequence of metamorphosed Paleozoic (570-225 m.y.a.) and Mesozoic (225-65 m.y.a) sedimentary rock, volcanic rock, and minor amounts of intrusive material (see Map 3). These metamorphic and igneous rocks are often referred to as the basement rock or subjacent series. The granitic batholith core is comprised of more than 100 plutons. The earliest intrusives are small, mafic plutons (generally dark dioritic to gabbroic rock) which have become inclusions within the later granitic intrusives (Norris and Webb, 1990). Metamorphic rocks in the southern Sierra Nevada consist of highly deformed, isolated patches (roof pendants) containing mostly slate, quartzite, hornfels, chert, phyllite, mylonite, schist, gneiss, and minor marble (Jennings, 1977). They represent the westward more metamorphosed continuation of the Paleozoic rock sequences exposed in the White and Inyo mountains to the east (Norris and Webb, 1990).

Overlying basement rock are sedimentary and volcanic rock of late Mesozoic and Cenozoic (65 m.y.a. to recent) referred to as the superjacent series. These were deposited after a long erosional interval that followed a significant uplift of the basement rock during the Nevadan orogeny (180-80 m.y.a.). Volcanic rocks in the southern Sierra have been extruded from isolated vents, are limited areally, and are younger than most of the northern Sierra volcanic rocks. Continued rapid uplift, erosion, and glaciation created the present landform in the area (Norris and Webb, 1990).

A significant structural feature of the region, one of the largest structures entirely within the Sierra Nevada, is the north-south-trending Kern Canyon fault (about 8 mi west of the

[1]Horst - An elongate, uplifted crustal unit or block that is bounded by faults on its long sides.

subject area). This fault occurred after the emplacement of the Sierra Nevada granitic batholith but before uplifting during the Nevadan orogeny. The prominent Kern Canyon and the Kern River follow the fault (Norris and Webb, 1990).

LOCAL GEOLOGY

The general study area is mapped as being undifferentiated pre-Cretaceous (Carboniferous(?) (345-280 m.y.a.)) phyllite, quartzite, schist, marble, gneiss, and metavolcanic rocks of the Kernville "Series" occurring as large roof pendants within the Jurassic(?) (190-135 m.y.a.) Isabella Granodiorite pluton (Smith, 1965).

One large, elliptical, northwest-trending roof pendant of Kernville Series metasedimentary rock, 7 mi (11.3 km) long by 3 mi (4.8 km) wide, is centered over the LCRNA. It consists mostly of phyllite, crystalline limestone, and a smaller amount of quartzite. The phyllite is greenish-gray to grayish-black and is highly foliated. Gray, thin-bedded quartzite and thick lenses of white to bluish-gray, banded, coarse crystalline limestone occur interbedded with the phyllite (see Photo 2). Beds of white marble, up to several feet thick occur within the crystalline limestone (see Photo 3). Two belts of crystalline limestone lenses, one continuous and one discontinuous, extend through the northeast quarter of the LCRNA (see Map 4). The general strike of the metasedimentary rocks in this pendant is N. 45° to 65° W., with steep easterly dips exceeding 70° (Miller and Webb, 1940).

The Isabella granodiorite pluton engulfs, and in some places intrudes, this metasedimentary roof pendant (see Map 4). This igneous rock, first identified as a granodiorite in the Isabella area, is typically medium to coarse grained and has a varying composition which is mostly quartz monzonite outside of the Isabella area. At places where phyllite is in contact with the granodiorite, the phyllite has been altered, locally, to mica schist. Alteration and replacement of limestone by assimilation and metasomatism has occurred within, and along contacts with, the granodiorite producing small, scattered bodies of garnet-epidote skarn called tactite. Several tactite bodies occur within the granodiorite along the northeast edge of the pendant, and at least two weakly altered occurrences were noted within the pendant.

The north end of this metasedimentary roof pendant is covered by Quaternary (1.7 m.y.a. to recent) alluvium which fans down into South Fork Valley (see Photo 2). Metasedimentary rock outcrops through the alluvium well into the valley (see Photo 4) and is exposed on the opposite side of the valley indicating that this pendant continues through South Fork Valley beneath the alluvium.

MINERAL DEPOSITS AND PRODUCTION HISTORY

Kern County has an abundance of mineral resources and the production of these resources has contributed greatly to the history and development of the county. The most economically significant mineral product has been petroleum fuel produced from the San Joaquin Valley in western Kern County. Other important mineral products for the county include boron, limestone, clay, gold, gypsum, pumice, salt, sand and gravel, silver, and tungsten (Troxel and Morton, 1962). Of these commodities, limestone and tungsten are the most pertinent to the vicinity of the LCRNA.

The LCRNA is located within the Weldon Tungsten District. According to Troxel and Morton (1962), the district contains at least 12 mineralized bodies with scheelite (a tungsten mineral) that lie within an approximately 1-mi-wide (1.6 km), 8-mi-long (12.9 km) northwest-trending belt with Long Canyon at it's northwest end. The scheelite is in garnet-epidote tactite zones (see Photo 5) occurring in small, elongate, highly metasomatized and assimilated metasedimentary pendants which are engulfed in granodiorite. These small elongate pendants lie scattered along, parallel and near to, the northeast flank of a large northwest-trending pendant; this large pendant is the one within which lies the LCRNA.

Production of tungsten from the district, mostly since 1941, has been credited primarily to four mines/prospects, although other mines/prospects in the area may have contributed to the total (see Table 1). The four mentioned mines/prospects are the B and F, Last Chance, Stardust, and Lucky Boy. Total production was probably less than .5 tons of concentrate which was most likely processed at a custom mill near Weldon (Troxel and Morton, 1962).

The B and F mine (see Table 1) is near the mouth of Long Canyon. Scheelite occurs as small, <3 mm diameter grains disseminated in an elongate body of tactite. The tactite body is 3 to 10 ft wide (.9 to 3 m), striking N50°W, dipping steeply to the southwest, and exposed almost continuous for 300 ft (91.5 m). It is composed mostly of coarsely crystalline epidote and garnet with subordinate quartz and calcite. Principle mine workings are two southeast trending adits, one about 50 ft (15.2 m) above the other (see Photo 5). They follow the tactite along a contact between marble and granodiorite for about 75 ft (22.9 m). Several units of tungsten concentrates were recovered from the mine in the early to mid 1950's (Troxel and Morton, 1962).

The Last Chance mine (see Table 1) is on the opposite end of the nearly continuous mineralized trend that the B and F mine is on. Rock exposures are poor, but dump material from workings consist mostly of coarsely crystalline dark-green epidote and dark reddish-brown garnet. Sparsely disseminated scheelite in the tactite dump material is present. This mine was believed to have been originally an old gold and copper mine with a few units

of tungsten concentrate being recovered from the dump in the early to mid 1950's. Workings along a N65°W trend for about 300 ft (91.5 m) include 2 old incline shafts, one newer (1950's) vertical shaft, and a 10 ft (3m) trench (Troxel and Morton, 1962).

The Stardust mine (see Table 1) produced about 1,000 tons of ore in 1943. Workings are in a zone of discontinuous, 4-ft-wide (1.2 m) bodies of medium- to coarse-grained garnet-epidote tactite. These mineralized bodies occur along the northeast border of two metasedimentary pendants which strike roughly N50°W and dip steeply to the southwest. Scheelite, <3 mm in diameter, is disseminated in thin layers parallel to the strike of the pendants. Some layers run several percent WO_3, but most run less than 1 percent. Development includes a southeast-trending drift adit, a 60-ft-deep (18.3 m) shaft with a large stope at the bottom, a small NW-trending drift adit, and an open cut (Troxel and Morton, 1962).

Other tungsten properties relatively near to, or within, the LCRNA are included in Table 1.

The LCRNA also occurs along a northwest-trending, steeply northeast-dipping belt of discontinuous limestone bodies collectively over 10 mi (16 km) long and several hundreds of feet wide referred to as the South Fork Valley deposit (a.k.a. Isabella limestone deposit). This deposit, part of the Kernville Series of metasedimentary rocks, forms steep hills and ridges, and some slightly rounded elongate hills (Troxel and Morton, 1962)(see Photos 2 and 4).

Table 1 - Tungsten Properties Near the LCRNA
(Troxel and Morton, 1962)

Name	Location T. R. Sec.	Remarks
B and F mine	26S 34E 33 SE4NW4 (1 km north)	Scheelite in tactite. See text
Bright Star prospect	27S 34E 4 NW4NW4 (NW corner of RNA)	.6- to 1.5-m wide sheared quartz vein (N35°W, vert.) in diopside-rich skarn. Developed by shaft 15 m deep. May be gold prospect.
High Enough prospect	27S 35E 7 SW4NW4 (3.5 km east)	Garnet-epidote tactite (N40°W, 50°SW) .6 to 1.5 m wide in hornfels and mica schist. Scheelite grains up to .6 cm in dia. Developed by 30 m adit and several open cuts.
Juniper prospect	27S 35E 7 SW4NE4	Layered, 1- to 1.3-m-thick

	(4.5 km east)	garnet-epidote tactite body (N70°W, vert.) with scheelite in calc-silicate hornfels. Developed by four shafts 3 m deep, and one adit.
Last Chance mine	26S 34E 34 S2S2 (.6 km northeast)	Scheelite in tactite. See text
Lucky Boy prospect	27S 35E 18 NW4NE4 (4.7 km east)	Two 1.2-m-wide, dark green tactite lenses cut by N25°W-trending shear zone. Scheelite mined from shear zone/tactite intersection. Developed by 3 shafts, 15 m of adits, and a 30 m cut.
Nichol Peak prospect	27S 34E 14 NE4SW4 (1.3 km southeast)	Two layers of garnet-epidote-calcite tactite (N40°E, vert.) in schist and limestone. Developed by two open cuts.
Stardust mine	27S 34E 2 SE4NE4 (2.2 km northeast)	Scheelite in tactite. See text

The only known production of limestone from this deposit occurred in a quarry just over 1 mi (1.6 km) northwest of the northwest corner of the LCRNA (SW4NW4, sec 32). This site, located in a irregular body of limestone about 1.5 mi (2.4 km) long and 500 to 1500 ft (152 to 458 m) wide, was first worked in 1958 by the Kennedy Minerals Company. It was the first site in Kern County to produce high-calcium limestone for whiting purposes. The high-calcium limestone in the quarry area is white, granular to coarsely crystalline, and thick-bedded (see Photo 3). Elsewhere, the limestone is less pure and contains large masses of dolomite, quartzite, and impure calcareous material. Samples collected from the quarry area by Kennedy Minerals Company averaged 51.68 percent calcium oxide and 2.26 percent magnesium oxide (Troxel and Morton, 1962).

MINERAL EXPLORATION AND DEVELOPMENT WORK

Because of the subject area's proximity to nearby gold mining districts (the Cove district about 10 mi (16.1 km) northwest, the Keyesville district about 11 mi (17.7 km) west northwest, the Erskine Creek district about 4 mi (6.4 km) west southwest, and the Piute District about 7 mi (11.3 km) south), local exploration and development may have originally began in the late 1800's for lode gold. It wasn't until the early 1950's that already established prospects such as at the Bright Star, B & F, and Last Chance were worked for tungsten. Limestone activity followed shortly afterwards in the late 1950's.

Only two small, long abandoned sites where mineral-related activity had occurred were found on the LCRNA. One site is the Bright Star prospect which has a 20 ft by 15 ft (6.1 m by 4.6 m) glory hole/caved shaft (see Photo 6) exposing skarn and quartz vein material. The other site is an unnamed prospect with a pit 12 ft by 15 ft (3.7 m by 4.6 m) in a low-grade tactite skarn (see Photo 7). Both are located in the northern portion of section 4, T. 27 S., R. 34 E., and were probably gold/tungsten prospects. Many of the gold/tungsten lode properties in the area were claimed as recently as the late 1970's but were abandoned by the late 1980's and their case files have been closed. The lack of any obvious new disturbances indicates that activity beyond minor prospecting had not occurred during this most recent claim filing. No other indications of mineral-related activity on the LCRNA were found.

The only current claims in the immediate area were located by Specialty Minerals for high-calcium limestone. In 1996, Specialty Minerals had 8 placer claims and 14 mill site claims; all on BLM land just northwest of the LCRNA around the Kennedy Minerals quarry and associated deposit. All the claims except for 3 placer claims were abandoned at the end of the 1996 assessment year. According to the company (Specialty Minerals, personal communication, 1997), this site was too far from their current market to be economic, but that they retained their best claims to keep out unforeseen, innovative competition.

FIELD WORK, SAMPLING, AND ANALYTICAL WORK

Field work on the subject land was conducted during the week of April 20, 1997. During this field examination, reconnaissance was conducted by walking out areas of the LCRNA to verify existing geologic information while looking for indications of mineralized rock and prospecting activity.

Pan concentrate samples (LCP-1 through LCP-6) were collected from LCRNA drainages (see Map 4 and Photo 1) to check for gold or tungsten that would indicate the presence of lode sources up drainage. Stream bed material from the drainages were screened to a -12 mesh. The -12 mesh material was then panned down, but not to a clean black sand concentrate. This is because scheelite has about the same specific gravity as black sand and some could easily be lost if panned down too much. Rock samples (LCR-1 through LCR-5) were taken from potentially mineralized material found within the LCRNA during reconnaissance. One rock sample (K-Q) from a known high-calcium limestone source just outside of the LCRNA (see Photo 3) was collected for comparison with limestone within the LCRNA (see Photo 8). Only the 11 sample sites within the LCRNA are shown on Map 4.

Samples were sent to Skyline Labs, Inc. of Tucson, Arizona, for analysis (see Attachment 1). The pan concentrate and non-carbonate rock samples were assayed for gold and tungsten. The limestone samples were given a whole rock analysis to determine

percent calcium carbonate. Tables 2, 3, and 4 show some of the analyses along with a brief description of the sample.

None of the pan concentrate and non-carbonate rock samples showed detectable levels of gold. Potentially ore grade tungsten (0.47% WO_3) was detected in one of the non-carbonate rock samples (LCR-2) collected at the unnamed prospect pit found within the LCRNA (see Photo 7). This was a select high-graded sample from a tactite stockpile at the prospect. The remaining non-carbonate rock and pan concentrate samples had undetectable levels of tungsten (see Tables 2 and 3).

Table 2 - Assay Results of Pan Concentrate Samples

Sample Number	Description	Gold (ppm)	Tungsten (%WO_3)
LCP-1	Sand and gravel from a east-trending tributary near the head of Long Canyon. Oversize composed of phyllite and some granitic material.	<0.005	<0.01
LCP-2	Sand and gravel from main drainage near the head of Long Canyon. Oversize composed of phyllite and some granitic material.	<0.005	<0.01
LCP-3	Sand and gravel from a southeast-trending tributary near the mouth of the Canyon. Oversize composed of phyllite and some granitic material.	<0.005	<0.01
LCP-4	Sand and gravel from main Long Canyon drainage below mouth of canyon within alluvium filled area. Oversize composed of phyllite, some granitic material, and noticeable amounts of quartz vein material.	<0.005	<0.01
LCP-5	Sand and gravel from tributary drainage just before it exits the RNA through the alluvium. Oversize composed of phyllite and some granitic and quartz vein material.	<0.005	<0.01
LCP-6	Sand and gravel from a southeast-trending tributary draining limestone area of the RNA. Oversize composed of phyllite.	<0.005	<0.01

Table 3 - Assay Results of Non-Carbonate Rock Samples

Sample Number	Description	Gold (ppm)	Tungsten ($\%WO_3$)
LCR-1	Random chip sample of fine-grained tactite and quartz vein hosted in biotite schist exposed in wall of shaft at the Bright Star prospect.	<0.005	<0.01
LCR-2	Select grab sample of dense, fine-grained skarn (tactite(?)) from stockpiled material at unnamed prospect pit in altered phyllite.	<0.005	0.47
LCR-5	Random chip sample from outcrop of metasedimentary rock (phyllite (?)) that appears to be a weakly altered.	<0.005	<0.01

Both carbonate rock samples collected from within the LCRNA (LCR-3 and 4) had calcite, dolomite, and silica percentages that classify the rocks as high-calcium limestone. Additionally, sample LCR-4 had a low enough percent of MgO to be considered a high purity limestone (Bowen and others, p. 23, 1973). This sample's chemical composition compared very closely to the sample (K-Q) collected from the past producing quarry (see Attachment 1 and Table 4). Physically, however, this sample did not have the same whiteness as did the quarry sample; whiteness is a valued quality necessary for many uses of limestone.

Table 4 - Whole Rock Analysis of Carbonate Rock Samples

Sample Number	Description	$CaO/CaCO_3$ (%)	$MgO/MgCO_3$ (%)
LCR-3	Select chip sample of dense, coarse grained, very weathered, light gray, banded marble. This was a high-grade sample separated from obviously less pure (more weathered) material.	52.9/94.4	2.15/4.50
LCR-4	Select chip of coarse-grained marble that was denser, whiter, and less banded than LCR-3 but still had a gray tint to it. This was a high-grade from less pure material in area.	55.2/98.5	0.35/0.73
K-Q	Select chip of high-calcium limestone from quarry. Outcrop was banded, coarse-grained marble varying in color from dark gray to white. Sample was from the whitest material.	55.2/98.5	0.32/0.67

MINERAL POTENTIAL

Locatable Minerals

Geologic conditions on the LCRNA are favorable for the occurrence of locatable mineral resources. This is due to the presence of a carbonate-bearing metasedimentary roof pendant and a granodiorite intrusive near to and within the LCRNA. High-calcium limestone within roof pendants is often metamorphosed into coarsely crystalline marble. Contact metamorphism that occurs when an igneous body intrudes or envelopes carbonate rock often forms metalliferous skarn deposits. Skarn, as well as coarsely crystalline marble were observed within the boundaries of the LCRNA.

Analysis of stream deposit pan concentrate samples testing most of the area did not detect any gold or tungsten. This indicates that this portion of the subject area is likely to be void of mineral potential for these metals. One high-grade rock sample collected from a mineralized site just outside of the pan concentrate coverage area had a fairly high tungsten concentration. This sample came from a prospect exposing skarn material in proximity with limestone (see Photo 7). Because of this finding, along with the string of tungsten properties just to the northeast of the LCRNA, the north and northeast edges of the LCRNA must be considered to have a moderate potential for the occurrence of small scheelite-bearing (tungsten) deposits. This is an area of the LCRNA where limestone is in contact with granodiorite and, in places, may have been altered to tactite. However, due to extremely low tungsten prices and evidence that tungsten occurrences in the area are small, the potential for the discovery and development of an economical tungsten deposit within the subject area is low.

The two carbonate rock samples collected from within the LCRNA compare closely to a sample collected from a quarry just outside of the subject area where high-calcium limestone has been produced. Because of this similarity, and the fact that large, thick volumes of carbonate rock occur in the LCRNA (see Photos 2 and 8), the potential for the occurrence of a sizable locatable high-calcium limestone deposit is high. However, development of any limestone from the Isabella area is not currently expected due to high transportation cost to get this material to existing markets in southern California. This makes them uncompetitive with deposits much closer to those markets. Once these closer resources are depleted, high-calcium limestone in the Isabella area could become competitive. It would be expected that the large amount of known resources occurring outside of the LCRNA in topographically lower terrain (see Photos 3 and 4) and much closer to existing transportation infrastructure would be mined first before any more remote deposits within the LCRNA (see Photo 2) are considered for development. Therefore, while the potential for an economical high-calcium limestone deposit could be high (has the necessary quantity and quality), it's development is not in the foreseeable future.

Leasable Minerals

All of the subject area lies within the outer edge of a region classified as being "prospectively valuable" for geothermal resources. This classification is in part due to the presence of warm thermal springs occurring along a 25 mi (40 km) stretch of the Kern River from near Kernville southwestward which is likely fault related (Majmundar, 1983). The nearest warm spring is about 7 mi (11.3 km) west of the LCRNA. The potential for the occurrence of geothermal resources, although classified as prospectively valuable, is most likely low because the geologic setting within the LCRNA is not the same as it is within the warm springs area.

No other "prospectively valuable" classifications for leasable energy or non-energy mineral commodities occur over the subject area. No leases, lease applications, prospecting permits, or records of interest in prospecting or exploring for these types of mineral commodities on the subject lands were found in BLM files. Based on the above information and the local geologic setting, there is a low potential for the occurrence of valuable leasable minerals within the LCRNA.

Salable Minerals

Limestone resources of salable quality are very likely to occur within the subject area but have a low marketability at the present time. If a market should develop, other nearby sources more closer to existing transportation and in a less remote terrain are likely to be developed first. Therefore, an economic interest in this limestone is not likely in the immediate future.

No other salable mineral commodities of more than nominal value are known to occur on the LCRNA, nor are there unique geologic conditions present to infer a better source than any other source in the general area. It is my opinion that the subject area has a low potential for the occurrence of valuable deposits of these other salable mineral commodities.

Critical and Strategic Minerals

Critical and strategic minerals, other than tungsten, are not known to occur on the subject lands in concentrations representative of a potential resource. Tungsten, as mentioned previously, is not likely to exist in economic quantities.

REFERENCES

Bowen, O. E., Gray, C. H., Jr., and Evans, J. R., 1973, The Mineral Economics of the Carbonate Rocks; Limestone and

Dolomite Resources of California: California Division of Mines and Geology Bulletin 194, 60 pp.

Clark, W. B., 1970, Gold Districts of California: California Division of Mines and Geology Bulletin 193, 186 pp.

Jennings, C. W., 1977, Geologic Map of California: California Division of Mines and Geology, scale 1:750,000.

Keeler-Wolf, T., 1990, Ecological Survey of the Proposed Long Canyon Research Natural Area, Sequoia National Forest, Kern County, California: U.S. Forest Service, Sequoia National Forest, Unpublished document.

Majmundar, H. H., 1983, Technical Map of the Geothermal Resources of California: California Division of Mines and Geology, California Geologic Data Map Series, Map No. 5, Scale 1:750,000.

Miller, W. J., and Webb, W. W., 1940, Descriptive Geology of the Kernville Quadrangle, California: California Journal of Mines and Geology, Vol 36, No. 4, pp. 343-378.

Norris, R. M., and Webb, R. W., 1990, Geology of California: John Wiley & Sons, Second Edition, Chapter 3, pp. 62-125.

Smith, A. R., 1965, Geologic Map of California; Bakersfield Sheet: California Division of Mines and Geology, Olaf P. Jenkins Edition, scale 1:250,000.

Troxel, B. W., and Morton, P. K., 1962, Mines and Mineral Resources of Kern County, California: California Division of Mines and Geology, County Report 1, 370 pp.

USDA Forest Service, Pacific Southwest Region, 1990, Research Natural Area Establishment: Unpublished Document.

Photos.

Photo 1 - Drainage in the interior of the LCRNA from which sample LCP-1 was collected. View is looking east towards the rugged terraine just north of Heald Peak. Photo by M. Dunn April 1997.

Photo 2 - View from outside of LCRNA looking southeast at a white limestone outcrop which forms a ridge that is the LCRNA's proposed northeast boundary. Photo by M. Dunn, April 1997.

Photo 3 - White, high calcium limestone in upper workings of the Kennedy Minerals quarry northwest of the LCRNA. Rock sample K-Q taken here. Photo by M. Dunn, April 1997.

Photo 4 - View from Kennedy Minerals quarry looking northwest at the continuation of limestone outcrops. Photo by M. Dunn

Photo 5 - Upper workings at the B and F Mine in section 33 about 1 km north of the LCRNA. Note large boulder of garnet-epidote tactite in lower right corner. Photo by M. Dunn, April 1997.

Photo 6 - Workings within the LCRNA at the Bright Star Prospect. Sample LCR-1 was collected from quartz vein and skarn along right wall of glory hole/shaft. Photo by M. Dunn, April 1997.

Photo 7 - Unnamed prospect in NW4NE4 Sec.4 within the LCRNA. Rock sample LCR-2 was collected from stockpiled tactite shown in lower left corner. Photo by M. Dunn, April 1997.

Photo 8 (below) - Limestone along ridge forming northeast boundary of LCRNA. Site of sample LCR-4. Photo by M. Dunn, 1997.

APPENDIX E

MINERAL POTENTIAL REPORT UPDATE (DUNN, 2003)

December 9, 2003

MINERAL REPORT UPDATE

For the
Long Canyon Candidate Research Natural Area
Sequoia National Forest
Prepared by Michael D. Dunn, RMET

The purpose of this mineral report update is to provide information relative to the establishment of the Long Canyon Research Natural Area (RNA) that has occurred since the original mineral potential report prepared in 1997. This update combined with the original mineral report should be sufficient for the preparation of the RNA's Establishment Record. As of this date, the RNA has not been officially proposed for mineral withdrawal to the BLM. Once proposed by the Forest Service, the BLM is required to serialize the withdrawal and place the area under temporary segregation for 2 years. At the end of this 2-year period, the Secretary of Interior and/or BLM representative will make a final decision on the withdrawal. During this 2-year period, a revised mineral potential report meeting BLM report standards will need to be prepared by the Forest Service and approved by BLM. This update to the original Long Canyon RNA mineral report should not be used for any purpose other than that for which it was prepared.

The candidate Long Canyon RNA is still the approximately 2300-acre Long Canyon watershed on the Greenhorn Ranger District as identified in the 1997 mineral report. Land status for T. 27 S., R 31 E., MDM, has not changed since February 1996 and the subject land is shown on the BLM Master Title Plat as open Public Domain land. Specialty Minerals still holds active the three placer claims for high-quality limestone that were active during the 1997 mineral report (Big Piute, CAMC 15152; Piute #4, CAMC 15156; and Piute #7, CAMC15159). Since then, four new 160-acre association placer claims have been located adjacent to and within the candidate RNA by an association of individuals. They are Desert Star #1 (CAMC 275509) in the SE1/4 section 33 and Desert Star #2 (CAMC 275510) in the SW1/4 section 34, T. 26 S., R. 34 E.; and the Desert Star #3 (CAMC275511) in the NW1/4 section 3 and Desert Star#4 (CAMC 275512) in the NE1/4 section 4, T. 27 S., R. 34 E. All four claims were located on December 14, 1998 and are current for the 2004 assessment year. Based on the type and location of these claims, it is my belief that these are also located for high-quality limestone. Placer gold and tungsten is a possibility since tactite skarn mineralization occurs in the area and this mineralization could contain these heavy metals. None of the seven active claims are known to be in operation at this time.

It is my opinion that the mineral potential for the candidate Long Canyon RNA as stated in the 1997 mineral report remains the same. The subject area has a low potential (L/C) for locatable deposits of tungsten and gold and high potential (H/C) for locatable deposits of

high-calcium limestone, but low likely hood of economical development. Since 1997, pressure from environmental organizations on current limestone quarry operators on the San Bernardino National Forest has lessened allowing for greater expansion at existing operations. This means that these San Bernardino resources that are closer to markets than the resources on the Long Canyon RNA will continue to produce well into the foreseeable future. More distant resources, such as those on the subject lands are now even less likely to be developed then they were in 1997. The subject area also has a low potential (L/B) for geothermal resources and no indicated potential (O/B) for other energy or non-energy leaseable resources. Limestone resources of saleable quality have a high potential (H/C) for occurrence but a low likelihood of development due to distance to major markets in the southern California area.

It is still my recommendation that the Forest supervisor take into consideration the potential for future marketability of high-calcium limestone resources occurring on the subject lands, but that any decision should not be overly influenced by the presence of these new mining claims.