SIGNATURE PAGE

For

RESEARCH NATURE AREA ESTABLISHMENT RECORD

Big Pine Mountain Research Natural Area

Los Padres National Forest

Santa Barbara 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 10/22/04
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Recommended by _____ Date 6/3/04
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Recommended by _____ Date 6/3/04
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Established by _____ Date 11/29/04
Jack Blackwell, Regional Forester, Pacific Southwest Region

TITLE PAGE

Establishment Record for
Big Pine Mountain Research Natural Area
Within
Los Padres National Forest
Santa Barbara County, California

Big Pine Mountian Research Natural Area

MAPS

MAP 1: Location and Access to Big Pine Mountain RNA

MAP 2: Big Pine Mountain RNA Boundaries

MAP 3: Vegetation Types

MAP 4: Soil Types

A. INTRODUCTION

The Research Natural Area (RNA) system is a national network of ecological areas designated in perpetuity for research, education, and for the maintenance of 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 ecological 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 Big Pine Mountain Research Natural Area on the Santa Lucia Ranger District, Los Padres National Forest, in Santa Barbara County, California was chosen to represent the Sierra Nevada mixed-conifer forest for the California Coast Range Open Woodland-Shrub-Coniferous Forest-Meadow Province (M262) (Miles and Goudey 1997).

Big Pine Mountain RNA (BPMRNA) was nominated by Los Padres National Forest in 1986. An ecological survey of the RNA was completed by Todd Keeler-Wolf in 1989 and the report written in 1991.

1) Land Management Planning
   The recommendation for establishment of the Big Pine Mountain RNA is included in Los Padres National Forest Land and Resource Management Plan (LRMP) (1988a) and the effects of its establishment are analyzed in the Environmental Impact Statement for the LRMP (1988b). Relevant pages regarding BPMRNA from these two documents are included in Appendices A and B. Land allocation for the Big Pine Mountain RNA was made in the Record of Decision (ROD) for the LRMP signed by the Regional Forester. Big Pine Mountain RNA is within the San Rafael and Dick Smith Wildernesses.

B. OBJECTIVE

Objectives for establishing the Big Pine Mountain RNA are: 1) to enhance the Regional and National RNA systems by the addition of the Sierra Nevada Mixed Conifer type (SAF 243)[1] and its asscioated ecosystems within the Central California Coast Ranges ecological section; and 2) to provide potential habitat for California condors which have used this area in the past and have recently been re-introduced into the nearby Sisquoc Condor Sanctuary. No other RNAs in this ecological province contain Sierra Nevada mixed conifer. Establishment of the BPMRNA will also serve the objective of including other vegetation types and their interrelationships with the target mixed conifer type. These include Canyon Live Oak (*Quercus chrysolepis*)[2] (SAF 245) and Jeffrey Pine (*Pinus jeffreyi*) (SAF 247).

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[1] Society of American Foresters Forest Cover type of the United States and Canada (Eyre 1980)
[2] Plant taxonomy follows Munz (1974) except for tree species which follows Little (1979).

C. JUSTIFICATION STATEMENT

Mixed Conifer Forest

This forest type, typical of the mid-montane areas of California, is dominated by a similar mix of tree species throughout most of the state. These species include white fir (*Abies concolor)*, sugar pine (*Pinus lambertiana*), ponderosa pine (*P. ponderosa*), incense-cedar (*Libocedrus decurrens*), and, to a lesser degree, Jeffrey pine. In addition, many of these forests in northern California have Douglas-fir (*Pseudotsuga menziesii*) as a significant component. Southern California stands of mixed conifer forest, including those at Big Pine Mountain, lack Douglas-fir, but may contain its southern California relative, bigcone Douglas-fir (*Pseudotsuga macrocarpa*). In addition, the stands at RNA are without ponderosa pine, but do have Jeffrey pine.

In the southern Coast Ranges mixed conifer forests are largely restricted to north-facing slopes at upper elevations. The largest single area of this vegetation type is on the north slope of Big Pine Mountain between 6000 ft (1829 m) and the summit ridge. Other smaller stands occur to the west on the north slopes of West Big Pine Mountain and intervening peaks, as well as along the gently sloping valley bottom in the vicinity of Upper Bear Camp.

The forest is dominated by large individuals of the above-mentioned species and, usually has an open understory with numerous large trees over 300 years old. The largest sugar pine measured was about 80 inches (2 m) dbh[3]. Incense-cedar ranges up to 6 ft (1.8 m) dbh, and Jeffrey pine and white fir are represented by individuals to 5.5 ft (1.7 m) dbh. Most of the larger specimens have basal fire scars indicating repeated ground fires in the past.

There is variation in the composition of the stands. Some areas are dominated largely by white fir and sugar pine; some are without Jeffrey pine; some are dominated by Jeffrey pine; and some are without incense-cedar. Valley bottom stands near Upper Bear Camp differ structurally from those on the upper slopes by having higher densities of saplings and young trees. Bigcone Douglas-fir does not mix regularly with the large stand at Upper Bear Camp. However, it does occur in steep ravine bottoms and ranges up to the lower limit of mixed conifer stands on north-facing slopes.

Associated with the stands of mixed conifer forest are animal species typical of this vegetation type throughout the state. Species such as the mountain chickadee (*Parus gambeli*)[4] and white-headed woodpecker (*Picoides albolarvatus*) are both residents of the mixed conifer zone in California. These species are non-migrants. Their presence at Big Pine Mountain indicates relatively stable conditions within the mixed conifer zone. Although the aerial extent of this habitat is limited and is isolated by several miles from the nearest stands, it is large enough and well-developed enough to support such avian species. Conversely, certain mammalian species characteristic of the California mixed conifer zone such as the golden-mantled ground squirrel (*Spermophilus lateralis*)[5] and various montane chipmunks (*Tamias* spp.) appear to be absent.

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[3] diameter at breast height

[4] Bird taxonomy follows Peterson, R. T. 1990. A field guide to western birds, revised edition. Houghton-Mifflin, Boston.

[5] Mammal taxomony follows Jameson and Peeters (1988).

California Condor (*Gymnogyps californianus*)

This species has been the subject of much publicity in recent years not only because it's the largest and rarest land bird in North America, but also because of the controversial decision to capture and to remove the last remaining wild individuals to zoos for a captive breeding program. Prior to 1987, when the last individual was captured, the San Rafael Wilderness was one of the last remaining strongholds of the species.

Just 2.5 miles (4 km) west of the RNA is the Sisquoc Condor Sanctuary. This area of about 1200 acres (486 ha) was established in 1937 to protect one of the last nesting sites of this species as well as to provide bathing and roosting sites (information on file at Los Padres National Forest Supervisor's Office, Goleta, California). According to condor biologist Janet Hamber at the Santa Barbara Museum of Natural History, the cliffs just south of West Big Pine and Big Pine Mountain have been used by condors as nesting and roosting sites in the past (Janet Hamber, pers. comm., January 1991). To quote her:

"Enclosed within the boundary of the RNA is one condor nest site, one cliff roost site, and several large conifers that were used as roosts. The nest site was last active in 1980. The last breeding by the Santa Barbara pair was in 1985 on the south slopes of Big Pine Mountain, just outside the proposed RNA. In addition, there is another nest site, used in 1976, 1977, 1981, and 1984 on the south side of West Big Pine, just outside the RNA. The last two mentioned condor use areas also include several roost sites, drinking and probably bathing pools within the proposed boundary. A number of trees at the top of Big Pine Mountain and on the ridge of West Big Pine Mountain were used as perch trees by the condors."

Some of the last wild condors were seen from the Alamar Trail and from West Big Pine Mountain, both within the RNA, in July and December 1986 (notes from condor observation party in register atop West Big Pine Mountain). It is likely that if the re-introduction program is a success, the BPMRNA will again become prime condor habitat (Janet Hamber, pers. comm.)

Rare Plants

Sidalcea hickmanii ssp. *parishii* (CNPS[6] list 1B) is known from chaparral on Big Pine Mountain (Smith 1976, Tibor 2001). This species is limited to a few restricted populations and is endemic to California. It is endangered in a portion of its range. It was not seen during the ecological survey. However, it should be expected in dry disturbed and sandy areas around fuel breaks and bordering fire roads along summits of mountains.

The Santa Ynez false lupine (*Thermopsis macrophylla* var. *agnina*, now *Thermopsis macrophylla macrophylla* in Jepson Manual [Hickman 1993]) is an endemic to the mountains of Santa Barbara County and is known from the Big Pine Mountain 7.5 minute topographic quadrangle (Skinner and Pavlik 1994). A plant which is apparently *Thermopsis macrophylla*

[6] California Native Plant Society

var. *velutina* is locally common in openings in mixed conifer forests near the summit of Big Pine Mountain and forms colorful displays during early summer.

Animals of Special Concern

In addition to the endangered California condor, four other species of birds were seen in the area during the field work for the ecological survey, which are considered species of special concern by the California Department of Fish and Game (Steinhart 1990). These include the Cooper's hawk (*Accipiter cooperii*), seen flying twice over the coniferous forest at Upper Bear Camp. The golden eagle (*Aquila chrysaetos*), seen four times in as many days primarily over the summit ridge and once perched atop a large sugar pine in the main stands of mixed conifer forest on the north slope of Big Pine Mountain; the spotted owl (*Strix occidentalis*), heard one night in the valley bottom mixed conifer forest at Upper Bear Camp; and the yellow warbler (*Dendroica petechia*) seen several times along riparian stretches of the Sisquoc River. All four of these species are likely breeders in the area. Additional species of special concern observed within the RNA by Janet Hamber and associates of the Santa Barbara Museum of Natural History include sharp-shinned hawk (*Accipiter striatus*), prairie falcon (*Falco maxicanus*), and purple martin (*Progne subis*, a likely nester in the mixed conifer forest) and the Federally endangered peregrine falcon (*Falco peregrinus*).

Biogeographic Significance

The RNA is near the juncture of several major ecological provinces. Although part of the South Coast Ranges, its high elevation and proximity to the high Transverse Ranges add a number of montane elements to the biota of the area that are not typically observed in the South Coast Ranges. Because the area is also close to the Mojave Desert and arid slopes surrounding the southern San Joaquin Valley, several species typical of desert areas also occur here. For example, single-leaf pinyon pine (*Pinus monophylla*) occurs as scattered individuals along the ridgecrest west of West Big Pine Mountain. At approximately 119° 41'W longitude, the RNA is near the westernmost distribution and perhaps the closest location to the Pacific Ocean for this typical desert montane species in southern California (Griffin and Critchfield 1976). Other desert-montane species such as *Chrysothamnus nausiosus* and *Penstemon speciosus* are also found on the xeric, upper ridges of the area.

Numerous montane elements also show their closest distributions to the ocean in this area. In addition to some of the typical members of the mixed conifer forest such as white fir and Jeffrey pine, there are 41 less conspicuous montane species at or near their westernmost distributions in southern California (Appendix C1).

As was mentioned in a previous section, birds such as the white-headed woodpecker and mountain chickadee are absent from the entire South Coast Ranges, except the local high peaks in the San Rafael chain. Other more wide-ranging montane birds atypical of the South Coast Ranges are also known from the mixed conifer forest, adjacent montane chaparral, and Jeffrey pine forests of the RNA. These include the Cassin's finch (*Carpodacus cassini*), red crossbill (*Loxia curvirostra*), Clark's nutcracker (*Nucifuga columbiana*), Townsend's solitaire (*Miodynestes townsendii*), pygmy nuthatch (*Sitta pygmaea*), dusky flycatcher (*Empidonax*

oberholseri), fox sparrow (*Spizella passerna*), and yellow-rumped (Audubon's) warbler (*Dendroica coronata*). Most of these species are thought to breed in the BPMRNA although they may not be permanent residents (either migrants or nomadic visitors).

Large Predators and Pristine Environment

Several carnivorous mammals including black bear (*Ursus americanus*), mountain lion (*Felis concolor*), bobcat (*Lynx rufus*), coyote (*Canus latrans*), and gray fox (*Urocyon cineroargentaeus*) were seen or noted within the RNA. Black bears were particularly conspicuous, seen twice in the four-day ecological survey with numerous fresh signs noted throughout the area. In addition to the carnivores, a number of raptors also are known from the area including six species of owls, three hawks, three falcons, and the golden eagle (see Appendix D1). The remoteness of the area (more than 30 miles, 50 km, to the nearest settlement) and its location within a large, Federally-established Wilderness ensure conditions necessary for maintaining healthy populations of these species.

Riparian Habitat

Some of the best remaining riparian vegetation in the South Coast Ranges occurs along the Sisquoc River (Ayn Martin, PSW RNA aquatic target element specialist and Mark Borchert, Ecologist, Los Padres N. F.; both pers. Comm.. 1989). Although the upper reaches of the river within the RNA are intermittent, several short stretches of permanently flowing water occur, and these are lined with well-developed riparian vegetation including exceptionally large individuals of white alder (*Alnus rhombifolia*) up to 100 ft (30 m) tall and 32 inches (81 cm) dbh. Bigleaf maple (*Acer macrophyllum*), Fremont cottonwood (*Populus fremontii*), California bay (*Umbellularia californica*), and *Salix lasiandra* also occur as large trees. The understory is often well developed with stream clematis (*Clematis lingusticifolia*), stinging nettle (*Urtica holosericea*), *Satureja mimuloides*, *Artemisia douglasiana*, and *Stachys albens*. Further downstream coast live oak (*Quercus agrifolia*) distributes lines the stream bottom.

The flowing sections of the stream are home to numerous aquatic invertebrates and a population of presumed native rainbow trout (*Salmo gairdneri*) with some individuals reaching 12 inches (30 cm) in length.

Vegetation Diversity

In addition to mixed conifer forest and riparian vegetation, Big Pine Mountain RNA contains a number of other well-developed vegetation types. These include several distinct types of montane chaparral composed of bitter cherry and choke cherry (*Prunus emarginata* and *P. virginiana* var. *demissa*, respectively), Parry manzanita (*Arctostaphylos parryana*)-dominated montane chaparral, and deerbrush (*Ceanothus integerrimus*) scrub. True chaparral is represented at lower elevations by *Cercocarpus betuloides*, chamise (*Adenostoma fasciculatum*)-dominated types as well as by mixed phases co-dominated by several species. Also represented are bigcone Douglas-fir/canyon live oak forests, some of which are transitional to mixed conifer forest.

Another extensive vegetation type is Coulter pine (*Pinus coulteri*)/chaparral. Local stands of Coulter pine are largely even-aged, dating back to fires in the late 1930s or early 1940s. As with most stands in the chaparral matrix of the South Coast Ranges, these trees appear to have serotinous cones (Borchert 1985).

History of Scientific Research

The high-elevation, disjunct forests and the presence of California condors in the area have attracted a number of researchers. Several botanical and zoological expeditions to the area have undertaken. Much of the information useful for further research is available through the staff at the Santa Barbara Museum of Natural History (SBMNH), 2559 Puesta del Sol Rd., Santa Barbara, CA 93105. Information on plants is available from staff from the Santa Barbara Botanic Garden. Information on local vertebrate occurrences (noted in Appendix D1) has been greatly augmented by Janet Hamber of the SBMNH.

D. PRINCIPAL DISTINGUISHING FEATURES

A part of the South Coast Ranges of California, and more specifically part of the San Rafael Mountains, Big Pine Mountain has one of the few well-developed examples of Sierra Nevada Mixed Conifer Forest (or Sierran Mixed Coniferous Forest by Holland's classification system [Holland 1986]) in this ecological province. The island-like mixed conifer forest at Big Pine Mountain are separated from similar forest on Madulce Peak and Pine Mountain (also known as Reyes Peak, a part of the Transverse Range) by about 5 and 16 miles (8 and 26 km), respectively. Mixed conifer forests are limited to the elevations above 5100 ft (1555 m) and are diverse and variable topographically and compositionally.

The area is also notable for being adjacent to one of the last regular nesting localities of the Federally-endangered California condor. Until 1986, condors were regularly seen in the area. Other sensitive species and species of special concern (Steinhart 1990) known from the area include the spotted owl, Cooper's hawk, sharp-shinned hawk, golden eagle, prairie falcon, purple martin, yellow warbler and the Federally endangered peregrine falcon.

In addition to the target vegetation, the Big Pine Mountain RNA also contains a number of other plant communities including well-developed riparian vegetation along the Wild and Scenic Sisquoc River, bigcone Douglas-fir/canyon live oak forests, Coulter pine/chaparral, and such locally unique communities as shale barrens. At the highest elevations within the South Coast Ranges, several species of montane animals and plants reach their distribution limits at Big Pine Mountain; otherwise, most of them are found to the east in the higher Transverse Ranges. The large size and elevational range of this RNA encompass much of the biotic variety in the region.

The area supports populations of one CNPS-listed 1B rare species, *Sidalcea hickmanii* ssp. *parishii* (Tibor 2001). *Thermopsis macrophylla macrophylla*, also a rare species, has been sighted in areas near the RNA (Skinner and Pavlik 1994).

The geology of the area is dominated by Eocene and Upper Cretaceous sedimentary rocks, including massive sandstone and thinner beds of shale. The sandstone has eroded into spectacular cliffs along the southern boundary and along parts of Big Pine Canyon. Two major faults, the Rinconada Fault (also known as Sur-Nacmiento) and the Big Pine Fault, converge in the immediate vicinity of the area. Numerous smaller faults also occur in the RNA (Jennings *et al.* 1977).

E. LOCATION (reference maps 1 and 2)

(1) National Forest involved

BPMRNA is located on the Santa Lucia Ranger Districit of Los Padres National Forest, in Santa Barbara County. It is entirely within the San Rafael and Dick Smith Wildernesses except for a narrow right-of-way on either side of Forest Service Road 9N11. BPMRNA is located within Southern California Mountains and Valleys Ecological Section (M262B), San Rafael Topatopa Mountains Ecological Subsection (M262Ba). The Sisquoc River is a designated Wild and Scenic River and the corridor extends into the RNA along its northeast boundary.

(2) Latitude/Longitude

The approximate center of the area is latitude 34° 42'N and longitude 119° 40'W.

(3) Boundary description

Big Pine Mountain RNA lies within portions of sections 5, 6, 7, 8, and 9 T7N, R26W and sections 1 and 12 T7N, R27W, San Bernadino Baseline and Meridian.

The boundaries of BPMRNA are delineated using topography and trails. The following described the general boundaries of BPMRNA. For further clarification, please refer to Map 1.

a) Beginning at the Fire Lookout tower atop West Big Pine Mountain, at 6490 ft (1978 m) elevation and 34° 41.74' N latitude and 119° 40.62' W longitude (point a) the boundary winds east along the crest of Big Pine Mountain to a knoll at 34° 41.541' N and 119°38.219' W and the end of a fire road (point b).

b) from that point, it turns NE following a ridge down to the road on the boundary of the wilderness. The boundary follows the road past the Alamar Guard Station about 800 ft (244 m) to a trail leading to Lower Bear campground (point c).

c) thence, the boundary turns west and follows the trail dropping down to the Sisquoc River, and then follows the river west to the junction with the creek flowing out of Big Pine Canyon at 34° 43.831' N and 119° 40.453' W, elevation 3650 ft (1112 m) (point d).
d) hence, turns southeast following the Big Pine Canyon creek to its second tributary stream at 34° 43.512' N and 119° 40.247' W at 3787 ft (1154 m) elevation (point e)

e) from there, it turns south and follows the middle fork of the tributary stream up to the ridgetop at 34° 42.024' N and 119° 41.045' W to the top of a knoll whose elevation is noted on the topographic map as 6387 ft (1947 m) (point f).

f) The boundary than follows the ridgetop southeast for about 0.6 mile (1 km) to its origin at the fire lookout tower atop West Big Pine Mountain (point a).

(4) Acreage

The RNA covers 2963 acres (1199 ha).

(5) Elevations

Elevations range from 3600 ft (1097 m) at the confluence of the Sisquoc River and Big Pine Canyon to 6828 ft (2081 m) atop the summit of Big Pine Mountain spanning an elevational range of 3228 ft (984 m).

(6) Access (Map 1)

The BPMRNA is accessible from the south via the gated Forest Service Road 9N11, known as the Big Pine-Buckhorn Road.

From Highway 101 in Goleta take State Highway 154 (San Marcos Pass Highway) north approximately 10.5 miles (16.9 km) to the paved Forest Service Road 5N18 (Los Prietos Rd.). From this point it is approximately 3.5 miles (5.6 km) to the Los Prietos Ranger Station. From the Los Prietos Ranger Station continue on Road 5N18 approximately 2 miles (3.2 km) to the junction with 9N11. Take this road approximately 1 mile (1.6 km) to the Upper Oso Campground.

Road 9N11 is gated at two points before reaching the RNA. The first one is at the Upper Oso Campground, and second one is 11.5 miles (18.5 km) beyond the first gate. A Forest Service key must be obtained to travel beyond both gates. The first gate, however, is open to motorcycles and bicycles.

The drive from Upper Oso Campground to the RNA is slow and steep in parts. It is approximately 32 miles (51.4 km) to the summit of the road (at the southern edge of the RNA) and requires about 1.5 hours of driving time.

Once at the edge of the RNA, Road 9N11 continues across the north slope of Big Pine Mountain for approximately 3 miles (4.8 km) to the site of the old (now dismantled) Alamar Guard Station and the intersection with the Alamar Trail (27W07). This point is at the northeastern corner of the RNA. This road is only occasionally traveled by Forest Service or Forest Service authorized vehicles.

In addition to the road, two trails afford access to portions of the RNA. The Mission Pine Trail (28W01) follows the prominent ridgecrest west from the summit of Road 9N11 to (and beyond) the southwestern corner of the area at West Big Pine Mountain. The portion of the trail within the RNA was once a vehicle route to the lookout on West Big Pine Mountain (now dismantled) and is easily traversed. The second trail, the Alamar Trail (27W07), follows the Sisquoc River westward from its origin. It affords access to the lower elevations of the RNA along its northern boundary, and passes through Upper and Lower Bear camps.

The true summit of Big Pine Mountain is reached by an old jeep trail, now difficult to find, branching off to the south from Road 9N11 about 1 mile (1.6 km) north of the road summit. This now-obscure trail ascends the steep north slope of the mountain, and after reaching the crest, follows the gradually-sloping main ridge eastward for about one mile (1.6 km) to the southeast corner of the RNA.

Aside from these routes, all travel within the interior of the RNA is cross-country. Slopes are often steep and there are many small and large escarpments. Thick chaparral and low growing oak scrub also hamper travel at both the mid and lower elevations. The target vegetation is open, close to the roads and trails and therefore is easily accessible.

F. AREA BY COVER TYPES

SAF Types (Eyre 1980)	Percent	Acres	Hectares
Canyon Live Oak (245)	18.0	532	215.3
Sierra Nevada Mixed Conifer (243)	22.0	653	264.3
Jeffrey Pine (247)	2.6	78	31.6
Unclassified	57.4	1700	688.0
Total	100.0	2963	1199.0

KUCHLER TYPES (Kuchler 1966)	Percent	Acres	Hectares
Mixed Conifer Forest (5)	24.6	731	295.8
California Oakwoods (26, in part)	18.0	532	215.3
Chaparral (29)	26.8	794	321.3
California Steppe (41, in part)	0.3	9	3.6
Unclassified	30.3	897	363.0
Total	100.0	2963	1199.0

HOLLAND TYPES (Holland 1986)	Percent	Acres	Hectares
Northern Mixed Chaparral (37110)	21.2	640	259.0
Montane Chaparral (37500)	5.2	155	62.7
Valley and Foothill Grassland (42000)	0.3	9	3.6
Montane Riparian Forest (61510, 63500, 61220)	1.0	29	11.7
Canyon Live Oak Forest (81320)	18.0	532	215.3
Coulter Pine Forest (84150)	14.2	420	170.0
Bigcone Douglas-fir/Canyon Oak Forest (84150)	10.3	306	123.8
Sierran Mixed Coniferous Forest (84230)	22.0	653	264.3
Jeffrey Pine Forest (85100)	2.6	78	31.6
Unclassified	4.8	141	57.1
Shale Barrens		(29)	(11.7)
Rock Outcrop		(112)	(45.3)
Total	100.0	2963	1199.0

G. PHYSICAL AND CLIMATIC CONDITIONS

The proposed RNA lies along the crest and the northern slopes of the eastern San Rafael Mountains, the southernmost and highest mountains of the South Coast Ranges. The San Rafael Mountains are characterized by extremely steep south-facing escarpments dropping abruptly to the drainage of Santa Cruz Creek, and, relatively gentler north-facing slopes that descend to the Sisquoc River. Although more gradual than the southern escarpment, slopes in the area range from moderate to steep, particularly in lower Big Pine Canyon where escarpments more than 400 ft (122 m) high loom over the intermittent stream.

Several side branches of Big Pine Canyon dissect the slopes between West Big Pine Mountain and the base of Big Pine Canyon cliffs. These canyons all exhibit stepped topography with relatively gradual slopes alternating with steep pitches, and small waterfalls associated with

bedding planes in the massive sandstone. The level summit of Big Pine Mountain drops steeply to the north, descending about 1500 ft (457 m) within a mile (1.6 km) to the relatively level bench at Upper Bear Camp. From Upper Bear Camp the slopes again steepen as the budding Sisquoc River drops into a series of waterfalls before reaching Lower Bear Camp.

Due to an elevational difference of over 3000 ft (914 m), there are substantial climatic differences between upper and lower elevations in the RNA. Although no climatological records have been kept within the RNA, estimates of temperature and wind patterns may be obtained from records kept from 1971 to 1976 at Bluff Camp Guard Station at about 4400 ft (1341 m), approximately 1 air mile (1.6 km) due south of the southern boundary of the RNA (data on file at Los Padres N. F., Goleta, CA). Table 1 summarizes the results from the four years of records kept at this station.

Table 1. Annual summary of wind and temperature data collected at Bluff Camp Guard Station 1972-1975, inclusive.

Year	Wind		Temperature °F (°C)		
	Average Direction	Max. Speed mph (kmph)	Average	Max.	Min.
1972	West	15.5 (25)	56.3 (13.5)	101 (38.3)	6 (-14.4)
1973	West	14.5 (23)	56.3 (13.5)	103 (39.4)	20 (- 6.7)
1974	Northwest	17.5 (28)	58.7 (14.8)	98 (36.7)	24 (- 4.4)
1975	West	37.0 (60)	52.0 (11.1)	103 (39.4)	13 (-10.6)

Temperatures at the upper elevations of the RNA likely average 6 to 8 °F (3-4 °C), colder than those at Bluff Camp, while temperatures at the lower elevations along the Sisquoc River average probably 3 to 4 °F (2 °C) higher than Bluff Camp. During the four days of ecological survey in early June 1989, temperatures at 6200 ft (1890 m) ranged from a high of 73 °F (23 °C) to a low of 31 °F (0 °C).

Data from the nearby and similarly oriented Pine Mountain (Borchert and Hibberd 1984), suggest that precipitation decreases rapidly moving from the mountain crest to the north. According to Rantz (1972), average annual precipitation along the crest of the San Rafael Mountains in the vicinity of the RNA is somewhat above 30 inches (762 mm), ranging down to about 25 inches (635 mm) along the upper Sisquoc River. Most precipitation falls between November and March, much of it in the form of snow.

Based on scanty information recorded at registers by hikers and mountain bikers visiting the summits of Big Pine and West Big Pine mountains, snow falls regularly along the crest in the winter and early spring. At the summit of Big Pine Mountain, snow has been reported through April in some years and has been recorded as deep as 3 ft (about 91 cm) in December and in 2-ft

(61 cm) drifts in early April. Judging from lichen (*Letharia* sp.) growth on mature conifers at the upper elevations, the snow depth on north-facing slopes averages 12-18 inches (30-46 cm).

H. DESCRIPTION OF VALUES

1. Flora

The flora of the RNA is moderately rich. During the four-day survey about 260 taxa of vascular plants were identified in the area (Appendix C2); additional species recorded for the RNA by Smith (1976) are listed in the same appendix. It is likely that a number of other species occur in the area, particularly in the lower elevations of Big Pine Canyon and in the Sisquoc River canyon. Floristic diversity in the area results from the well-balanced array of plant associations that extend from low elevation chaparral and riparian to montane chaparral and mixed conifer forest.

The vegetation map (Map 3) is based on the Holland (1986) system of terrestrial plant communities. The following is a description of the major plant associations occurring in the BPMRNA.

(1) Sierra Mixed Coniferous Forest (Holland 84230):

Despite the limited extent of this vegetation in the RNA, it is remarkably diverse. Its diversity in density, composition, and successional status rivals that of several other RNAs targeted for the same vegetation type in ecological provinces where it is much more widespread, e.g., Doll Basin (Keeler-Wolf 1986a), Hall Canyon (Keeler-Wolf 1986b), Cub Creek (Taylor and Randall 1978), Sugar Pine Point (Palmer 1981).

The mixed conifer forest at Big Pine Mountain occurs as fragmented stands (see Map 3). Each of these stands has its own peculiarities. They range from tall, dense-canopied alluvial flat forests with a sparse understory dominated by saplings of white fir and incense-cedar to open ridgetop stands on shallow soils with low canopies and a shrubby understory dominated by chaparral and canyon live oak.

Even within individual stands there is considerable variation. This is particularly true of the largest forest area on the north slope of Big Pine Mountain. This stand varies elevationally from stunted, ridgetop forests dominated by Jeffrey pine and white fir through a zone of mixed incense-cedar and sugar pine. The latter forest transitions to bigcone Douglas-fir/canyon live oak in the low elevation ravines. Forest tree composition also varies from west to east at the same elevation, with the western side having a more mixed species composition and the eastern side strongly dominated by white fir and sugar pine.

Vegetation was sampled in the largest stand on Big Pine Mountain (2400 m^2 sampled), and in the alluvial flat stand near Upper Bear Camp (1500 m^2).

(a) The best-developed upper-slope stands occur on north-facing slopes and are characterized by an open canopy dominated by white fir and to a lesser extent by Jeffrey pine, incense-cedar and sugar pine. All four species attain sizes of greater than 5 ft (1.5 m) dbh. Canopy height is variable depending upon slope exposure ranging from 50-60 ft (15-18 m) along the ridgetops to about 125 ft (38 m) on sheltered slopes. The understory of these upper-slope forests is extremely open and sparse. Herb and shrub cover averages less than 5 percent and seedling and sapling tree densitie average about 40/ac (100 trees/ha) with white fir the dominant. Sampling results for the main upper-slope stand on Big Pine Mountain can be found in Appendix E.

Although the east-central portion of the main upper-slope stand was not sampled, it clearly is less mixed than the remainder of the stand having virtually no incense-cedar or Jeffrey pine. This portion is co-dominated by white fir and sugar pine. Sugar pine in particular is 4 to 5 times more abundant in the canopy than in other parts of the main forest (see photo 1). Site factors are probably largely responsible for this difference; since this area occupies relatively steeper and more north-facing slopes than the remaining stand. This white fir- sugar pine phase resembles the forest type of the same name described for Pine Mountain (Reyes Peak) by Borchert and Hibberd (1984). They found this type to be strongly restricted to steep (62 percent slope), protected slopes between 5840 and 6266 ft (1780-1910 m).

In general, the most abundand species in the main forest is white fir. Jeffrey pine is moderately restricted to xeric sites, where it grades into relatively pure Jeffrey pine forests (see later discussion of Jeffrey pine forest) on exposed ridgetops and on shallow shales or sandstones. Incense-cedar is restricted to sheltered, mesic ravines or sites with relatively deep soils, and sugar pine is most common on steep, north-facing slopes.

The open nature of the canopy and understory of this upper-slope mixed conifer forest has contributed to its persistence. Surrounding lower slope vegetation is frequently dense chaparral or canyon live oak forest, both of which carry crown fires. Numerous cat-face scars on the mature conifers (up to 20 ft, 6 m, tall) attest to past ground fires in the main body of the mixed conifer forest. Apparently, the open canopy and sparse, discontinous understory retard the initiation and spread of crown fires. The abrupt boundary along the summit of Big Pine Mountain between chaparral on the south slope and conifer forests on the north slope demonstrates the divergent effects of fire in these two communities.

Pre-European fire frequency in the main mixed conifer forest on Big Pine Mountain averaged one fire every 12 years based on the analysis of several fire scars by Nancy Sandberg (pers. communication 1989). Samples were taken on the north slope of Big Pine Mountain adjacent to the Big Pine-Buckhorn Road.

(b) The other large upper-slope stand occurs midway between Big Pine and West Big Pine mountains. It is structurally similar to the western side of the main forest with a core area dominated by white fir and sugar pine measuring up to 100 ft (31 m) in height and 52 inches (132 cm) dbh. However, it is edaphically restricted to surrounding sterile

shale and sandstone outcrops. Conifers, especially incense-cedar and sugar pine adjacent to these outcrops, are stunted both at the upper elevations and in the more sheltered lower sites. This stand also seems to have suffered more from the recent drought than the main forest on Big Pine Mountain. Several recently dead and dying white fir and sugar pine were noted in June 1989. Reproduction in the core of this stand appears better for white fir and sugar pine than in much of the main stand, although incense-cedar and Jeffrey pine are poorly represented by saplings and seedlings.

(c) The westernmost mixed conifer forest occurs at West Big Pine Mountain. It is extremely open and dominated by Jeffrey pine with scattered white fir and sugar pine. Incense-cedar is absent. The understory is is interrupted by numerous sandstone outcrops and is dominated by scrubby canyon live oak mixed with chaparral species such as *Arctostaphylos glandulosa*, *Garrya flavescens*, and *Cercocarpus betuloides*. Trees are relatively stunted, averaging about 50 ft (15 m) tall.

(d) The low-elevation, alluvial-bench forest at Upper Bear Camp is connected to the main forest via several fingers that descend into the steep ravines. Ravine forests are transitional and composed primarily of bigcone Douglas-fir/canyon live oak but not Jeffrey pine, although there are individual white firs, sugar pines, and incense-cedars.

The sheltered Upper Bear Camp stand has a higher tree density, basal area, canopy cover, and density of saplings and seedlings than upper-slope stands. Tables 4 and 5 in Appendix E summarize the results of samples for this forest.

Seedling and sapling density averages 287/ha with white fir averaging 140, incense-cedar 47, and canyon live oak 100/ha. In addition to saplings and seedlings, there are higher densities of pole-size individuals than in upper-slope stands. The presence of canyon live oak and scattered occurrence of mesophilic valley bottom species such as bigleaf maple and coast live oak are indicative of the more mesic environment of Upper Bear Camp.

Growth rates of white fir appear more rapid at the Upper Bear Camp stand than on upper slopes. One individual, 26.5 inches (67.3 cm) dbh, growing at the edge of the small grassy glade was 101 years old. In contrast, a 25 inch (63.5 cm) dbh white fir on the main north-slope stand of Big Pine Mountain was 201 years old. In outlying portions of the alluvial-flat stand, most canopy trees were destroyed after a crown fire 110 years ago. White fir rapidly colonized these areas as indicated by a cohort of 100-year-old trees.

Like the upper-slope forests, the stand at Upper Bear Camp has a long history of ground fires. Upper-slope vegetation is dominated by canyon live oak and Coulter pine with some chaparral on more xeric exposures. The restriction of the mixed conifer forest to the gently sloping, low-lying area around Upper Bear Camp is probably results from several factors including the differential effect of slope position on fire behavior and the marginal climatic conditions for maintenance of mixed conifer forest at this low elevation.

Canopy height of the Upper Bear Camp stand is substantially greater than that of any of the upper-slope stands. Several old individuals of Jeffrey pine attain heights of more than 170 ft (52 m), and may exceed of 450 years in age.

Successional relationships in the RNA mixed conifer forest vary from stand to stand. White fir appears to be the overall dominant in all age classes in most stands. It is the most active colonizer of canyon live oak and chaparral habitats adjacent to the main north-slope stand and the alluvial-flat stand. Crown fire frequency and, to a lesser degree, climatic intolerance are probably largely responsible for the inability of the upper-slope and alluvial flat stands to meet on the lower, north-slopes of Big Pine Mountain. The other upper-slope stand between Big Pine and West Big Pine mountains is edaphically restricted by shale and sandstone outcrops. Jeffrey pine forest borders it on sandstone, whereas there is an abrupt alternation with shale barrens on its west side. Jeffrey pine appears to be the most successful reproducer at the margins of this stand, although white fir is most successful in the interior.

Where the mixed conifer forest intermingles with bigcone Douglas-fir/canyon live oak forest in ravines and canyon bottoms, white fir and incense-cedar are the most abundant conifers. Local clumps of incense-cedar dominate both mesic and hydric sties well into the canyons up to 1000 ft (305 m) below the main mixed conifer forest belt. The shade-intolerance of Jeffrey pine and sugar pine is an reason for their scarcity in the canyon bottoms.

One of the most intriguing features of mixed conifer forests within the RNA is the absence of ponderosa pine. Although Griffin and Critchfield (1976) show the species in the vicinity of Big Pine Mountain (on Madulce Peak), not a single specimen was located in the RNA. Several miles to the east on Reyes Peak it does occur (Borchert and Hibberd 1984). Apparently it has a bimodal distribution there, with a high- and a low-elevation zone of occurrence. Ponderosa pine is abundant at low elevations on north-facing slopes but gradually shifts its abundance to south-facing slopes at the higher elevations. Borchert and Hibberd found that xeric high-elevation sites, ostensibly suitable for ponderosa pine, are occupied by Jeffrey pine suggesting that Jeffrey pine may out-compete ponderosa pine in the colder, drier high-elevation habitats. Aside from the ridgetops, there is little remaining favorable habitat for ponderosa pine in the area. It requires much sun for early stages of growth, and the shady north-facing aspect of virtually all of the mixed conifer forest favors white fir, sugar pine, and incense-cedar.

(2) Northern Mixed Chaparral (Holland 37110):

This vegetation classification is somewhat artificial, encompassing a variety of chaparral types found in the lower- and mid-elevations of the RNA. In general, stands are dominated by several different species. Hence, there is little pure chamise (*Adenostoma fasciculatum*), pure manzanita (*Arctostaphylos* spp.), or scrub oak (*Quercus berberidifolia*) chaparral.

Ranging from low to high elevations, several phases of chaparral are apparent. At the lowest elevations on steep, southwest-facing exposures chamise tends to dominate in a mixed chaparral with *Arctostaphylos glauca*, *Salvia leucophylla*, *Eriogonum fasciculatum*, *Leptodactylon californicum*, *Lotus saoparius*, *Ephedra viridis*, *Mimulus longiflorus*, and *Ceanothus* spp. (photo 2). At similar elevations on less-exposed, rocky sites (west and east-facing aspects) *Cercocarpus betuloides* is often dominant with chamise, *Prunus ilicifolia*, *Ceanothus leucodermis*, *Arctostaphylos glauca*, and *Quercus berberidifolia*. At low elevations on northeast aspects the chaparral is composed of *Arctostaphylos glauca*.

One thousand feet (305 m) higher, on northeast and northwest aspects, chaparral is typically dominated by *Cercocarpus betuloides*, *Quercus berberidifolia*, *Garrya flavescens* ssp. *pallida*, and *Arctostaphylos glandulosa* with *Yucca whipplei*, *Marah fabaceus* var. *agrestis*, and *Lonicera interrupta*. In some areas other scrubby oaks besides *Q. berberidifolia* may become important including *Q. wislizenii* var. *fructescens* and a shrubby form of coast live oak (*Quercus agrifolia*). At higher elevations the chaparral assumes a more montane character with shrubby canyon live oak frequently dominating with *Arctostaphylos glandulosa*, *Cercocarpus betuloides*, and *Garrya flavescens*. This latter type ranges to the crest of the mountains.

(3) Canyon Live Oak Forest (Holland 81320)

This forest is widespread on mid and upper slopes, and ranges from below 4000 ft to over 6400 ft (1219-1950 m). At the lower elevations, as in lower Sisquoc and Big Pine canyons, it is restricted to north-facing, concave slopes, often adjacent to riparian vegetation. However, at upper elevations, it occupies steep, west- and east-facing exposures. Canopy height and stem size vary depending upon fire history and local site conditions. In general, the best developed trees are in ravines or in low-lying concavities where they are single-trunked with dbhs up to 3.5 ft (1.1 m) and heights of 90 ft (27 m). On upper, open slopes they are often only 10-15 ft (3-4 m) tall with multiple stems only a few inches in diameter. Modal mid-slope stands are typically 20-30 ft (6-9 m) tall with trunks 10-12 inches (25-30 cm) in diameter.

Crown cover is usually high except on extremely steep slopes that verge on cliffs and rock outcrops. The understory is typically poorly developed, consisting largely of duff with occasional sprigs of *Elymus glaucus* and other herbs. Stem age of the majority of these stands is about 50 years, likely dating back to the last major fire.

(4) Coulter Pine Forest (Holland 84140)

Borchert (1985), in his study of Coulter pines in the South Coast Ranges, has defined several Coulter pine associations. In the BPMRNA two main types exist: the Coulter pine/chaparral and the Coulter pine/canyon live oak. By far, the most extensive type in the RNA is the Coulter pine/chaparral. This phase occupies the open slopes and ridges at

the mid elevations from about 4800 to 6000 ft (1463-1829 m). It is dominated by even-aged stands of Coulter pine averaging 50-60 ft (15-18m) tall and approximately 50 years old. The trees are often dense, averaging 800-1000 trees/ha and are 6-12 inches (15-30 cm) dbh. The understory is variable but dominated by chaparral shrubs, particularly *Arctostaphylos glandulosa*, *Quercus dumosa*, *Q. wislizenii* var. *fructescens*, *Cercocarpus betuloides*, and *Garrya flavescens* var. *pallida*. Coulter pine/chaparral type is the dominant type in the Big Pine Canyon drainage. In this area it tends to form a belt of variable width between the mixed chaparral on the lower-slopes and canyon live oak forest on the upper-slopes.

The Coulter pine/canyon live oak phase is abundant on the north slopes of Big Pine Mountain. It occurs in smaller stands, and pine densities are not as high as in the previous phase. The associated canyon live oaks are generally small, multi-trunked individuals averaging 15-20 ft (5-6 m) with stems 5-8 inches (13-20 cm) in diameter. The understory is sparse with few herbs and shrubs.

Both phases may have occasional large specimens of Coulter pine in relatively sheltered ravines or rocky areas. One such individual was 75 years old, 27 inches (69 cm) dbh and about 71 ft (21.6 m) tall. Such trees pre-date the last major fire. Some exceptionally large Coulter pines exist in valley-bottom locations adjacent to Upper Bear Camp. One tree, marked with an aluminum tag, may be one of the largest Coulter pines in the region. It measures 59 inches (1.5 m) dbh and about 125 ft (38 m) high. It occurs along the Alamar Trail a few yards north of Upper Bear Camp at 5100 ft (1555 m) elevation.

The dense stands of Coulter pine in the RNA are serotinous, as described in Borchert (1985). Based on branch whorl counts, the 45- to 50-year-old trees have cones which persist on the main stem for an average of about 12 years before fully opening, dropping, or disintegrating. Some closed cones up to 15 years old were seen on 50-year-old trees. Tightly closed cones were commonly 6 to 8-year-old, and virtually all cones younger than 6 years were tightly closed. Stand-immolating fires burn over extensive areas of both chaparral and canyon live oak types.

(5) Bigcone Douglas-fir/Canyon Oak Forest (Holland 84150)

This forest is restricted to ravines and steep, concave slopes between about 4200 and 5700 ft (1280-1737 m). Thus, individual stands are usually small and linearly oriented. The most extensive stands occur along the several branches of Big Pine Canyon. The dominant bigcones in such locations have rough, deeply furrowed bark and may be up to 6 ft (1.8 m) dbh and 130 ft (39 m) tall. Understory trees of canyon live oak may have diameters of 3 ft (91 cm) dbh and reach 60 ft (18 m) in height. The canopy of bigcone averages 40-50 percent with a relatively dense subcanopy of canyon live oak (photo 3).

Bigcone Douglas-fir is restricted to steep, ravines and canyon bottoms. Although it occurs immediately adjacent to the alluvial-flat mixed conifer forest at Upper Bear Camp, it does not ascend the steep slopes and intermingle with the mixed conifers, nor does it

ascend the north-facing ravines to the more open upper slopes of Big Pine Mountain. There is a fairly distinct transition between the upper-slope mixed conifer forests and the bigcone Douglas-fir/canyon live oak type. The open understory of the former abuts the more closed and heavily vegetated understory of the latter. Apparently, this difference in distribution is largely due to susceptibility to crown fire. The sheltered sites dominated by bigcone Douglas-fir are protected from fire.

According to McDonald and Littrell (1976), the bigcone Douglas-fir/canyon live oak community is a well-defined ecological unit which may have changed little over thousands, if not millions of years. This community's relict nature is in part due to its moisture requirements within a relatively xeric climatic zone. Fossil evidence of a similar type of forest occurs in Pliocene and Pleistocene deposits.

The community is apparently one of the least affected by fire in Southern California lower montane areas. McDonald and Littrell found little evidence of major disturbance in any of their well-developed stands. Their results indicate that at low elevations the community is limited to mesic ravines and north-facing slopes. At upper elevations the community may be found on south-facing exposures outside of canyons, streams, and draws. This latter situation does not occur at BPMRNA.

The specific adaptations for fire-resistance (very thick, firm bark and the ability to resprout from boles and major branches) in bigcone Douglas-fir are only evident in relatively large and old specimens. The species reproduces best in the semi-shade of forests. However, it grows relatively slowly in these conditions and increases its growth rate after growing through the canyon live oak overstory (which takes 40-70 years). Thus, it takes many years of little or no disturbance before bigcone Douglas-fir dominates the area.

Several other tree species also occur in this association. White fir and sugar pine are not usually abundant and typically occur as scattered individuals. However, incense-cedar is relatively common, especially close to ravine bottoms where it dominates locally. Bigleaf maple and California bay (*Umbellularia californica*) are also locally common in ravine bottoms. Occasional large Coulter pines and individual sapling and pole-size specimens also occur. The understory is sparse, usually rocky and covered with duff. It is frequently dominated by poison oak (*Toxicodendron diversilobum*) and shrubby specimens of canyon live oak. Other understory species include *Arnica discoidea*, *Bromus marginatus*, and *Carex multicaulis*.

Large bigcone Douglas-firs in this association may be up to 400 years old. Joel Michaelson and others (Barbour *et al.* 1991) conducted a detailed climatological study of the past 400 years using tree rings of bigcone Douglas-fir in central Santa Barbara County. Single-stemmed canyon live oaks may be between 200 and 300 years old. An individual, 2.5 ft (76.2 cm) dbh, along the trail near Lower Bear Camp was about 225 years at breast height.

(6) Montane Chaparral (Holland 37500)

Like northern mixed chaparral, this is an aggregation of types that are not strictly defined by a single set of dominants. The montane chaparral of Big Pine Mountain RNA can be more easily divided into distinct types than chaparral typical of lower elevations. Three main phases occur: 1) the parry manzanita phase, 2) the *Ceanothus integerrimus* phase, and 3) the bitter cherry-choke cherry (*Prunus emarginata-P. virginiana* var. *demissa*) phase.

(a) Parry manzanita dominates or codominates with scrub oak, low canyon live oak, *Cercocarpus betuloides*, *Garrya flavescens* var. *pallida*, *Artostaphylos glandulosa*, *Amorpha californica*, and *Ceanothus integerrimus*. *Ribes roezlii*, *Amelanchier pallida*, *Chrysothamnus nausiosus*, and *Eriogonum wrightii* also are present. In some areas the shrubby oak is *Quercus wislizenii* var. *fructescens* instead of *Q. berberidifolia* or canyon live oak. Herbs are scarce and include *Stephanomeria chicoracea*, *Arabis perennans*, *Lupinus excubitus* ssp. *austromontanus*, and *Poa scabrella*. This type of chaparral is scattered on shale and sandstone outcrops at the head of the Big Pine Canyon drainage. It is closely associated with Jeffrey pine and mixed conifer forests and frequently occurs adjacent to shale barrens (see following discussion) or sandstone outcrops. Shrubs tend to be distributed as dense islands surrounded by patches of open ground but individual patches rarely cover more than a few acres. This type is transitional to the upper elevation form of northern mixed chaparral in several areas on the north slopes of West Big Pine Mountain.

(b) The *Ceanothus integerrimus* scrub is also closely associated with mixed conifer forest. However, it is less of an edaphic climax community than the parry manzanita phase. It occurs in several patches adjacent to the main stand of mixed conifer forest on Big Pine Mountain where it occupies a transitional position between the mixed conifer forest and adjacent canyon live oak association. It appears to occupy a dynamic zone between the two associations and may be indicative of secondary succession following the most recent major fire in the area. There are typically high numbers of white fire saplings associated with these areas.

Besides the dominant *C. integerrimus*, other species include *Prunus virginiana* var. *demissa*, and *Amorpha californica*. Openings in the shrubs may be dominated by *Thermopsis macrophylla* and *Angelica tomentosa*.

(c) The third major montane chaparral type is strongly dominated by bitter cherry with some choke cherry. It is the most localized of the three, restricted to about 10 ac (4 ha) on the upper, northwest slope of Big Pine Mountain. The patch is bisected by the Big Pine-Buckhorn Road. This is the tallest of the three chaparral types averaging 10-15 ft (3-4 m) in height and is also the most continuously dense phase. It occupies relatively steep slopes at the base of a very rocky, steep portion of mixed conifer forest just below the summit of the mountain. There is little else associated with the dense stand, although *Amelanchier pallida* occurs as isolated shrubs and *Ceanothus integerrimus* forms a border on the north side of the patch near the edge of the mixed conifer forest. As with

the *Ceanothus integerrimus* type, this type appears to be successional with numerous pole size and larger white fir and sugar pine associated with it.

(7) Rock Outcrop (No Holland equivalent)

Rock outcrops occur in many parts of the BPMRNA. The most spectacular are the cliffs in the lower Big Pine Creek drainage, but several more gently sloping outcrops occur in the upper reaches of Big Pine Canyon up to the crest. All of these are made up of massive sandstone. The flora of these outcrops appears relatively consistent throughout the RNA. Cover is restricted to scattered plants in cracks and crevices. Typical species include *Dudleya cymosa* ssp. *minor*, *Eriogonum saxitile*, *Zauschneria californica*, *Keckiella brevifolia*, *Cirsium californicum*, *Mimulus longiflorus*, *Eriogonum wrightii*, *E. umbellatum* (upper elevations), and *E. fasciculatum*.

(8) Jeffrey Pine Forest (Holland 85100)

This open forest is closely associated with the mixed conifer forests, but typically occupies shallower soils, or more exposed positions on ridges or on outcrops. Because of the harsh conditions of these sites, trees are usually stunted and much shorter than Jeffrey pines within the main body of the forest. The average size of dominant individuals is roughly 3 ft (1 m) dbh and 50 ft (15 m) tall. Most dominant Jeffrey pines appear to be moderately old (200-300 years). However, occasional large specimens may be twice as old.

Jeffrey pine stands occupy two main environments: relatively deep, sandy soils atop the summit of Big Pine Mountain and very shallow, rocky soils over shale or sandstone in more sheltered, gradual-to-moderate-sloping northerly exposures. The latter setting was sampled immediately west of the roadcrest near the junction of the Big Pine-Buckhorn Road and the Mission Pines Trail. The results are presented in Tables 6 and 7 in Appendix E.

The most common associate of Jeffrey pine on the rocky sites is canyon live oak that typically occurs as small multi-trunked individuals with stems averaging about 5-6 inches (13-15 cm) dbh and heights of 15-20 ft (4.5-6 m). White fir and sugar pine are scattered about, mostly represented by young individuals. Reproduction is typically poor for all species except canyon live oak (142 seedlings and saplings/ha). Jeffrey pine and other conifer saplings and seedlings average less than 15/ha. Aside from the scattered subcanopy of canyon live oak, several montane chaparral shrubs such as *Symphoricarpos parishii*, parry manzanita, *Quercus berberidifolia*, *Holodiscus microphyllus*, and *Ceanothus integerrimus* occur in the understory. Table 7 in Appendix E lists most of the common herb species.

A different set of site conditions characterizes Jeffrey pine forests atop Big Pine Mountain. This area is underlain by deep, sandy soils that lie astride the main ridge,

separating the main body of the mixed conifer forest from extensive stands of chaparral on the south slopes outside of the RNA. The understory is dominated by herbaceous species and there are few rock outcrops. The dominant trees are stunted ranging from 40 to 60 ft (12 to 18 m), but attain girths of 3-4 ft (91-121 cm). The average age of the trees in canopy layer is estimated to be 200 years, although occasional ancients with deep, cat-face scars up to 20 ft (6 m) high are substantially older. Reproduction appears somewhat more frequent here than in the rocky phase.

The understory flora is composed of *Lupinus elatus*, *L. excubitus* ssp. *austromotanus*, *Agoseris retrosa*, *Dichelostemma pulchella*, *Solidago californica*, *Bromus tectorum*, *Zauschneria californica latifolia*, *Eriogonum nudum*, *Phacelia curvipes*, *Gilia modocensis*, *Eriogonum hirtiflorum*, *Gayophytum diffusum parviflorum*, *Madia elegans*, *Calystegia malacophylla* ssp. *pedicelluta*, and *Erysimum capitatum*. These species may cover up to 35 percent of the understory.

In some areas along the ridge, young Jeffrey pines have colonized the south-facing chaparral. However, no older individuals occur there, suggesting that fire limits colonization southward. The ridgetop Jeffrey pine forest presents an effective barrier to crown fires sweeping up from the south slope, with its open understory and widely spaced trees.

(9) Montane Riparian Forest (Holland 61510, 63500, 61220)

Riparian associations at the Big Pine Mountain RNA are patchily distributed, ranging from the lowest elevation at the confluence of Big Pine Canyon and the Sisquoc River to small seep and spring-side patches at elevations of up to 6200 ft (1890 m). The character of these riparian areas differs depending upon elevation and characteristics of the moisture source. Three Holland (1986) riparian types occur within the RNA. However, because of their limited and sometimes overlapping extents, these are difficult to map effectively at the scale used in the ecological survey. Hence, all are mapped under the broad heading above. These include Montane Riparian Scrub (63500), White Alder Riparian Forest (61510), and Central Coast Live Oak Riparian Forest (61220).

(a) The best developed of these three types is the White Alder Riparian Forest. It is extensive along the flowing stretches of the Sisquoc River and Big Pine Canyon and also dominates at several springs in the vicinity of Upper Bear Camp. Frequently, the white alders in this association are large (up to 32 inches or 81 cm dbh and 100 ft or 31 m tall) and at times create an arching canopy over narrow rocky streambeds. California bay and bigleaf maple often associate with the alders, and incense-cedar occurs as clumps or isolated individuals along nearly the entire length of the Sisquoc River within the RNA.

Riparian understory vegetation is often lush and dominated by *Aralia californica*, *Pteridium aquilinum pubescens*, *Galium aparine*, *Urtica holosericea*, *Artemisia douglasiana*, *Rosa californica*, *Rubus leucodermis*, *Equisetum laevigatum*, *Aquilegia formosa*, *Satureja mimuloides*, *Mimulus cardinalis*, and *M. guttatus* with extensive

trailing and climbing vines of *Clematis lingusticifolia*. There are occasional seeps within this zone with large patches of *Lilium pardalinum*, and other moisture-loving species such as *Habenaria leucostachys*, *Stachys albens*, and *Carex nudata*.

The low, fairly constant volume of water in these streams and the long intervals between floods has allowed the dominant trees to become large and relatively old with a degree of structuring to the forest not usually seen along small montane creeks. It is difficult to conceive of any better example of white alder dominated riparian forest in the South Coast Ranges.

At the lower elevations along Sisquoc River, particularly in sunny areas with accumulations of recent alluvium, other riparian trees are often present, including Fremont cottonwood (*Populus fremontii*), and willows such as *Salix lasiandra* and *S. goodingii* var. *variabilis*. Near the lowest portion of the Sisquoc in the RNA these species often share dominance with white alder. Additional heliophilic riparian understory species such as *Brickellia californica* and *Datisca glomerata* occur in openings beneath the scattered canopy, a situation reminiscent of Holland's Southern Cottonwood - Willow Riparian Forest (61330), which probably occurs downstream from the RNA.

(b) At these lower elevations, the second of the three major riparian elements becomes apparent. This is the coast live oak riparian forest. Coast live oak forms scattered stands and occasionally more extensive gallery forest just upslope of the white alder zone below about 4200 ft (1280 m). Some of these live oaks are spectacularly large, up to 90 ft (27 m) tall and 3 ft (91 cm) dbh, with straight boles, very unlike typical *Quercus agrifolia* in woodlands along the coast.

Understory species of this forest include dominants such as poison oak, *Rhus trilobata*, *Amorpha californica*, and snowberry (*Symphoricarpos mollis*) with subordinate species such as *Eriogonum fasciculatum*, *Eriodictyon trichocalyx*, *Phacelia distans*, *Collinsia heterophylla*, and *Galium nuttallii*. These forests occur on natural levees 5-10 ft (1.5-3 m) above the level of the stream. At higher elevations along the Sisquoc River these levee forests of coast live oak are replaced by analogous vegetation dominated by canyon live oak and/or California bay.

(c) The third major riparian type in the RNA is montane riparian scrub. This occurs along the upper reaches of intermittent creeks in Big Pine Canyon as well as near the head of the Sisquoc River at Upper Bear Camp. This vegetation is dominated by scrubby willows, typically *Salix scouleriana* and *S. lasiolepis*. These large shrubs form an intermittent cover over a rich hydrophilic herbaceous layer. Herb species include *Horkelia elata*, *Potentilla glandulosa* ssp. *nevadensis*, *Lupinus polyphyllus*, *Mimulus guttatus*, *M. pilosus*, *Juncus mexicanus*, *J. macrophyllus*, *Carex subbracteata*, *C. fracta*, *Poa pratensis*, *Cystopteris fragilis*, *Heleocharis bella*, and *Thalictrum fendleri*.

Although not directly analogous, there are also intermittent, moist streamside areas with no willow overstory. These are particularly conspicuous on crumbly shale areas at the

upper reaches of Big Pine Canyon, often adjacent to Jeffrey pine or mixed conifer forest. One such area in the west-central portion of section 7 between 5700 and 5800 ft (1737 and 1768 m)(dubbed "Bear Meadow", because of the abundant bear sign), has a typical mixture of vernally hydrophilic annuals and geophytes, including: *Navarretia intertexta*, *Gayophytum humile*, *Allium amplectens*, *Allium lacunosum*, *Trifolium cyathiferum*, *T. microcephalum*, *Chorizanthe polygonoides*, *Mimulus pilosus*, *Gnaphalium palustre*, *Lotus purshianus*, *Lupinus luteolus*, and *Danthonia californica* var. *americana*. This flora is a unique mixture of low-elevation vernal pool, relatively xerophytic, and montane meadow species. Site conditions for these herbaceous stands resemble vernal pools in that they are relatively flat or gently sloping topography that lie along seasonally moist drainage ways or swales. Soils is derived from very fine-grained shale with relatively high clay content (high moisture holding capacity).

(10) Shale Barrens (no Holland equivalent)

This vegetation type is characteristic of the high-elevation shale outcrops in the upper drainages of Big Pine Canyon. Several of these outcrops occur between 5700 and 6500 ft (1737-1981 m). None is larger than about 10 acres (4 ha), and all are separated by mixed conifer forest, Jeffrey pine forest, montane chaparral, or sandstone outcrops. Parent material is highly fractured dark gray shale, which has little or no true soil component. The small, angular shale fragments range from pea size on the slopes to fine silt in hollows. Often there is a scattering of larger rocks on the surface. Vegetative cover is variable ranging from less than 1 percent to about 40 percent. The density-determining conditions are probably substrate moisture, aspect, and depth.

This harsh substrate supports a unique assemblage of plants, several of which occur nowhere else in the RNA. These include *Psoralea californica*, *Lomatium dasycarpum*, *Frasera neglecta*, *Allium monticola* var. *keckii*, *Allium burlewii*, *Phacelia imbricata* ssp. *patula*, *Phlox diffusa*, *Eriogonum wrightii* ssp. *subscaposum*, *Fritillaria pinetorum*, *Zauschneria californica* ssp. *latifolia*, *Chrysothamnus nausiosus*, *Astragalus lentiginosus* var. *idriensis*, *Crepis occidentalis* var. *pumila*, *Calochortus invenustus*, *Asclepias californica*, *Madia elegans*, *Mimulus johnstonii*, *Leptodactylon pungens* ssp. *pulchriflorum*, *Eriogonum nudum*, *Sitanion hystrix*, *Chaenactis santolinoides*, and *Eriophyllum confertiflorum*. Although vegetation cover is typically limited to a very sparse cover of herbaceous species, in more sheltered areas with higher soil moisture dense aggregations of *Madia elegans*, *Eriophyllum confertiflorum* and other species may be present.

The drainage ways in these shale barrens may have a trickle of water or at least remain moist into early summer. These areas contain such species as *Lupinus luteolus*, *Allium amplectens*, *Navarretia intertexta* and other species mentioned for this seasonlly moist habitat in the montane riparian discussion.

(11) Valley and Foothill Grassland (Holland 42000)

Open grass- and herb-dominated vegetation occurs in a small glade at Upper Bear Camp, in several small openings in alluvium along the Sisquoc River, and at the site called "Bear Meadow" along the upper reaches of Big Pine Canyon. Each of these sites has a different assemblage of plants, but all have physical and compositional similarities.

The Upper Bear Camp glade is dominated by *Muhlenbergia rigens* with *Artemisia dracunculus*, *Linanthus androsaceus*, *Calochortus venustus*, *Arabis glabra*, *Agoseris retrorsa*, and *Elymus glaucus*. Other moisture-loving plants such as *Equisetum arvense*, *Muhlenbergia richardsonis*, *Juncus mexicanus*, and *Carex subbracteata* are present near the intermittent drainageway at the edge of the glade

Further downstream along the Sisquoc River, in small openings on alluvial benches bordered by chaparral, canyon live oak, and coast live oak forest are other herbaceous and grass-dominated sites (too small to indicate on vegetation map). These sites have such species as *Bromus diandrus*, *B. rubrum*, *Linanthus androsaceus* ssp. *micranthus*, *L. a.* ssp. *luteus*, *Camissonia campestris*, *Chorizanthe thurberi*, *Clarkia purpurea* ssp. *quadrivunera*, *Clarkia unguiculata*, *Cryptantha clevelandii*, *Eriogonum gracile* var. *polygonoides*, *Lupinus bicolor*, *Allophyllum gilioides*, *Madia gracilis*, and *Penstemon centranthifolius*.

A different type of grassland dominated by annual grasses and herbs occurs as small patches at the upper elevations adjacent to the riparian scrub in "Bear Meadow." *Hordeum leporinum*, *Bromus tectorum*, *Vulpia megalura*, *Vulpia reflexa*, *Elymus caput-medusae*, *Caucalis microcarpa*, *Lotus purshianus*, *Madia minima*, *Linanthus ciliatus*, and *Trifolium microcephalum* are the principal members of this association.

2. Fauna

Appendix D1 lists all species of vertebrates known form the BPMRNA. Including some 80 species noted by Todd Keeler-Wolf (June 1989) as well as 57 additional species noted during previous survey work by Janet Hamber and associates at the Santa Barbara Museum of Natural History. Rare species and species of special concern were previously mentioned.

A bird census was conducted in the mixed conifer forest at Upper Bear Camp on the morning of June 12, 1989. This study was begun at 7:43 A.M. and lasted 20 minutes. It involved tallying all individuals heard or seen in a strip approximately 700 by 100 m (7 ha). Fifty-four individuals of 21 species were tallied. Appendix D2 displays the totals for the census. Some species not detected from this survey were also common in the mixed conifer forests of the upper slopes. These included pygmy nuthatch, northern flicker (*Colaptes auratus*), Cassin's finch, and band-tailed pigeon (*Columba fasciata*).

In general, the faunal relationships of the upper elevations of the RNA have more in common with the low-elevation chaparral and oak woodland formations than they do with the montane coniferous forest. Species typical of southern California chaparral, such as wrentit

(*Chamaea fasciata*), blue-gray gnatcatcher (*Polioptila caerulea*), plain titmouse (*Parus inornatus*), rufous-sided towhee (*Pipilo erythrophthalmus*), black-chinned sparrow (*Spizella atrogularis*), and others, are common and conspicuous up to the crest of the mountains at elevations of more than 6500 ft (1981 m). This trend is true for mammals as well, with no strictly montane species such as montane shrew (*Sorex* sp.), lodgepole chipmunk (*Tamias speciosus*), golden-mantled ground squirrel or other species known from certain other montane areas of Southern California.

3. Geology

The high San Rafael Mountains are composed of a thick assemblage of sandstone and some interbeded clays, shales and conglomerates of Cretaceous and Eocene ages. The sedimentary sequence which dominates the BPMRNA is thousands of feet thick. The San Rafael Mountains were elevated somewhat like a wedge, mainly between two thrust faults that dip under it from each side and the thick sedimentary sequence of this uplifted block is severely folded and faulted. The Sur-Nacimento and the Big Pine faults (Norris and Webb 1976) intersect at oblique angles approximately 2 miles (3.2 km) east of the RNA (Jennings *et al.* 1977). The majority of the RNA is underlain by Upper Cretaceous rocks, principally sandstone, with notable shale outcrops underlying the shale barrens of upper Big Pine Canyon. The summit of Big Pine Mountain and the eastern third of the RNA are underlain by Eocene sandstone with minor shale and conglomerates. This Ecocene sandstone appears locally less deformed and uplifted with fewer scarps and large outcrops than the Upper Cretaceous rocks of the Big Pine Canyon area.

4. Soils (Map 4)

The soils map of the area (USDA Forest Service 1977) classifies the majority of the area as one mapping unit. It is known as the Livermore - Agua Dulce - Hambright Families Association, 30-80 percent slopes. The three components of the mapping unit make up 40, 20 and 20 percent, respectively, of the mapping unit. Inclusions of the following soil families make up an additional 20 percent of the mapping unit: Rincon, Inks, Lopez, Lodo, and Chular. All three of the principal families in this unit occupy similar landscape positions and slope steepness. Following is a brief description of the three families:

(1) The Livermore family is derived primarily from sandstone and has a surface layer of from 0 to 3 inches (0-8 cm) which is brown, gravelly sandy clay loam and in neutral, a subsoil from 3 to 17 inches (8-43 cm) deep which is yellowish brown, very gravelly sandy clay loam about 50 percent pebbles and 3 percent cobbles with 7.5 pH; and a substratum from 17 to 60 inches (43-152 cm) which is yellowish brown, extremely gravelly sandy clay loam 60 percent pebbles and 2 percent cobbles and a pH of 7.5.

(2) The Agua Dulce family has a surface layer from 0 to 38 inches (0 to 97 cm) deep that is light brownish gray, gravelly loam with 15 percent pebbles and 5 percent cobbles and a pH of 7.4; a subsoil from 38 to 65 inches (97 to 165 cm) that is light yellowish brown, very

cobbly clay loam, 35 percent pebbles and 20 percent cobbles; and a substratum reached at 65 inches (165 cm) that is fractured hard shale.

(3) The Hambright family is the shallowest of the three main soils with a surface layer from 0 to 11 inches (0-28 cm) that is grayish brown, extremely cobbly loam, 30 percent pebbles and 40 percent cobbles with a pH of 6.8. The Hambright family has no subsoil and the substratum is at 11 inches (28 cm) and is composed of fractured hard shale.

The other soil mapping unit is the Millsholm - Exchequer -Stonyford Families Association, 30-75 percent slopes. This unit is characteristic of the extremely steep areas of the lower Big Pine Canyon including the cliff faces. It is composed of 35 percent Millsholm, 20 percent Exchequer and 20 percent Stonyford components. All three of these soils are shallow with Millsholm reaching hard fractured siltstone in 14 inches (36 cm), and the other two families reaching hard sandstone in 12 inches (30 cm). The Stonyford is the most acidic with the surface layer averaging pH 6.0. The pH of surface layers of the other family components are: Exchequer, 6.5; and Millsholm 7.1.

5. Lands

The BPMRNA is under the management of Los Padres National Forest. It is part of the San Rafael and Dick Smith Wildernesses. The Sisquoc River is a designated Wild and Scenic River its corridor extends into the northeast boundary of the RNA.

6. Cultural values

The Sisquoc River drainage was the former home of the Interior Chumash people (note: the Cuyama Region in reference Grant 1978a). Several village sites are known from the Sisquoc downstream from the RNA where there are numerous rock painting sites. The Chumash of the Cuyama Region apparently acquired the rock painting tradition from the Yokuts and developed it to its highest point (some well-known examples are at Painted Rock on the Carrizo Plain and Painted Cave near Santa Barbara). The rock paintings of the Chumash are the most interesting and spectacular in the United States (Grant 1978b). The extraordinarily fanciful character of many of the paintings suggests that they were painted by persons under the influence of the powerful hallucinogen toloache (*Datura* sp.) (Grant 1978a).

The locality of Mission Pines (9 trail miles, 14.5 km, west of the junction of the Mission Pines Trail and the Big Pine-Buckhorn Road) has been reported to be the location where Chumash cut timbers for the Santa Barbara Mission (Smith 1976).

7. Fire History

Aside from the one large fire resulting in the approximately 50-year-old (note: in 1991 when the ecological survey was conducted) stand of Coulter pine, there is no evidence of recent

widespread fires. Evidence of a small fire (note: in 1991) near the Big Pine Camp was noted; however this apparently did not spread into the crowns of trees or cover large areas of brush. The open nature of the the mixed conifer forests suggests that they are well protected from damaging crown fires. This, however, is probably not true for the alluvial flat stand at Upper Bear Camp.

I. IMPACTS AND POSSIBLE CONFLICTS

The isolated wilderness location of the RNA precludes most human impacts and conflicts. The Road 9N11 has well-controlled access, being gated in several places on either end. It is lightly used by Forest Service personnel and is otherwise accessible only to researchers and others on official business. The road is a narrow, one-lane dirt track with little erosion. No logging or other impacts are associated with the road to the RNA. The area has a rain gage about halfway between the junction of Mission Pines Trail and the Big Pine-Buckhorn Road and West Big Pine Lookout site. This is the only other structure seen in the RNA.

1. Mineral Resources

The RNA is in congressionlly designated wilderness and mineral extraction is not allowed.

2. Grazing

There are no grazing allotments affecting the RNA.

3. Timber

The RNA is in congressionally designated wilderness; timber extraction is not permitted.

4. Watershed Values

Although low in volume, the Sisquoc River and Big Pine Canyon both contain numerous pools and short flowing stretches which contain permanent water. The intermittent stream courses, springs and seeps in the RNA support a variety of organisms from large, apparently native populations of rainbow trout to aquatic insects. Water ouzels were seen around waterfalls on Big Pine Canyon and the upper Sisquoc and may represent a small isolated breeding population (Janet Hamber 1991, personal communication).

Establishing BPMRNA will further protect watershed values and associated aquatic ecosystem of the area.

5. Recreation Values

As observed by Todd Keeler-Wolf in 1989, recreational use of the Big Pine-Buckhorn Road, the Alamar Trail, and the Mission Pines Trail is light. Entries in the registers atop West Big Pine and Big Pine mountains indicate that most visitors to the area come in the winter and spring. Mountain bikers are the most common visitors to the summit area, followed by Sierra Club hikers and condor researchers. Only one entry by a hunting party was noted.

Based on the scarcity of litter and the level of trail wear, recreational impact is light even at established trails and campsites. The two campsites at Upper Bear Camp had been lightly used within the past year before Keeler-Wolf's 1989 field work with the upper site near the springs receiving most of the use. The campground known as Big Pine Camp had clearly not been used for several years (despite the 4-5 improved sites concrete fireplaces, and covered spring), perhaps as a result of the lack of water at the spring. Improvements at the Upper Bear and Big Pine campsites were made mostly in the late 1930s (dates on cement fireplaces, etc.).

Recreational use of the RNA is not encouraged; hunting is not allowed in the RNA. BPMRNA establishment will not significantly impact recreational uses of the area.

6. Wildlife and Plant Values

Establishment of BPMRNA will protect and preserve the wildlife and plant values of the area.

7. Special Management Area Values

The BPMRNA lies entirely within the San Rafael and Dick Smith wildernesses. Establishing BPMRNA does conflict with the Wilderness status. However, as mentioned above, current recreational use of the area is very light and does not conflict with the values and objectives of the RNA. As a result, impact of RNA establishment on recreational use is minimal. The corridor of the Sisquoc Wild and Scenic River extends into the RNA and follows the northeast boundary. There is, however, no use conflicts between these two designations.

8. Transportation Plans

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

9. Research Values

RNA establishement will ensure the scientific values of the area. However, since only non-destructive research is allowed in RNAs, the establishment of BPMRNA may have some

impact on the research activities in the area. This impact will be minimal since researchers are also want to protect the scientific values of the area.

J. MANAGEMENT PRESCRIPTION

The management direction for BPMRNA is contained in the Forest Service Manual 4063 and Los Padres LRMP. The Los Padres LRMP calls for protection and management of associated amenity values, including unique plants, animal, and aquatic systems, to be consistent with the objectives of establishing BPMRNA.

1) RNA Management Strategy

Los Padres National Forest will prepare a management plan for the BPMRNA in consultation with the Pacific Southwest Research Station. The plan will specify management prescriptions, practices, uses and monitoring conducive to the objectives for establishment of the BPMRNA.

K. ADMINISTRATION RECORDS AND PROTECTION

The official responsibility for administration and protection of the RNA is with the District Ranger, Santa Lucia Ranger District, (1616 North Carlotti Dr., Santa Maria, CA 93454).

Because the BPMRNA is within a congressionally-designated wilderness, the authority to approve management strategy and to oversee and coordinated approved research rests with the Regional Forester of Region 5 (1323 Club Drive, Vallejo, CA 94592) (Forest Service Manual 2323.04c, 4063.04b). In exercising this authority, the Regional Forester shall coordinate plan for research with the Director of Pacific Southwest Research Station (800 Buchanan Street, Albany, Ca 94710). The Research Station Director is resonsible for maintaining research data files.

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, Foress, and scientists.

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APPENDICES

Appendix A: Information excerpted from Los Padres National Forest Land and Resource Management Plan (USDA Forest Service, Los Padres National Forest 1988a)

Appendix B: Information excerpted from the Final Environmental Impact Statement, Los Padres National Forest Land and Resource Management Plan (USDA Forest Service, Los Padres National Forest 1988b)

Appendix C: Vascular plants of Big Pine Mountain RNA

Appendix D: Vertebrates of Big Pine Mountain RNA

D1: Vertebrates known form the Big Pine Mountain RNA

D2: Results of a 20 minute census for birds conducted on a 700 x 100 m strip of mixed conifer forest at Upper Bear Camp, Big Pine Mountain RNA.

Appendix E: Summaries of vegetation survey data

Appendix A: Information excerpted from the Los Padres National Forest Land and Resource Management Plan (USDA Forest Service, Los Padres National Forest 1988a)

1988

Los Padres National Forest
Land and Resource Management Plan

Monterey, San Luis Obispo, Santa Barbara, Kern, Ventura and Los Angeles Counties, California

Responsible Agency:

USDA, Forest Service
6144 Calle Real
Goleta, CA 93117-2053

Responsible Official:

Paul F. Barker, Regional Forester
Pacific Southwest Region
USDA, Forest Service
630 Sansome Street
San Francisco, CA 94111

For Further Information Contact:

Forest Supervisor
Los Padres National Forest
6144 Calle Real
Goleta, CA 93117-2053
Telephone: (805) 683-6711

accounted for 57% of all general forest use; motorcycle use, general forest camping, swimming or water play, and fishing accounted for another 26%.

Demand for general forest recreation is expected to increase 101% by the end of the planning period. The greatest increases are anticipated in water and snow-related activities. Demand for cross-country skiing and snow play is expected to increase dramatically. Opportunities exist for expanding winter sports areas, primarily on the Mt. Pinos Ranger District, by constructing facilities, trails, parking, and by providing law enforcement and visitor information services.

Demand for land-based activities is expected to rise 87%. To help meet this demand, the Forest has the opportunity to improve the trail system by:

- increasing emphasis and funding for annual maintenance needs.
- constructing loop and connecting trails to enhance and facilitate use of existing opportunities.
- providing trail links with developed sites and facilities owned by other agencies or private concerns.
- increasing trail opportunities in areas adjacent to certain populations.
- providing additional trailhead facilities.
- emphasize separating potentially conflicting trail uses. ie. hikers, ORV, mountain bicycles, horses.

The problem of administration of Forest restrictions on recreation use can be alleviated somewhat by a higher level of general forest recreation management, but can never be eliminated.

3.4.10 Wilderness

Los Padres National Forest has 5 designated Wilderness Areas comprising 412,912 aggregate acres. These include the Ventana on the Monterey Ranger District; the Santa Lucia on the Santa Lucia Ranger District; Machesna Mountain on the Santa Lucia District; the San Rafael on both the Santa Lucia and Santa Barbara Ranger Districts; and the Dick Smith on the Santa Barbara and Mt. Pinos Ranger Districts.

Recreation use is the most obvious and readily measured demand for Wilderness although other types of demand are recognized (e.g. Wilderness for the sake of Wilderness). The Forest can provide an estimated 309,000 RVDs of Wilderness recreation. Assuming a 2% annual growth rate, existing capacity should accommodate future recreational use for the next five decades. Non-recreational demand for Wilderness, although unquantified, should also increase.

Wilderness Areas are managed to preserve naturalness, solitude, and other qualities of Wilderness. Current problems include locally heavy use, inadequate access, wildfire danger from fuels buildup, seasonal fire closures, and restrictions on camping and campfires. The current trail system may not accommodate future demand. The opportunity therefore exists to improve public access, decrease the wildfire danger and closures, and to enhance the trails system to meet demand for use.

3.4.11 Special Emphasis Areas and Areas of Special Designation

Special Emphasis Areas and Areas of Special Designation may include Biosphere Reserves, districts listed in the National Register of Historic Places, Wild and Scenic Rivers, Research Natural Areas, National Natural Landmarks, Wildlife Sanctuaries, and Geological and Botanical Areas.

The Forest's current inventory of such areas includes the Eastern Sierra Madre Ridge Archeological District, Sisquoc and Sespe Condor Sanctuaries, and the Cuesta Ridge Botanical Area and the Cone Peak Gradient Research Natural Area.

Several other Special Emphasis Areas and Areas of Special Designation are currently under consideration by the Forest. These areas include: 1 Biosphere Reserve; 4 Wild and Scenic River Segments; 7 Research Natural Areas; 1 National Natural Landmark; 5 Botanical Areas; and 1 Geologic Area.

Interim management direction for Special Emphasis Areas focuses on maintaining the natural values that distinguish each area. They will be managed to protect these values until they are either designated or dropped from further consideration. The Forest has the opportunity to expand special interest acreage and diversity to meet a variety of demands.

3.4.12 Cultural Resources

The objectives for Forest Service cultural resources management are found in FSM 2361.02 and are reproduced in the cultural resources element of the AMS. The focus of these objectives is development and implementation of a long-term program to inventory, evaluate, and protect and enhance cultural resources on National Forest System lands. Forest-wide standards and guidelines incorporate legal requirements for cultural resources management, focus on active management of the Forest's curated and archived collections, and provide for additional protection of cultural properties through maintaining confidentiality of site locations.

The Forest's cultural resources include both properties and documents. These have been inventoried and are continually updated. The inventory includes documentation of; properties, including districts, sites, structures, buildings, and other improvements; artifacts curated in collections (both in private and National Forest ownership); and docu-

253,886 acres for Wilderness (portion of Garcia [107], portion of La Brea [117], portion of Matilija [129], and a portion of Sespe-Frazier [002] Roadless Areas). Addition of these Roadless Areas to Los Padres Wilderness Areas will create 666,798 net acres of Wilderness and will further expand capability to meet demand for recreational and non-recreational uses. Thirty-eight percent of the Forest will be designated Wilderness.

Wilderness areas will be managed according to management prescriptions designed to preserve their Wilderness character. Prescribed burning will assist in the maintenance and enhancement of the Wilderness character and will reduce dangerous fuel loading. Better access and more evenly distributed use will be achieved through construction of an estimated 232 miles of trail.

4.2.11 Special Areas

The Plan provides for the management of existing and proposed Special Areas. Table 4.2-2 lists the areas.

Table 4.2-2
Special Areas

Category and Name	Size	Location and Significance
Research Natural Areas		
Cone Peak Gradient (Established 1987)	2955 acres	West slope of Cone Peak, Monterey District. Unique ecological diversity, mixed evergreen forest with diverse plant communities associated with steep elevational gradient.
American Canyon	1500 acres	On south slope of Pine Mountain in La Panza Range, Santa Lucia District. Coulter pine and chaparral.
Wagon Caves	150 acres	Along San Antonio River at south base of Junipero Serra Peak, Monterey District. Oak-annual grass savanna.
Black Butte	540 acres	On north slope of Cuesta Ridge near Mount Lowe, Santa Lucia District. Scattered groves of knobcone pine and associated chaparral.
San Emigdio Mesa	1200 acres	Southwest slope of Cerro Noroeste, Mount Pinos District. Pinyon-juniper and associated brush species.
Ventana Cones	1400 acres	Vicinity of Ventana Double Cone and and Ventana Cone, Monterey District. Santa Lucia fir/canyon live oak forest with mixed evergreen forest in association.
Southern California	undet	Location to be selected from either of two candidate areas with mixed conifer forest and chaparral: (1) San Rafael Mountain (1300 acres) (2) Big Pine Mountain (1000 acres)
Botanical Special Interest Areas (All acreages approximate)		
Cuesta Ridge (Established 1969)	1330 acres	San Luis Obispo Co., Santa Lucia District; Sargent cypress, Coulter pine and 12% of Forest's sensitive plants.
Southern Redwood	10 acres	Along Soda Creek south of Silver Peak, Monterey District. Southernmost natural stand of coast redwood.

Management Area 66

Area Description:

Management Area 66 consists of six separate land units comprising 7,745 total acres. Two canditate areas totaling 2300 acres are also identified. These units are situated as follows:

66a, "Cone Peak RNA," three miles east of Lopez Point between Cone Peak and Lime kiln Creek (Monterey RD) within the Highway 1 scenic corridor; (2955 acres)

66b, "Wagon Caves RNA," nine miles northeast of Lopez Point on lower Rattlesnake Creek (Monterey RD); (150 ac.)

66c, "Black Butte RNA," three miles northeast of San Luis Obispo in the vicinity of Mt. Lowe (Santa Lucia RD); (540 ac)

66d, "American Canyon RNA," nine miles east of Santa Margarita Lake at Pine Mountain (Santa Lucia RD); (1500 acres)

66e "San Emigdio Mesa RNA," fifteen miles west of Frazier Park near Mount Abel (Mount Pinos RD); (1200 acres)

66f, "Ventana Cone RNO," seven miles northwest of Big Sur (Monterey RD). (1400 acres)

66g, "Candidate San Rafael Mountain RNA," twelve miles northeast of Lake Cachuma (Santa Lucia RD); (1300 acres)

66h, "Candidate Big Pine Mountain," twelve miles north of Gibralter Reservoir (Santa Barbara RD); (1000 acres)

American Canyon RNA is within critical habitat of the California Condor.

Management Emphasis: Protection and management of candidate and proposed Research Natural Areas

The area is managed for non-destructive, non-manipulative research and study. Cultural resources management emphasizes complete inventory and evaluation of properties with a high priority placed on enhancement through research and study. Other uses are secondary to scientific use. RNA's may be located within designated Wilderness. Landscapes will essentially possess the visual characteristics of a natural condition.

Management Guidelines	Management Standards
General/mgmt. practices. Evaluate suitability of Candidate Research Natural Areas Prepare an Establishment Report and Management Plan by 1990.	
Cultural Resources/ 1, 2, 4 Management of cultural resources emphasizes complete inventory and evaluation with a high priority placed on enhancement through research and study.	

Recreation/ 33, 44, 46
Recreational use should not be encouraged. Where it is not practical to eliminate recreational use, only primitive or semi-primitive non-motorized use will be permitted.

New recreational improvements are not permitted.

Trails to and through RNA's are permitted if they promote or do not detract from scientific use.

Trails are maintained at level 1 or 2.

Visual Resources/ 5a
Maintain a natural landscape.

Summary Visual Quality Objectives

Class	% Acres
Preservation	100
Minimum VQI =	69

Wilderness Management/ 9
Where an RNA is located within an established Wilderness, Wilderness implementation direction applies.

Fish and Wildlife/ 10, 11
Wildlife improvements may be permitted if needed for sensitive or Threatened and Endangered species, or if they would not significantly alter the botanical community for which the RNA was established.

Any projects which may destroy or modify critical condor habitat shall undergo consultation with U.S. Fish and Wildlife Service prior to approval.

Range Resource/ 14, 15
Grazing opportunities will not be expanded and may be eliminated as identified in the RNA management plan.

Timber/ 19
Neither timber harvest nor reforestation are permitted.

Special Uses/ 25
No special use permits will be granted unless they aid in scientific study.

Withdrawals/ 26
RNA's will be recommended for withdrawal from mineral entry.

A "no surface occupancy" stipulation will be included in any recommendation for mineral leases.

Transportation/
Roads will not be constructed in RNA's.

Fire/ 34, 35, 36, 37, 38
Suppression methods will be selected to minimize impacting RNA values.

Prescribed burning is permitted only to perpetuate ecosystems.

Appendix B: Information excerpted from the Final Environmental Impact Statement, Los Padres National Forest Land and Resource Management Plan (USDA Forest Service, Los Padres National Forest 1988b)

1988

Los Padres National Forest
Final Environmental Impact Statement
Land and Resource Management Plan

Monterey, San Luis Obispo, Santa Barbara, Kern, Ventura and Los Angeles Counties, California

Type of Action:	Administrative
Responsible Federal Agency:	USDA, Forest Service
Responsible Official:	Paul F. Barker, Regional Forester Pacific Southwest Region USDA, Forest Service 630 Sansome Street San Francisco, California 94111
For Further Information Contact:	Forest Supervisor Los Padres National Forest 6144 Calle Real Goleta, California 93117-2053 Telephone (805) 683-6711

Abstract: This Environmental Impact Statement describes the Forest Plan and eight alternatives for managing the land and resources of Los Padres National Forest. The land area involved is 1,753,023 acres. The alternatives provide levels of outputs, goods and services. The environmental consequences for the Forest Plan and alternatives are displayed.

This document and its supportive analysis provides specific disclosure of estimated environmental and economic effects of alternative management strategies for a period of 10 to 15 years. Estimates beyond this period are displayed for decision-makers and public information only.

needed in all Wilderness areas within the Forest to reduce resource damage both within and outside Wilderness.

3.12 Special Areas

3.12.1 Introduction

Special areas include the following categories:

- Wild and Scenic Rivers.
- Recommended and Candidate Research Natural Areas (RNAs).
- Candidate Botanical Special Interest Areas.
- Candidate Geologic Special Interest Areas.
- Sierra Madre Cultural Resource Areas.
- National Natural Landmarks.
- Coastal Zones.
- Biosphere Reserves.

The following discussion briefly outlines the significance of and opportunities related to these areas.

3.12.2 Wild and Scenic Rivers

Four rivers within the Forest were studied to determine their suitability for wild or scenic river status. The three possible classifications in the study were Wild, Scenic, and Recreational. To be eligible for any of these classifications rivers must meet criteria described in the Wild and Scenic River Act (PL 90-542) . Under the Act, river corridors are evaluated on the basis of naturalness and human activity. The most natural rivers are classified as Wild, those somewhat less natural as Scenic, and those that have undergone some development as Recreational.

An eligible river must be free flowing and possess one or more "outstandingly remarkable" resource values (e.g., special geological, ecological, recreational,cultural, or scenic features). The study rivers and segments within Los Padres National Forest are described in detail in Appendix E. These rivers are most significant when considered in the context of their location in Southern California. They are not necessarily comparable to other rivers in the State. Eligible rivers are divided into segments; the width of a segment extends one quarter mile inland from each bank. The Big Sur and Sisquoc Rivers, and Sespe and Piru Creeks were studied.

The Big Sur River study area is 14.4 miles in length. One segment runs from the confluence of the North and South Forks of the Big Sur downstream to the Forest boundary adjacent to Pfeiffer-Big Sur State Park. It is adjacent to the eastern boundary of Pfeiffer-Big Sur State Park and accessible from the heavily used Big Sur coast and Highway 1. The other segment is composed of the two main upper tributaries of the river. Both segments are entirely on National Forest lands within the Ventana Wilderness and accessed by trail.

The Sisquoc River study area is also divided into two segments. Segment 1 is about 31 miles long and is on National Forest lands within the San Rafael Wilderness. Segment 2 is about 2 miles long and extends from the San Rafael Wilderness boundary downstream to the National Forest boundary; a majority of this segment is in private ownership. The river is accessible by foot and equestrian trail only; there is no public access across the private lands.

Fifty-one miles of Sespe Creek were studied. About 42 miles are National Forest lands, and 9 miles are in private ownership. Approximately 15 miles of the creek are accessible by vehicle from Highway 33. The remaining sections have trail access only. Segment 1 extends 8 miles, from the source downstream to the confluence with Chorro Grande Canyon; segment 2 runs 17 miles from Chorro Grande Canyon to the confluence with Bear Canyon; and segment 3 extends 26 miles from Bear Canyon to Devil's Gate.

Fourteen miles of Piru Creek, beginning at Frenchman's Flat and ending downstream at Lake Piru, were studied. The upper 12 miles are within the National Forest while about 2 miles of the lower portion are in private ownership. A road paralleling the lower 2.5 miles of the creek provides access to Blue Point Campground and private ranches. The remainder contains 4 miles of trails. The rivers are further described in Appendix E.

Any recommendation for a wild and scenic river designation is a preliminary administrative recommendation. Such recommendations will receive further review and possible modification by the Chief of the Forest Service, Secretary of Agriculture, and the President of the United States. Final decisions have been reserved by the Congress to designate rivers to the National Wild and Scenic Rivers System.

3.12.3 Recommended and Candidate Research Natural Areas

These areas are part of a nationwide network set aside as examples of typical and distinctive natural ecosystems and reserved for scientific and educational use. RNAs preserve genetic diversity, provide habitat for threatened and endangered species, and are used to compare the effect of human activities on similar ecosystems. The recommended and candidate RNAs identified in Table 3.12-1 represent significant Forest botanical types. Additional information describing each area is found in Appendix I.

Table 3.12-1
Recommended Research Natural Areas

Name	Botanical Element	Size and Location	Importance
Black Butte	knobcome pine forest	540 acres situated on the steep generally northwest facing slopes of Cuesta Ridge in the Santa Lucia Wilderness.	Area contains scattered and continuous stands of knobcone pine inter-mixed with chaparral
Wagon Caves	valley oak grassland	150 acres at the boundary of the Forest and Hunter-Liggett Military Reservation	Area contains exceptionally good stand of valley oak grassland, a type which has disappeared or is little protected elsewhere.
San Emigdio Mesa	pinyon woodland	Covers 1200 acres of a large flat alluvial fan on the Mt.Pinos Ranger District.	Fan is dominated by single-leaf pinyon and dwarf oak.
American Canyon	Coulter pine woodland	1500 acre area in Machesna Wilderness, Santa Lucia Ranger District.	Coulter pine occurs in abundance as generally well dispersed even-aged stands growing in chamise chaparral.
Ventana Cones	Santa Lucia fir	1400 acre area in the rugged Ventana Wilderness on the Monterey Ranger District.	Area contains some of the best stands of the rare Santa Lucia fir growing on steep rocky outcrops and slopes.

Note: The Cone Peak Gradient RNA which was listed as a recommended RNA in the DEIS has been formally designated as an RNA.

San Rafael Mountain	mixed conifer forest	1300 acre area in San Rafael Wilderness on the Santa Lucia Ranger District.	Area contains mixed conifer forest with good stands of bigcone douglas fir and Coulter pine. Montane chaparral covers a large portion of the area.
Big Pine Mountain	mixed conifer forest	1000 acre area in the San Rafael Wilderness.	Similar to San Rafael Mountain area except it also contains extensive stands of canyon live oak woodland.

3.12.4 Candidate Botanical Special Interest Areas

Botanical Areas do not meet all requirements for RNA designation, but do contain significant plants or plant communities. In addition, these areas also may have important recreation values. The Cuesta Ridge Botanical Area was classified in 1969. The five additional areas considered are listed in Table 3.12-2 and further described in Appendix I.

3.12.5 Candidate Geologic Special Interest Area

Geologic Areas have outstanding or unique geologic features. The Quatal Canyon Geologic Area consists of 2540 acres in the Cuyama Badlands. This area has unique, eroded terrain and vertebrate remains of the Miocene Epoch (12 to 16 million years ago). A more detailed description of this area may be found in Appendix I.

Although the Forest has other unique geologic features including the Sierra Blanco limestone and the Sespe red-bed formations, a Forest-wide inventory of unique geologic features has not been completed. Local organizations, State universities, and colleges do, however, conduct on-going inventory programs within the Forest.

3.12.6 Sierra Madre Cultural Resource Area

The Sierra Madre Special Interest Area includes about 5,700 acres within the Sierra Madre Mountains of the Mt. Pinos Ranger District. The majority of the area is within the Eastern Sierra Madre Ridge National Register District (Section 3.13.1); also included are adjacent areas of known cultural value. Management emphasizes protection and research related to rock art sites and other cultural properties.

3.12.7 National Natural Landmarks

The National Natural Landmark (NNL) Program is administered by the National Park Service under the Historic Sites Act of 1935. The program is intended to preserve and enhance outstanding examples of ecological or geological character, and encourages scientific, educational, and cultural use.

Two areas within the Forest, Cone Peak-Limekiln Creek and Quatal Canyon Geologic Area, have been proposed for designation as NNLs. The Secretary of the Department of the Interior approves such areas for listing on the National Registry of Natural Landmarks. The listing of National Natural Landmark

Table 4.12-1
Allocation Of Special Areas

Alternative **Area**	I	II	III	IV	V	VI	VII	VIII
Wild and Scenic Rivers								
Big Sur 1	W	W	W	W	W	W	W	
Big Sur 2	W							
Sisquoc 1	W	W	W	W	W	W	W	
Sisquoc 2	L							
Sespe 1								
Sespe 2			S		S	S		
Sespe 3	W		W	W	W	W	W	
Piru								
RNAs								
American Canyon	X		X	X	X	X	X	X
San Emigdio Mesa	X		X		X	X	X	
Wagon Caves	X		X		X	X	X	
Cone Peak Gradient(Existing)	X	X	X	X	X	X	X	X
Black Butte /1	X		X	X	X	X	X	X
Ventana Cones	X		X	X	X	X	X	X
San Rafael Mtn.	P		P	P	P	P	P	P
Big Pine Mtn.	P		P	P	P	P	P	P
Special Interest Areas								
Botanical Areas								
Alder Creek	X	X	X	X	X	X	X	X
Lion Den Spring	X	X	X	X	X	X	X	X
Mt. Pinos Summit	X		X	X		X		
Southern Redwood	X		X	X	X	X		
Dry Lakes Ridge	X					X		
Cuesta (Existing)	X	X	X	X	X	X	X	X
Geologic Area								
Quatal Canyon	X					X		
Other Special Areas								
Sierra Madre Cultural Resource Area	X		X		X	X		
National Natural Landmarks								
Cone Peak-Limekiln Creek	X	X	X	X	X	X	X	X
Quatal Canyon	X	X	X	X	X	X	X	X
Biosphere Reserve	X	X	X	X	X	X	X	X

KEY:
W = Recommended Wild River
S = Recommended Scenic River
X = Recommended
P = RNA study area (no recommendation)
[Blanks] = Not Recommended
L = Portion recommended

/1 was called Water Canyon in the DEIS.

4.12 Special Areas

4.12.1 Introduction

Recommendations for special emphasis areas are based on compatability with the theme of each alternative. The following types of special areas were identified and considered under each alternative.

- Wild and Scenic Rivers
- Research Natural Areas (RNAs)
- Botanical Special Interest Areas
- Geological Special Interest Areas
- National Natural Landmarks
- Cultural Resources Areas
- Coastal Zone.

Four assumptions important to this discussion are that:

- the existing Biosphere Reserve within the Forest is not discussed with the exception of the portion that overlaps with the Cone Peak Gradient RNA.
- no recommendation for the mixed conifer forest RNAs will be made until additional studies are completed.
- the Cone Peak-Limekiln Creek and Quatal Canyon National Natural Landmarks are designated in every alternative and since they have no impact on the area's management activities are not discussed.
- Management of the Forest within the coastal zone will be consistent to the maximum extent practicable with the State's management program for the coastal zone.

The major factor affecting the coastal zone is the withdrawal of the area from mineral exploration and development. For the remaining special areas only management activities consistent with the qualities for which the area was designated are permitted. As a consequence, the activity with the greatest impact is designation itself.

4.12.1.1 Mineral Withdrawal

Withdrawal of the coastal zone from mineral activities would protect the area's unique scenic and coastal values. Varying degrees of withdrawals were considered : no withdrawal; withdrawal of the lands between the ocean and Highway 1 from all mineral entry; withdrawal of the entire coastal zone from mineral leasing.

4.12.1.2 Designation

Wild and Scenic rivers are managed to protect and, if possible, improve the values for which the river was designated; other uses must be consistent with this purpose. If a river is not designated, these values could be degraded.

RNAs are dedicated to research and education, and exclude other management activities. Designation as an RNA is more constrained than Wilderness management . Management activities are permitted in Botanical and Geologic Special Interest Areas as long as they do not adversely impact the special values of the area. Recreation is generally a compatible use. Designation of a Biosphere Reserve does not usually affect an area's management.

Management activities are permitted in Cultural Resources Areas as long as they are compatible with cultural resource values. Activities which substantially increase use or create adverse surface impacts are not appropriate.

Designation of an area as a National Natural Landmark recognizes its uniqueness but has no effect on the management activities which may occur.

4.12.2 Consequences

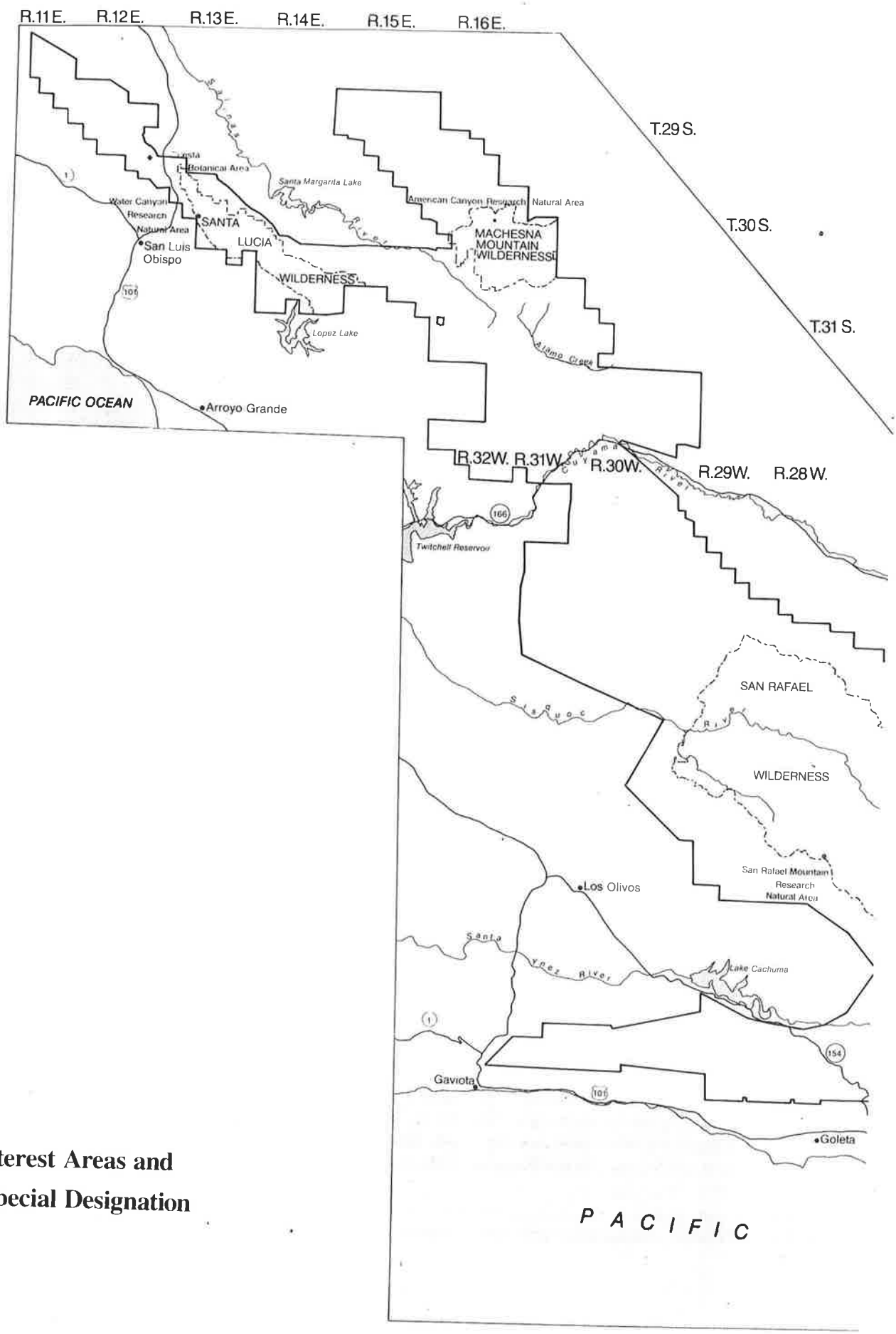
Table 4.12-1 graphically displays the recommendations for special areas under each alternative and helps in understanding the consequences of designating special areas. A description of each of these areas is found in Section 3.12.

4.12.2.1 Alternative I

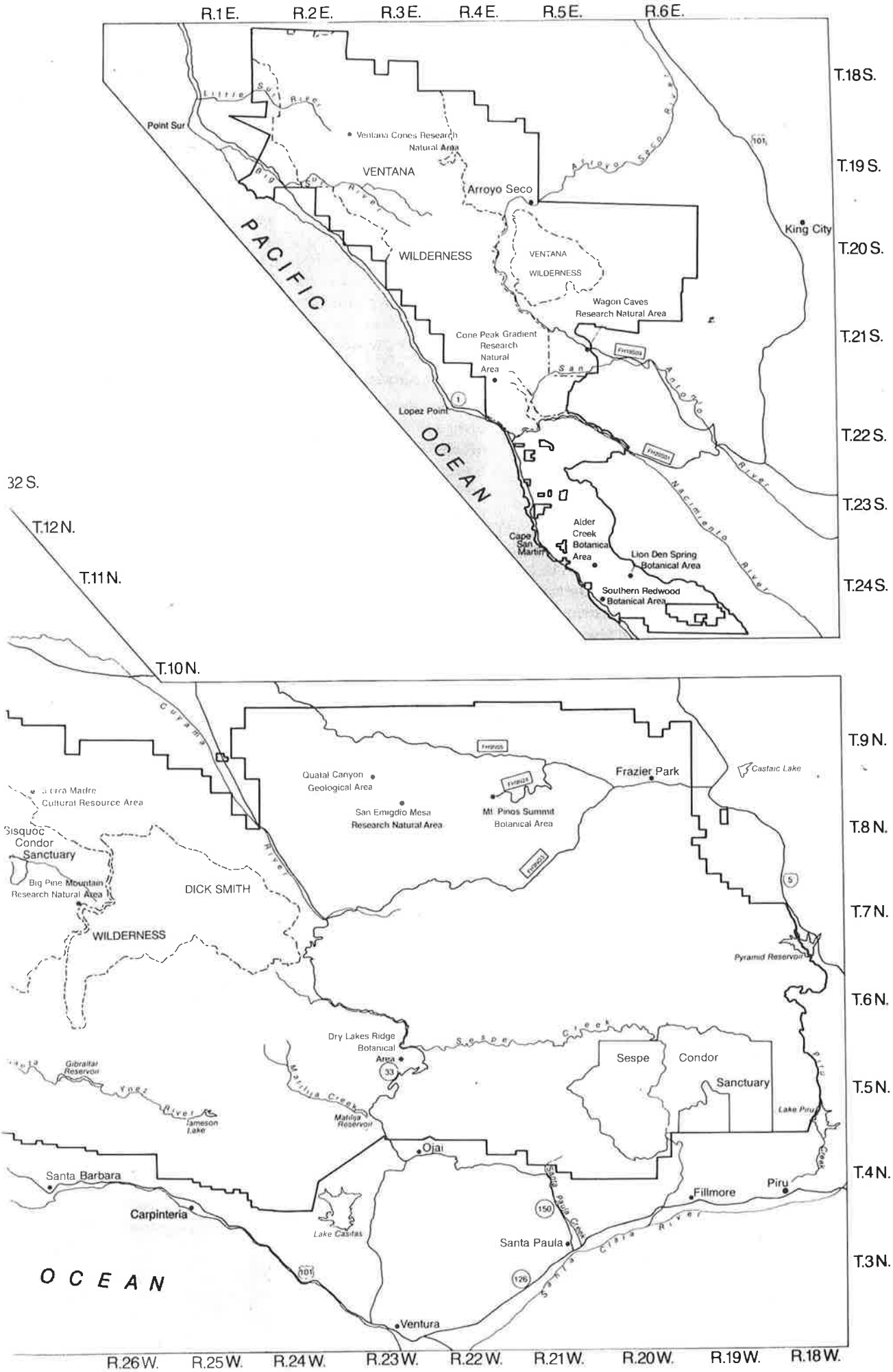
This alternative designates five RNAs, three Wild River segments, five botanical special interest areas, a geologic special interest area, a cultural resources special area and two National Natural Landmarks. It also proposes two candidate RNAs. The three Wild River segments, the two candidate RNAs, and three of the recommended RNAs are in Wilderness. The effect of adding a dual designation to these areas would be minimal.

Designation of Wagon Caves and San Emigdio Mesa RNAs would result in the loss of 175 AUM's/year. The mineral potential of these areas is low to medium. Management activities can continue in the five botanical special interest areas so long as they do not degrade botanical values. Botanical and geologic special interest areas are low in mineral potential and contain no known resources of commercial value. The Sierra Madre cultural resources area has low potential for locatable minerals and moderate potential for oil and gas. Designation as a special area would prohibit surface access for minerals activities by withdrawing the area from mineral entry, but would allow directional access to subsurface minerals such as oil and gas.

This alternative emphasizes the coastal zone's unique scenic resources by proposing the withdrawal of the land between the ocean and Highway 1 from all mineral activity. Other lands within the coastal zone are proposed for withdrawal from mineral leasing.



Special Interest Areas and Areas of Special Designation


R.1E.
R.2E.
R.3E.
R.4E.
R.5E.
R.6E.
T.18S.
T.19S.
T.20S.
T.21S.
T.22S.
T.23S.
T.24S.
32S.
T.12N.
T.11N.
T.10N.
T.9N.
T.8N.
T.7N.
T.6N.
T.5N.
T.4N.
T.3N.
R.26W.
R.25W.
R.24W.
R.23W.
R.22W.
R.21W.
R.20W.
R.19W.
R.18W.
Point Sur
Little Sur River
Ventana Cones Research Natural Area
VENTANA
WILDERNESS
Big Sur River
Arroyo Seco
Arroyo Seco River
101
King City
PACIFIC
OCEAN
VENTANA WILDERNESS
Wagon Caves Research Natural Area
Cone Peak Gradient Research Natural Area
San Antonio River
Lopez Point
Alder Creek Botanical Area
Cape San Martin
Lion Den Spring Botanical Area
Southern Redwood Botanical Area
Nacimiento River
Sierra Madre Cultural Resource Area
Sisquoc Condor Sanctuary
Big Pine Mountain Research Natural Area
DICK SMITH
WILDERNESS
Cuyama River
Quatal Canyon Geological Area
San Emigdio Mesa Research Natural Area
Mt. Pinos Summit Botanical Area
Frazier Park
Castaic Lake
Pyramid Reservoir
Dry Lakes Ridge Botanical Area
Sespe Creek
Sespe
Condor
Sanctuary
Piru Creek
Lake Piru
Gibraltar Reservoir
Ynez River
Lake Jameson
Matilija Creek
Matilija Reservoir
Ojai
Santa Barbara
Carpinteria
Lake Casitas
Santa Paula Creek
Santa Clara River
Fillmore
Piru
Santa Paula
Ventura
OCEAN

4.12.2.2 Alternative II

This alternative designates two Wild River segments, two Botanical Special Interest Areas and two Natural National Landmarks. The Wild River segments are in Wilderness. The effect of adding a dual designation to these areas would be minimal.

The two Botanical Special Interest Areas are low to medium in mineral potential and contain no known resources of commercial value; furthermore, these designations allow most management activites.

The impacts of not proposing 2 candidate RNAs and not designating five RNAs, three Botanical Special Interest Areas, and a Geologic Special Interest Area are generally not significant. These areas are either in Wilderness or in areas where no increase in management activities is proposed. Only the Wagon Caves RNA would likely be affected by nondesignation since recreational and grazing uses could cause a gradual degradation of the areas's botanical values. The botanical values of the Dry Lakes Ridge Botanical Special Interest Area could be significantly degraded by fuelbreak construction.

The impacts of not designating the Sierra Madre Cultural Resources Special Area could be significant. Non-designation could result in surface entry and other activities related to oil and gas leasing which would have unmitigable, adverse impacts on the fragile cultural values of an archeological district listed on the National Register of Historic Places.

This alternative maintains the current emphasis within the coastal zone of maintaining its scenic resources by working with mining interests to prepare comprehensive operating plans which will to the fullest extent practical, protect and preserve unique coastal values.

4.12.2.3 Alternative III

This alternative designates five RNAs, three Wild River segments, one Scenic River segment, four Botanical Special Interest Areas, and a Cultural Resources Special Area. It also proposes two candidate RNAs. The three Wild River and one Scenic River segments, the two candidate RNAs, and three of the recommended RNAs are in Wilderness. The effect of adding a dual designation to these areas would be minimal.

Designation of Wagon Caves and San Emigdio Mesa RNAs would result in the loss of 175 AUM's/year. The mineral potential of these areas is low to medium. Management activities can continue in the four Botanical Special Interest Areas so long as they do not degrade botanical values. Botanical Special Interest Areas are low in mineral potential and contain no known resources of commercial value. The Sierra Madre Cultural Resources Area has low potential for locatable minerals and moderate potential for oil and gas. Designation as a special area would prohibit surface access for minerals activities by withdrawing the area from mineral entry, but would allow directional access to subsurface minerals such as oil and gas.

The impacts of not designating Quatal Canyon a Geologic Special Interest Area are negligible since the area is of low to medium potential and contains no other commercially important resources. The botanical values of the Dry Lakes Ridge Botanical Special Interest Area could be significantly degraded by fuelbreak construction. This alternative emphasizes the coastal zone's unique scenic resources by proposing the withdrawal of the land between the ocean and Highway 1 from all mineral activity. Other lands within the coastal zone are proposed for withdrawal from mineral leasing.

4.12.2.4 Alternative IV

This alternative designates three RNAs, three Wild River segments, and four Botanical Special Interest Areas. It also proposes two candidate RNAs and two National Natural Landmarks. The two Wild River segments, two candidate RNAs, and all of the recommended RNAs are in Wilderness. The effect of adding a dual designation to these areas would be minimal.

Management activities can continue in the four Botanical Special Interest Areas so long as they do not degrade botanical values. Botanical Special Interest Areas are low in mineral potential and contain no known resources of commercial value.

Non-designation could adversely impact the Wagon Caves RNA since recreational and grazing uses could cause a gradual degradation of the areas's botanical values. The impacts of not designating Quatal Canyon Geologic Special Interest Area are negligible since the area is of low to medium potential and contains no other commercially important resources.

The impacts of not designating the Sierra Madre Cultural Resources Special Area could be significant. Non-designation could result in surface entry and other activities related to oil and gas leasing which would have unmitigable, adverse impacts on the fragile cultural values of an archeological district listed on the National Register of Historic Places.

This alternative emphasizes the coastal zone's unique scenic resources by proposing the withdrawal of the land between the ocean and Highway 1 from all mineral activity. Other lands within the coastal zone are proposed for withdrawal from mineral leasing.

4.12.2.5 Alternative V

This alternative designates five RNAs, three Wild River segments, one Scenic River segment, three Botanical Special Interest Areas, and a Cultural Resource Special Area. It also proposes two candidate RNAs and two National Natural Landmarks. The three Wild and one Scenic River segment, two

candidate RNAs, and three of the recommended RNAs are in Wilderness. The effect of adding a dual designation to these areas would be minimal.

Designation of Wagon Caves and San Emigdio Mesa RNAs would result in the loss of 175 AUM's/year. Mineral potential of the latter areas is low to medium. Management activities can continue in the four Botanical Special Interest Areas so long as they do not degrade botanical values. Botanical Special Interest Areas are low in mineral potential and contain no known resources of commercial value. The Sierra Madre Cultural Resources Area has low potential for locatable minerals and moderate potential for oil and gas. Designation as a special area would prohibit surface access for minerals activities by withdrawing the area from mineral entry, but would allow directional access to subsurface minerals such as oil and gas. The impacts of not designating Quatal Canyon a Geologic Special Interest Area are negligible since the area is of low to medium potential and contains no other commercially important resources. The botanical values of the Dry Lakes Ridge botanical special interest area could be significantly degraded by fuelbreak construction.

This alternative emphasizes the coastal zone's unique scenic resources by proposing the withdrawal of the land between the ocean and Highway 1 from all mineral activity. Other lands within the coastal zone are proposed for withdrawal from mineral leasing.

4.12.2.6 Alternative VI

This alternative designates five RNAs, three Wild River segments, one Scenic River segment, five Botanical Special Interest Areas, a Geologic Special Interest Area, and a Cultural Resources Special Area. It also proposes two candidate RNAs and two National Natural Landmarks. The three Wild and one Scenic River segment, the two candidate RNAs, and three of the recommended RNAs are in Wilderness. The effect of adding a dual designation to these areas would be minimal.

Designation of Wagon Caves and San Emigdio Mesa RNAs would result in the loss of 175 AUM's/year. The mineral potential of these areas is low to medium. Management activities can continue in the five Botanical Special Interest Areas so long as they do not degrade botanical values. Botanical and Geologic Special Interest Areas are low in mineral potential and contain no known resources of commercial value. The Sierra Madre Cultural Resources Area has low potential for locatable minerals and moderate potential for oil and gas. Designation as a Special Interest Area would prohibit surface access for minerals activities by withdrawing the area from mineral entry, but would allow directional access to subsurface minerals such as oil and gas.

This alternative emphasizes the coastal zone's unique scenic resources by proposing the withdrawal of the land between the ocean and Highway 1 from all mineral activity. Other lands within the coastal zone are proposed for withdrawal from mineral leasing.

4.12.2.7 Alternative VII

This alternative designates five RNAs, three Wild River segments, and two Botanical Special Interest Areas. It also proposes two candidate RNAs and two National Natural Landmarks. The three Wild River segments, the two candidate RNAs, and three of the recommended RNAs are in Wilderness. The effect of adding a dual designation to these areas would be minimal.

Designation of Wagon Caves and San Emigdio Mesa RNAs would result in the loss of 175 AUM's/year. The mineral potential of these areas is low to medium. The two Botanical Special Interest Areas are low to medium in mineral potential and contain no known resources of commercial value; furthermore, this designation allows most management activities.

The impacts of not designating three Botanical Special Interest Areas, and a Geologic Special Interest Area are generally not significant. The botanical values in the Dry Lakes Ridge Botanical Special Interest Area could be significantly degraded by fuelbreak construction. The impacts of not designating the Sierra Madre Cultural Resources Special Area could be significant. Non-designation could result in surface entry and other activities related to oil and gas leasing which would have unmitigable, adverse impacts on the fragile cultural values of an archeological district listed on the National Register of Historic Places.

This alternative recommends withdrawal of the lands between Highway 1 and the ocean within the coastal zone from all mineral activity. The remainder of the coastal zone is not withdrawn.

4.12.2.8. Alternative VIII

This alternative designates three RNAs, and two Botanical Special Interest Areas. It also proposes two candidate RNAs and two National Natural Landmarks. The two candidate RNAs and three recommended RNAs are in Wilderness; the effect of adding a dual designation to these areas would be minimal.

The two Botanical Special Interest Areas are low to medium in mineral potential and contain no known resources of commercial value; furthermore, this designation allows most management activities.

Non-designation could adversely impact the Wagon Caves RNA since recreational and grazing use could cause a gradual degradation of the areas's botanical values. The botanical values of the Dry Lakes Ridge Botanical Special Interest Area could be

Table 4.13-1

Overall Condition Of Forest Cultural Resources At The End Of The Planning Horizon*

Alternative Activity	I	II	III	IV	V	VI	VII	VIII
Wildfire	-50	-90	-70	-50	70	-50	-50	-50
Rx Fire	-30	-10	-30	-30	-15	-30	-30	-30
General Forest								
Recreation	-24	-27	-20	-25	-25	-21	-22	-27
Grazing	-40	-20	-20	-60	-20	-20	-60	-60
Program Mgmt.								
- inventory	80	0	160	120	0	160	160	0
-evaluation	41	24	44	41	24	41	64	24
-protection	31	9	46	25	9	25	25	9
- interpretation and enhancement	23	8	28	23	8	23	23	8
Total Index (CRI)	**31**	**-106**	**138**	**44**	**-89**	**128**	**110**	**-126**

*Changes are relative to the existing situation which has been assigned a CRI of 0.

significantly degraded by fuelbreak construction. Impacts of not designating the Quatal Canyon Geologic Special Interest Area and Mt. Pinos and Southern Redwood Botanical Special Interest Areas are negligible since they contain no commercially important resources and no significant management activities are planned in these areas.

The impacts of not designating the Sierra Madre Cultural Resources Special Area could be significant. Non-designation could result in surface entry and other activities related to oil and gas leasing which would have unmitigable, adverse impacts on the fragile cultural values of an archeological district listed in the National Register of Historic Places.

This alternative maintains the current emphasis within the coastal zone of maintaining its scenic resources by working with mining interests to prepare comprehensive operating plans which will to the fullest extent practical, protect and preserve unique coastal values.

4.12.3 Mitigation

Recognized values of special areas are protected from adverse consequences of mineral leasing through the imposition of the "no surface occupancy" stipulation. Visitor use and management activities are limited within designated special areas to maintain recognized values.

4.13 Cultural Resources

4.13.1 Introduction

The following discussion of environmental consequences is based upon cultural resources monitoring, literature (including overview documents), and research (Barnette and Horne 1985). The overall condition of Forest cultural resources provides a measure of the effectiveness of the cultural resources program. Overall condition encompasses the following positive factors: inventorying, protecting, interpreting, and enhancing cultural properties (which includes the opportunity to increase knowledge through research)(Section 3.13). Negative factors such as intentional and inadvertent damage to properties are also part of the assessment of overall condition. In order to assess overall condition under each alternative, an index which incorporates both positive and negative factors was developed. This index is referred to as the Cultural Resources Index (CRI).

The assumptions used in this analysis are:

- A cultural resources survey is completed prior to all site-specific projects (e.g., utility lines, fuelbreak construction, minerals management, type conversions, and timber management).
- Impacts from site-specific activities are controllable and can usually be avoided (these activities are not discussed in detail here). Activities or events that are non-site specific are less controllable and may result in severe impacts.
- Potential impacts can be discussed in general terms rather than on a property-specific basis. Alternatives can be compared on the basis of potential effects of activities (e.g., wildfire, grazing) on classes of properties (e.g., rock art sites, historic structures).

I1.0 Recommended Research Natural Areas

I1.1 Cone Peak Gradient (Established 7/87)

I1.1.1 Affected Environment

This area is located in portions of Sections 33, 34, and 35, T. 21 S., R. 4E.; and Sections 2, 3, 10, 11, 14, and 15, T. 22 S., R. 4 E., MDM in Monterey County.

This 2955 acre area is remarkable for its ecologic diversity. Within a three mile horizontal distance inland from the Monterey coast, the mountains rise from sea level to 5000 feet. The resulting elevational and climatic gradient has associated with it 12 plant communities including canyon live oak *(Quercus chrysolepis)* woodland, mixed evergreen forest, coast live oak *(Quercus agrifolia)* woodland, coast redwood *(Sequoia sempervirens)* and chaparral.

Other features are:

- the area is within the Ventana Wilderness
- commercially important timber species occur in the area
- a minor amount of grazing occurs in the area
- several trails traverse the area.

I1.2 American Canyon

I1.2.1 Affected Environment

This area is located in Sections 9 and 10, portions of Sections 14, 15, 16, and 23, T. 30 S., R. 16 E., MDM in San Luis Obispo County.

The area encompasses approximately 1500 acres of a basin that drains into American Canyon. Coulter pine *(Pinus coulteri)* occurs in abundance as dispersed, generally even-aged stands of varying size and density. Fires swept through the southeast and northwest portions of the basin in 1921 and 1939, respectively. Most stands date back to those fires; however, ridgetop and canyon bottom stands spared from the fires contain older trees. The associated chaparral is dominated by chamise *(Adenostema fasciculatum)* and Eastwood manzanita *(Arctostaphylos glandulosa)*.

Other features of this area are:

- no mineral claims or oil and gas leases are known for the area
- no grazing occurs within the area but does occur seasonally in small nearby oak grasslands
- no commercially important timber species occur in the area
- trail 16E01, which runs along the east-west ridge of the basin is an approved Off-Road Vehicle (ORV) trail; 16E02 is closed to ORVs
- some hunting likely occurs in the area
- the area is within the Machesna Wilderness.

I1.2.2 Consequences

Designation: The consequences of designation are negligible because the area is in Wilderness. The Wilderness designation does not permit silvicultural activities or surface occupancy for oil and gas activities. Grazing would not be permitted for transitory range. Trail construction would not be permitted in Alternatives III, VI, and VII which have a recreation emphasis.

Non-designation: The values and resources of the area would be little-affected by non-designation since, as explained above, Wilderness constrains management activities.

I1.3 Wagon Caves

I1.3.1 Affected Environment

The proposed Research Natural Area is located adjacent to road 19509 at the entrance to the Forest from Hunter-Liggett Military Reservation in T. 21, R.5E, MDM in Monterey County.

Although only 150 acres in size, this valley oak (Quercus lobata) grassland is an exceptionally good stand of a type which has mostly been converted to agricultural land throughout California. No other National Forest, public or private reserve, has an example of this oak savanna type in comparable size or condition (J. R. Griffin, pers. comm.).

Other features are:

- No mineral claims or oil and gas leases are known for the area
- the area is part of the Upper Milpitas allotment and is extensively grazed
- the area is used with increasing frequency by wood gatherers and hunters.
- potential for leasable and locatable minerals is very low.

I1.3.2 Consequences

Designation: Designation would result in the loss of 100 AUMs/year and an insignificant amount of cordwood. Mineral withdrawal would have no effects

since potential for leasable and locatable minerals is very low.

Non-designation: Non-designation could result in the gradual degradation of this stand by continued recreational and grazing use. This could result in the loss of a good example of a type that is disappearing or little-protected off Forest.

I1.4 Black Butte

I1.4.1 Affected Environment

This candidate covers portions of Sections 6, 7, 8, 9, 17 and 16, T. 30 S., R. 13 E., MDM in San Luis Obispo County.

This 540 acre area is situated on the steep, generally northwest facing slopes on the Cuesta Ridge within the Santa Lucia Wilderness. Knobcone pine-chaparral is the primary vegetation type. The principal tree species is knobcone pine *(Pinus attenuata)* and is found on north and northeast slopes as scattered groves and occasional continuous areas. Chaparral species, principally chamise *(Adenostema fasciculatum)*, manzanita *(Arctostaphylos obispoensis)*, and the sensitive Santa Lucia manzanita *(A. luciana)* occupy the area between pine stands.

The intermittent streams that drain into Black Butte support riparian vegetation composed of coast live oak *(Quercus agrifolia)*, California bay *(Umbellaria californica)*, tanoak *(Lithocarpus densiflora)*, madrone *(Arbutus menziesii)*, and bigleaf maple *(Acer macrophyllum)*.

Other features are:

- no mineral claims or oil and gas leases are known for the area
- no grazing occurs within the area
- no commercially important timber species occur within the area
- no trails cross the area

I1.4.2 Consequences

Designation: The consequences of designation are negligible because the area is in Wilderness. The Wilderness designation does not permit silvicultural activities or surface occupancy for oil and gas activities. Grazing would not be permitted for transitory range. Trail construction would not be permitted in Alternatives III, VI, and VII which have a recreation emphasis.

Non-designation: The values and resources of the area would be little-affected by non-designation since, as explained above, Wilderness constrains management activities.

I1.5 San Emigdio Mesa

I1.5.1 Affected Environment

This area is located in portions of Sections 7, 8, 12, and 13, T. 8 N., R. 22 W., SBM in Ventura County.

The area covers approximately 1200 acres of an expansive flat alluvial fan dissected by several intermittent stream channels and gullies. The main vegetation type is pinyon-juniper. Pinyon pine *(Pinus monophylla)*, the dominant tree species, averages 15 to 20 feet in height and is evenly distributed over the entire area in low to moderate densities. Of the three common brush species, California juniper *(Juniperus californica)*, big sagebrush *(Artemisia tridentata)*, and dwarf oak *(Quercus turbinella ssp. californica)*, dwarf oak is by far the most abundant. Common understory subshrubs are *Eriogonum kennedyi* and *Lupinus excubitus (or formusus)*.

Understory herbaceous plants are generally sparse and widely scattered. Some are: *Linanthus aureus, Descurainia pinnata, Eriophyllum pringlei, Lotus humistratus, Arenaria douglasii, Phacelia distans, Arabis pulchra, Mimulus spp., and Gilia spp.*

Other features of the area are:

- application for oil and gas leasing has been made. The general area is known to contain palladium in low concentrations. Oil and gas potential is moderate.
- the proposed Research Natural Area is within the Apache grazing allotment which is grazed between June 1 and October 31
- commercially important timber species do not occur in the area
- some hunting may occur in the area; there are no hiking or off road vehicle trails.

I1.5.2 Consequences

Designation: Designation would result in the loss of 75 AUMs/year. The area has medium to low potential for leaseable and locatable minerals so mineral withdrawalwould have little effect. Designation would not allow surface occupancy for oil and gas development.

Non-designation: Non-designation would have little effect on the are since grazing and recreational use are not expected to change from the existing condition. Oil and gas development is unlikely to occur.

I1.6 Ventana Cones

I1.6.1 Affected Environment

This area is located in portions of sections 6,7, and 8 of T.19 S., R.3 E. and portions of Sections 1 and 12, T.19 S., R.2 E., MDM Monterey County.

Some of the best Santa Lucia fir *(Abies bracteata)*/ canyon live oak *(Quercus chrysolepis)* forests are contained in this rugged 1400 acre area of the Ven-

tana Wilderness. Typically, these forests occupy the steepest slopes, seldom burned by fire because of their rocky character. Other types intermixed with this forest type include: chaparral, composed of a variety of species *(Quercus wizlizenii, Ceanothus integerrimus, Adenostoma fasciculatum and others)*, and mixed evergreen forests.

Other features are:

- no mineral claims or oil and gas leases occur in the area
- no grazing occurs within the area
- no commercially important timber species occur within the area
- no trails cross the area.

I1.6.2 Consequences

Designation: The consequences of designation are negligible because the area is in Wilderness. The Wilderness designation does not permit silvicultural activities or surface occupancy for oil and gas activities. Grazing would not be permitted for transitory range. Trail construction would not be permitted in Alternatives III, VI, and VII which have a recreation emphasis.

Non-designation: The values and resources of the area would be little-affected by non-designation since, as explained above, Wilderness constrains management activities.

I2.0 Candidate Research Natural Areas

I2.1 San Rafael Mountain

I2.1.1 Affected Environment

This area is located in Sections 1,2, and 3 of T.7 N., R.28 W. and a portion of Section 6, T.7 N., R.27 W., SBM Santa Barbara County.

The target botanical type of this 1300 acre area is southern California mixed conifer forest. Ponderosa pine *(Pinus ponderosa)*, sugar pine *(Pinus lambertiana)*, Jeffrey pine *(Pinus jeffreyi)*, white fir *(Abies concolor)*, and incense cedar *(Calocedrus decurrens)* are the principle species of this type. In addition, there are good stands of bigcone Douglas-fir *(Psuedotsuga menzesii)*/ canyon live oak *(Quercus chrysolepis)* along the steep slopes of the South Fork of the Sisquoc River. Montane chaparral, composed of a variety of brush species *(Arctostaphylos glandulosa, Ceanothus papillosus, Ceanothus leucodermis, and Quercus spp.)* is also well represented, covering nearly one-half the area.

Other features are:

- no grazing occurs in the area
- commercial timber species are present but unavailable because they are in Wilderness
- no oil and gas leases occur in the area.

I2.1.2 Consequences

Designation: The consequences of designation are negligible because the area is in Wilderness. The Wilderness designation does not permit silvicultural activities or surface occupancy for oil and gas activities. Grazing would not be permitted for transitory range. Trail construction would not be permitted in Alternatives III, VI, and VII which have a recreation emphasis.

Non-designation: The values and resources of the area would be little-affected by non-designation since, as explained above, Wilderness constrains management activities.

I2.2 Big Pine Mountain

I2.2.1 Affected Environment

This area includes portions of Sections 31 and 32, T.8 N., R.26 W.; and, Sections 1,2 and 12 of T.7 N., R27 W. and Sections 6 and 7 of T.7 N., R.26 W., MDM Santa Barbara County.

The same mixed conifer forest, montane chaparral, and bigcone Douglas-fir forests described for San Rafael Mountain are found in this 1000 acre area. In addition, however, there are extensive stands of canyon live oak woodland and Coulter pine *(Pinus coulteri)*/ chaparral.

- no grazing occurs in the area
- commercial timber species are present but unavailable because they are in Wilderness
- no oil and gas leases occur in the area.

I2.2.2 Consequences

Designation: The consequences of designation are negligible because the area is in Wilderness. The Wilderness designation does not permit silvicultural activities or surface occupancy for oil and gas activities. Grazing would not be permitted for transitory range. Trail construction would not be permitted in Alternatives III, VI, and VII which have a recreation emphasis.

Non-designation: The values and resources of the area would be little-affected by non-designation since, as explained above, Wilderness constrains management activities.

I3.0 Existing Botanical Special Interest Area

I3.1 Cuesta Ridge

The area is located in portions of Sections 26, 27, 28, 34, 35, T. 29 S., R. 12 E., MDM in San Luis Obispo County.

Established in 1969, the Cuesta Botanical Area covers 1,330 acres of serpentinite Sargent cypress *(Cupressus sargentii)*, but also includes small stands of Coulter pine *(Pinus coulteri)*. In addition to being the largest area of Sargent cypress on the Forest, the

area is of special importance because it harbors 12% of the Forest's sensitive plants such as *Sidalcea hickmanii spp. anomala, Carex obispoensis, Calochortus obispoensis and Chorizanthe breweri.*

I4.0 Candidate Botanical Special Interest Areas

I4.1 Southern Redwood

I4.1.1 Affected Environment

The area is located in Section 24, T. 24 S., R. 5 E., MDM, in Monterey County.

This site encompasses the southernmost natural stand of redwood *(Sequoia sempervirens)* and is the only reason for the proposed designation. The area is small, 10 acres, and narrow, since redwood *(Sequoia sempervirens)* at this latitude is usually riparian.

I4.1.2 Consequences

Classification: Because the area is small and has no known resources of commercial value, the consequences of designation are insignificant. Surface occupancy for oil and gas development is not permitted. Management activities can occur in the area so long as they do not adversely impact the redwood stands.

Non-classification: Non-classification would have little impact on the area's values since management activities are unlikely to occur.

I4.2 Alder Creek

I4.2.1 Affected Environment

The area is located in portions of Sections 1 and 2, T. 23 S., R. 5 E., MDM, in Monterey County.

The 75-acre site includes Sargent cypress *(Cupressus sargentii)* with a number of rare endemic plant species: *Monardella palmeri, M. subglabra, Cheilanthes carlotta-hallii,* and the sensitive species *Galium hardhamae.* This site and the Lion Den Spring site have been recognized as botanical areas in the Big Sur Coastal Planning Unit Plan.

I4.2.2 Consequences

Classification: Because the area is small and has no known resources of commercial value, the consequences of designation are insignificant. Surface occupancy for oil and gas is not permitted. Management activities can occur in the area so long as they do not adversely impact the area's rare endemic plants.

Non-classification: Non-classification would have little impact on the area's values since management activities, other than prescribed burning, are unlikely to occur. Moreover, management activities can occur in the area so long as they do not adversely impact the area's values.

I4.3 Lion Den Spring

I4.3.1 Affected Environment

The area is located in Section 8, T.24 SW., R.6 E., MDM, in Monterey County. Like Alder Creek, this site has a Sargent cypress *(C. sargentii)* grove. It covers 85 acres and has only a few endemics, in this case, Galium hardhamae, and possibly a *Fritillaria spp.* (C. Hardham, personal communication). The two areas complement one another well and provide a good representation of Sargent cypress endemics.

I4.3.2 Consequences

Classification: Because the area is small and has no known resources of commercial value, the consequences of designation are insignificant. Surface occupancy for oil and gas is not permitted. Management activities can occur in the area so long as they do not adversely impact the area's rare plants.

Non-classification: Non-classification would have little impact on the area's values since management activities unlikely to occur. Under non-classification oil and gas development is possible; however because of the low potential, such development is considered unlikely.

I4.4 Dry Lakes Ridge

I4.4.1 Affected Environment

The area is located in portions of Sections 2-3, T. 5 N., R. 23 W., SBM in Ventura County. The proposed area encompasses 450 acres of dry lakes formed from a relatively small internal basin located at the axis of a steeply folded anticline.

Of botanical and scientific interest are the disjunct relict plant species, *Lotus stipularis, Rhus trilobata quinata, Apoxynum pumilum, and Chrysothamnus nauseosus consumilis*; these are not found on nearby ridges. In addition, there are remnant stands of Pinus ponderosa.

I4.4.2 Consequences

Designation: Because the area is small and has no known resources of commercial value, the consequences of designation are insignificant. Fuelbreak construction would not be permitted.

I4.5 Mt. Pinos Summit

I4.5.1 Affected Environment

This 510-acre area is located in a portion of Section 32, T. 8 N., R. 21 W., SBM, in Ventura and Kern Counties. The species of special interest for this proposed area is limber pine *(Pinus flexilis)* which grows in two relatively small areas (less than 20 acres) on Mt. Pinos and Sawmill Mountain above 8,000 feet elevation. These are the only repre-

Appendix C: Vascular plants of Big Pine Mountain RNA

1. List of species at or near their westernmost distributions in Southern California:

Allium burlewii
Amelanchier pallida
Arabis hirsuta var. *glabrata*
Arctostaphylos parryana
Chaenactis santolinoides
Calochortus invenustus
Castilleja applegatei
Crepis occidentalis var. *pumila*
Danthonia californica var. *americana*
Delphinium patens ssp. *montanum*
Eriastrum densifolium ssp. *austromontanus*
Eriogonum umbellatum ssp. *aridum*
Eriogonum wrightii ssp. *subscaposum*
Frasera neglecta
Fritillaria pinetorum
Gayophytum humile
Holodiscus microphyllus
Horkelia bolanderi ssp. *parryi*
Leptodactylon pungens ssp. *pulchriflorum*
Lotus nevadensis
Lupinus elatus
Lupinus latifolius var. *parishii*
Madia minima
Mimulus johnstonii
Osmorhiza chilensis
Penstemon grinnellii ssp. *scrophularioides,*
Penstemon speciosus
Phacelia imbricata ssp. *patula*
Phlox diffusa
Potentilla glandulosa ssp. *nevadensis*
Prunus virginiana var. *demissa*
Rubus leucodermis var. *bernardinus*
Sambucus caerulea
Sanicula graveolens
Silene lemmonii
Symphoricarpos parishii
Tauschia parishii
Thalictrum fendleri
Trifolium cyathiferum
Viola purpurea ssp. *xerophyta*
Zauschneria californica ssp. *latifolia*

2. List of species identified during the four day period from June 9-12, 1989 and species mentioned for the area by Smith (1976). Taxonomy follows Munz (1968, 1974). This list includes approximately 286 taxa. Habitats following the plant names are abbreviated in the following way:

mcf.....mixed conifer forest
sb.....shale barrens
jp.....Jeffrey pine forest
chap.....northern mixed chaparral
mc.....montane chaparral
Q. agrifolia wdl.....coast live oak riparian phase
cp.....Coulter pine
co.....canyon live oak

Abies concolor; common mcf, 5000-6800 ft
Acer macrophyllum; occasional moist areas along Sisquoc and N-facing ravines on Big Pine Mountain
Adenostoma fasciculatum; lower elev. chap, lower Sisquoc and Big Pine Canyon drainages
Agoseris grandiflora: cited for Big Pine Mountain by Smith (1976)
Agoseris retrorsa; uncommon but widespread mcf, chap., jp
Agropyron parishii var. *laeve*; rhizomatous, uncommon in openings, edges of shale barrens, jp, mcf, co upper elevations
Allium amplectens; abundant in "Bear Meadow" about 5800 ft upper reaches of Big Pine creek also in cracks in sandstone adjacent to creek
Allium burlewii; uncommon on shale about 6500 ft on W side of Big Pine Mountain
Allium campanulatum; occasional dry banks cp-chap.
Allium lacunosum; mostly a serpentine endemic, but on sterile shale bottom land in hollows and low gradient gullies in jp. has mostly purple anthers (not yellow), not reported above 3000 ft by Munz, but above 6000 ft here
Allium monticola var. *keckii*; characteristic of shale barrens W Big Pine, single leaved, purple flowers, a rare plant
Allophyllum gilioides; scattered in openings from low to high elevations
Allophyllum intrigifolium; occasional at summit of Big Pine Mountain 6800 ft
Alnus rhombifolia; dominant in riparian along Sisquoc, Big Pine Canyon, springs at Upper Bear Camp, etc.
Amelanchier pallida; occasional, upper elevations sheltered rocky mcf
Amorpha californica; common upper elevations in co, edges mcf, mc, etc, food plant of California dogface butterfly
Angelica tomentosa; leaves generally narrow and glabrous, up to 6800 ft and down to 5100 ft mostly in mcf semi-shade
Apocynum canabinum var. *glaberrimum*; uncommon along moist parts of Big Pine Canyon mid-elevations
Aquilegia formosa; riparian, Sisquoc River
Arabis glabra; glade, Upper Bear Camp
Arabis repanda; common in understory of mcf, a montane disjunct
Arabis perennans; occas. chap. throughout up to 6200 ft.

Aralia californica; riparian, Sisquoc River, Big Pine Canyon
Arceuthobium abietinum; reported (Smith 1976) on white fir for Big Pine Mountain
Arceuthobium californicum; reported on sugar pine for Big Pine Mountain by Smith (1976)
Arceuthobium campylopodum; on jp, mcf
Arctostaphylos glandulosa; common at mid and upper elevations inchap.
Arctostaphylos glauca; lower chap.
Arctostaphylos parryana; small green leaves, no burl, jp, upper mc, co, shale barrens, a montane disjunct
Arnica discoidea; mcf and bd about 5400-6200 ft
Artemisia douglasiana; moist areas from 3300-6200 ft
Artemisia dracunculus; glade at upper Bear Camp
Asclepias californica; prostrate form on shale ridge around 6400 ft
Astragalus lentiginosus var. *idriensis*; common only on shale barrens
Avena barbata; dwarfed on shale up to 6300 ft
Balsamorhiza deltoidea; jp, co, occasionally
Boisduvalia densiflora; riparian, Big Pine Canyon
Brickellia californica; riparian lower Sisquoc River and Big Pine Canyon
Bromus diandrus; occasional, lower Sisquoc River valley in openings in chap, *Q. agrifolia* woods
Bromus marginatus; fairly common in semi-shade low to high elevations
Bromus rubens; occasional in chap mid elevations
Bromus tectorum; Upper Bear Camp 5100 ft
Calocedrus decurrens; common mcf 4500-6800 ft, some as low as 4000ft along Sisquoc
Calochortus invenustus; fairly common openings at upper elevations, mcf, mc, etc,
Calochortus venustus; common along Sisquoc trail in openings in chap, *Q. agrifolia* wdls. etc.
Calyptridium monandrum; open + disturbed places along trail at upper elevations
Calystegia malacophylla ssp. *pedicelluta*; occasional openings in mc, jp, and co upper elevations
Camissonia bistorta; uncommon dry slopes above "Bear Meadow" S-slopes cp-chap.
Camissonia campestris; low elevations along Sisquoc trail in openings in chap. etc.
Carex fracta; moist meadowy area "Bear Meadow" and Upper Bear Camp
Carex multicaulis; mcf, co mid elves.
Carex nudata; banks of Sisquoc River. near Bear Camp, also along creek in Big Pine canyon
Carex serratodens: cited for Big Pine Mountain by Smith (1976)
Carex subbracteata; moist areas at Upper Bear Camp, near S limits
Castilleja applegatei; occasional as at "Bear Meadow" scablands 6200 ft may be S. limits (from Mt. Pinos)
Castilleja martinii; not listed for Santa Barbara Co. most common at upper elevations but widespread throughout
Castilleja linariaefolia; along Big Pine Canyon up to 5800 ft
Castilleja stenantha; moist bank, "Bear Meadow" 5800 ft
Caucalis microcarpa; "Bear Meadow", up to 5800 ft only listed for 5000 ft
Ceanothus integerrimus; mc, openings mcf, co
Ceanothus leucodermis; mc, co, cp-chap
Ceanothus sp. lower chap S slopes with *Ephedra viridis*
Cercocarpus betuloides; common chap up to crest

Chaenactis sp.; jp forest
Chaenactis santolinoides; shale barrens, montane disjunct
Chenopodium sp. 1;. annual occasional in mcf
Chenopodium sp. 2; annual occasional in openings along lower Sisquoc
Chenopodium fremontii: reported for Big Pine Mountain by Smith (1976)
Chorizanthe clevelnadii: cited for Big Pine Mountain by Smith (1976)
Chorizanthe polygonoides; common in shale drainageways at upper elevations
Chorizanthe thurberi; locally abundant in dry flats along Sisquoc River
Chrysothamnus nauseosus; locally common along disturbed areas, Mission Pines trail, edges of blowouts, etc. mostly ssp. *mohavensis*
Cirsium californicum; pale lavender, buff chaparral-cp mid elevations
Clarkia deflexa; occasional Sisquoc River trail, openings
Clarkia purpurea ssp. *quadrivunera*; occasional dry open flats along Sisquoc River
Clarkia rhomboidea; fairly common, openings, semi-shade along summit crest, also in mcf near Upper Bear Camp
Clarkia unguiculata; common along Sisquoc River. trail, openings in chap.
Claytonia perfoliata; occasional in mcf, small plants
Claytonia spathulata; common in mcf
Clematis lingusticifolia; riparian, Sisquoc River.
Collinsia childii; occasional mcf in openings
Collinsia heterophylla; semi-shade of *Q. agrifolia* woods along Sisquoc trail.
Collinsia sp; yellow-greenish flowers, jp upper elevations (may be *C. childii*, cited for Big Pine Mountain by Smith 1976)
Collomia grandiflora; co, upper elves.
Cordylanthus sp.; jp, co, (probably *C. nevinii*, but *C. rigidus* also known from area, fide Smith 1976)
Corethrogyne filaginifolia var. *brevicula*; openings in jp, co, etc. down to low elevations
Crepis occidentalis ssp. *pumila*; uncommon upper elevations, sb, mc, e.g. "Bear Meadow" S limit Ventura Co.
Cryptantha clevelandii; fairly large flowers along Sisquoc River in openings to about 3800 ft (listed only to 2500 ft by Munz 1974)
Cryptantha echinella: collected by Smith (1976) on summit of Big Pine Mountain
Cryptantha intermedia; occasional throughout up to summits
Cryptantha muricata var. *jonesii*: Smith collected it on West Big Pine
Cryptantha simulans: as above
Cuscuta sp.; on *Eriogonum wrightii*, open jp, co, shale barrens, along crest
Cystopteris fragilis; occasional upper elevations moist crevices
Danthonia californica var. *americana*; edges of moist or vernally moist bottomlands in shale and sandstone 5800-6200 ft, not mentioned for this area (San Rafael-Big Pine Mountains).
Datisca glomerata; riparian, lower Sisquoc River.
Delphinium parishii; occasional semi shade, Sisquoc River to summit crest (*D. parishii* ssp. *purpureum* fide Smith 1976 is an endemic to the mountains of Santa Barbara Co.)
Delphinium patens ssp. *montanum*; occasional mcf, may be westernmost limit, a southern California montane species

Dichelostemma pulchella; occasional widespread in openings up to summit Big Pine Mountain
Dryopteris arguta; *Q. agrifolia* woods, lower Sisquoc
Dudleya cymosa ssp. *minor*; orange flowers, on cliffs below W Big Pine
Heleocharis bella; wet seep and bank "Bear Meadows"
Elymus caput-medusae; uncommon "Bear Meadow"
Elymus condensatus; occasional ecotones between jp and chap, mcf and co, 5000-6700 ft
Elymus glaucus; occasional mcf, co, 5000-6300 ft
Ephedra viridis; low elev chap, S slopes of Big Pine Canyon
Epipactis gigantea; uncommon, riparian, Sisquoc River
Equisetum arvense; moist glade, Upper Bear Camp
Equisetum laevigatum; occasional Sisquoc riparian
Eriastrum densifolium ssp. *austromontanus*; openings in jp, co, mcf, upper elevations
Erigeron foliosus; common co, chap, mcf
Eriodictyon trichocalyx; mcf-jp border, Big Pine Mtn. ridge, to chap in lower Sisquoc
Eriogonum fasciculatum; low s-facing chap, Sisquoc R. canyon, occas. in openings up to summits
Eriogonum gracile var. *polygonoides*; occasional along Sisquoc tr. in openings
Eriogonum hirtiflorum; annual, occasional at crest, chap-jp-mcf ecotones, not reported above 6000 ft by Munz, but up to 6800 ft here
Eriogonum nudum; common, jp, co, open mcf
Eriogonum saxatile; rocky openings chaparral, co, rock outcrop
Eriogonum umbellatum ssp. *aridum*; upper elevations on shale and other openings, a montane disjunct
Eriogonum wrightii ssp. *subscaposum*; fairly common in shale and other openings upper elevations, a montane disjunct
Eriophyllum confertiflorum; fairly common from chap to mcf, some herbaceous indivs. at upper elevations are var. *tridactylum*
Erodium cicutarium; occasional glade openings along Sisquoc River.
Erysimum capitatum; jp, co, mcf
Frasera neglecta; shale barrens upper elevations Transverse Range endemic, westernmost occurrence?
Fritillaria pinetorum; on Mission Pines trail, open mc, sb, a montane disjunct
Galium andrewsii; common mid-high elevations co, cp-chap.
Galium angustifolium; occasional low to mid-elev chap. *Q. agrifolia* wdl.
Galium aparine; shaded areas of forest and woodlands throughout
Galium nuttallii; lower Sisquoc valley chaparral
Galium trifidim var. *pacificum*; occasional along Sisquoc River. In shade
Garrya flavescens var. *pallida*; common in chap., cp, and co
Gayophytum diffusum parvifolium; fairly common in openings along Sisquoc River, up to mid and upper elevations
Gayophytum humile; tiny annual in vernally moist shale drainageways at upper elevations, a montane disjunct sp.
Gilia capitata ssp. *abrotanifolia*: reported by Smith (1976) for Big Pine Mountain
Gilia latiflora ssp. *cuyamensis*; flats along Sisquoc River.
Gilia modocensis; fairly common summit crest of Big Pine Mountain in openings in mcf, jp

Gilia splendens; occasional, as at summit of Big Pine Mountain 6800ft
Gnaphalium palustre; vernally moist shale swales upper elevations
Haplopappus arborescens; cited by Smith (1976) for Big Pine Mtn.
Haplopappus cuneatus; rocks upper elves.
Haplopappus squarrosus ssp. *obtusus*: cited for Big Pine Mountain by Smith (1976)
Holodiscus microphyllus; uncommon, cracks in sandstone scablands, jp, above "Bear Meadow" about 6000 ft
Hordeum leporinum; uncommon "Bear Meadow"
Horkelia bolanderi ssp. *parryi*; white flowers, just coming into bloom, common only in moist areas at "Bear Meadow" 5600-5900 ft, a montane disjunct.
Hulsea heterochroma: cited for Big Pine Mountain by Smith (1976)
Juncus kelloggii: collected near summit of rd. at Big Pine Mountain (Smith 1976)
Juncus sphaerocarpus: as above (Smith 1976)
Juncus uncinalis: as above in small depression in Jeffrey pine forest (perhaps shale drainage?)
Juncus macrophyllus; common along moist streambeds upper Bear Camp,"Bear Meadows", etc up to 5900 ft
Juncus mexicanus; upper Bear Camp
Keckiella breviflora; common from rocky gravel of Sisquoc River bed up to outcrops along crest about 6700 ft
Keckiella ternata ssp. *septentrionalis*: cited for Big Pine Mountain by Smith (1976)
Koeleria macrantha: collected at Big Pine Mountain by Smith (1976)
Lathyrys laetiflorus; uncommon up to 6300 ft openings in co, with *Chrysothamnus nauseosus*, etc.
Leptodactylon californicum; lower Sisquoc R. drainage, chap.
Leptodactylon pungens ssp. *pulchriflorum*; common rocky areas around summits, on shale barrens, etc.
Lilium *pardalinum*; riparian seeps, lower Sisquoc River, Big Pine Canyon
Linanthus androsaceus ssp. *luteus*; yellow flowers; flats along lower Sisquoc River.
Linanthus androsaceus ssp. *micranthus*; uncommon along dry openings Sisquoc River. trail
Linanthus androsaceus; white flrd form common around upper Bear Camp.
Linanthus ciliatus; very common at "Bear Meadow" and in openings along other upper elev. tributaries of Big Pine Canyon
Lomatium dasycarpum; common in openings on shale, all indivs. are acaulescent, 6000-6500 ft and are transitional with *L. mohavense*, cited for Big Pine Mountain by Smith (1976)
Lonicera interrupta; occasional, chap. up to crest
Lotus crassifolius; occasional, summit crest, mcf, jp, co
Lotus macranthus ?; 3 lfts. annual along w Big Pine trail not in flr.
Lotus nevadensis; common in shaley areas in jp forest, typically replaced in S. California by *L. davidsonii* which is reported for Big Pine Mtn. by Smoth (1976)
Lotus purshianus; fairly common at "Bear Meadow"
Lotus scoparius; occasional lower chap.
Lupinus bicolor; flats along Sisquoc River. lower elevations
Lupinus elatus; common in mcf, largely endemic to W Transverse Ranges
Lupinus excubitus ssp. *austromontanus*; mc, edge mcf, sb, upper elevations
Lupinus luteolus; common at upper elevations in vernally moist openings, eg., edges of shale barrens in drainageways

Lupinus latifolius var. *parishii*; scattered along upper stream in Big Pine Canyon above 5200 ft, a montane disjunct
Madia elegans ssp. *wheeleri*; common on shale, less so on sandstone, dense aggregations, upper elevations
Madia gracilis; occasional along Sisquoc trail open *Q. agrifolia* woods and flats
Madia minima; sandstone scablands and meadow edge above "BearMeadows"
Mahonia dictyota; common upper chaparral-jp ecotone Big PineMountain
Marah fabaceus var. *agrestis*; occasional upper chap., mcf, and co upper elevations
Melica imperfecta; widespread low to high in chap. and rocks
Mentzelia congesta; collected by Smith (1976) at Big Pine Mountain
Mentzelia montana; open shale and sandstone up to 6700 ft
Microseris gracilis; occasional upper elevations, in openings in mcf, jp
Mimulus cardinalis; riparian Sisquoc, Big Pine Canyon, etc.
Mimulus floribundus; cited for Big Pine Mountain by Smith (1976)
Mimulus guttatus; streamsides and seeps throughout
Mimulus johnstonii; scattered on shale in jp, open co, mcf, a montane Transverse Range species
Mimulus longiflorus; lower rocky S slopes lower Big Pine Canyon
Mimulus pilosus; tiny annual in shale dranageways of upper elevations, larger along moist areas along Sisquoc River near upper Bear Camp
Mimulus suksdorfii; cited by Smith (1976) as possibly at Big Pine Mountain
Monardella lanceolata: collected by Smith (1976) on Big Pine Mountain
Monardella odoratissima ssp. *australis*: cited for Big Pine Mountain by Smith (1976)
Muhlendergia richardsonis; most banks upper Big Pine cr. Also upper Bear Camp Meadow 5100 ft
Muhlendergia rigens; glades, e.g., Upper Bear Camp
Navarretia intertexta; common with *Gayophytum humile* in shale drainageways, upper elevations
Orobanche fasciculata; on *Eriogonum wrightii* at edge of shale barrens about 6200 ft
Osmorhiza brachypoda; fairly common oak woods, Sisquoc Valley, up to around 6300 ft in moist + shady areas
Osmorhiza chilensis; fairly common lower mcf, as near Upper Bear Camp, a montane disjunct
Penstemon bridgesii: cited by Smith (1976) for summit of Big Pine Mountain
Penstemon centranthifolius; occasional chap, co up to crest
Penstemon grinnellii ssp. *scrophularioides*; mc, disturbed trail edge, road edge mcf, a montane disjunct
Penstemon heterophyllus; fairly common low elevations, also on scabland above "Bear Meadow" at around 6000 ft
Penstemon laetus?; summit crest W Big Pine, co.
Penstemon speciosus; uncommon jp, W Big Pine, W. limits here?
Perideridia parishii: shale rivulets about 5700-6200 ft
Phacelia cicutaria var. *hispida*; lower Sisquoc River. semi shade of *Q. agrifolia* woods and chap.
Phacelia curvipes; common blue-purple (occasionally white) flrd. annual of openings in mcf
Phacelia distans; fairly common along Sisquoc R., but up to 6200 ft

Phacelia imbricata; fairly common in dry areas such as shale barrens, openings in mcf, etc. this and the nexta taxon are close to *P. egena*, cited for Big Pine Mountain by Smith (1976)
Phacelia imbricata ssp. *patula*; a montane disjunct, dry shale barrens, open jp
Phlox diffusa; shale barrens open jp, a montane disjunct, not cited by Smith (1976)
Phoradendron bollianum; often abundant on white fir, mcf
Pinus coulteri; common cp-chap, occasional edge mcf
Pinus jeffreyi; common jp, mcf 5100-6800 ft
Pinus lambertiana; common mcf 5000-6800 ft
Pinus monophylla; rare co, upper ridge crest sw corner up to 6300 ft
Pityrogramma triangularis; moist rock crevices mid and upper elevations.
Poa pratensis; Upper Bear Camp and "Bear Meadow"
Poa scabrella; common throughout in openings and semi-shaded areas
Polemonium micranthum; occasional as on summit plateau of Big Pine Mountain 6800 ft
Polystichum munitum; co, bay woods lower Big Pine Cyn.
Populus fremontii; occas. lower Sisquoc River
Potentilla glandulosa ssp. *nevadensis*; moist areas upper elevations a montane disjunct
Prunus emarginata; local patches in mc upper elevations
Prunus ilicifolia; lower chap. lower Sisquoc and Big Pine Canyon drainages
Prunus virginiana var. *demissa*; occasional upper elevations co, mc, a montane disjunct
Pseudotsuga macrocarpa; common inner canyons of Big Pine Canyon and N slope Big Pine Mountain up to 5800 ft
Psoralea californica; restricted to shale barrens on W Big Pine Mountain 6200-6400 ft, most have 6 - 7 leaflets
Psoralea macrostachya; riparian lower Sisquoc River
Pteridium aquilinum var. *pubescens*; moist areas, riparian, mcf, e.g. Upper Bear Camp
Pyrola picta f. *aphylla*; mcf uncommon
Quercus agrifolia; common lower Sisquoc River canyon *Q. agrifolia* wdl., up to 5500 ft; shrubby forms (perhaps hybrids with *Q. dumosa*) in cp-chap.
Quercus chrysolepis; common, co, edge mcf, cp-chap
Quercus dumosa; common chap, up to crest around 6300 ft
Quercus wislizenii var. *fructescens*; mc, up to 6300 ft
Rhamnus californica ssp. *cuspidata*?; fairly common to above 6000 ft flowers attractive to bees, leaves are mostly pubescent
Rhamnus crocea; lower Sisquoc River canyon
Rhus trilobata; occasional in thickets in Sisquoc River drainage
Ribes roezlii; co, mcf, upper elevations
Rosa californica; common Sisquoc River riparian, has bristly galls on leaves
Rubus leucodermis var. *bernardinus*; rill in mcf around 6000 ft also moist mcf near upper Bear Camp around 5300 ft, largely a Transverse Range taxon.
Salix goodingii var. *variabilis*; fairly common along Sisquoc and lower Big Pine Canyon
Salix lasiandra; often tree-sized willow low elevations along Sisquoc
Salix lasiolepis; Sisquoc riparian, up to 6200 ft at "Bear Meadow"
Salix scouleriana; most common willow of upper elev. streams and moist places up to 6300 ft
Salvia columbariae: cited for Big Pine Mountain (Smith 1976)
Salvia leucophylla; lower chap. Big Pine Canyon

Sambucus caerulea; occasional mcf, co, mc
Sambucus mexicanus; occasional, up to 6500 ft in openings in mcf, co
Sanicular graveolens; jp, mcf, occas. a montane disjunct
Sanicular tuberose; c, co
Sarcodes sanguinea: reported for Big Pine Mountain mcf (Smith 1976), a montane disjunct
Satureja mimuloides; orange-red flowers, riparian along Sisquoc River and lower Big Pine Canyon, nice odor
Sidalcea hickmanii ssp. parishii: noted for Big Pine Mountain chaparral by Smith (1976) and Smith and Berg (1988).
Silene lemmonii; fairly common mcf, a montane disjunct
Silene verecunda ssp. *platyota*: reported from mcf at Big Pine Mountain similar to above (Smith 1976)
Sisymbrium sp.?; openings lower Sisquoc
Sitanion hystrix; jp, rocky areas
Solanum umbelliferum var. *incanum*; occasional mountain chap., up to 6500 ft listed only to 4500 ft (known as S. californicum in Smith1976)
Solidago californica; *Q. agrifolia* wdl. To jp at summits, scattered
Stachys albens; fairly common along creek in Big Pine Canyon semi-shade, large leaves
Stachys bullata; lower Big Pine Canyon
Stephanomeria cichoriacea; occasional among rocks upper elevations co, mc
Symphoricarpos mollis; shade of *Q . agrifolia* lower elevations
Symphoricarpos parishii; common in openings in mcf and chap along crest, a montane disjunct
Tauschia hartwegii?; openings in mcf, jp, larger glaucous leaves than *T. parishii*, not reported by Munz above 5000 ft but up to 6200 ft here
Tauschia parishii; common in open jp and mcf above 6000 ft
Thalictrum fendleri; occasional, upper Big Pine Creek streamside, a montane sp.
Thalictrum polycarpum; semi-shade lower Sisquoc River valley, lower Big Pine Canyon
Thermopsis macrophylla var. *velutina*; common along crest of Big Pine Mountain edge mcf, mc. more scattered down to 6200 ft *T. m.* var. *agnina* is a rare plant endemic to Santa Barbara Co. collected fromthe Big Pine Mountain quadrangle (Smith and Berg 1988)
Toxicodendron diversilobum; lower Sisquoc valley, *Q. agrifolia* woodlands, chap., etc.
Trifolium cyathiferum; common only at "Bear Meadow", known in S. Calonly from Mt. Pinos?
Trifolium microcephalum; common at "Bear Meadow" and associated vernally moist areas
Umbellularia californica; scattered Sisquoc riparian up to 6500 ft in chap
Urtica holosericea; riparian, upper Bear Camp. Sisquoc R.
Verbena lasiostachys; disturbed areas, road sides
Vicia americana; depauperate forms fairly common in openings on shale in mcf, jp
Viola purpurea ssp. *xerophyta*; jp, openings in mcf, a montane disjunct
Vulpia megalura; border of "Bear Meadow" 5800 ft
Vulpia reflexa; less common, with above
Yucca whipplei; common chap. to crests
Zauschneria californica; occasional rocky areas chap., lower elevations
Zauschneria californica ssp. *latifolia*; higher elevations mcf, jp, sb, a montane taxon
Zigadenus fremontii; occasional chap. up to crest at 6000 ft (not reported above 3500 ft)

Appendix D: Vertebrates of Big Pine Mountain RNA

D1: Vertebrates known form the Big Pine Mountain RNA

This list includes all species detected during the ecological survey June 9-13, 1989 and some additional species (indicated by *) based on information provided by Janet Hamber, Santa Barbara Museum of Natural History. The total number of species is 137. Abbreviations for habitats are the same as in Appendix C.

Fish:
Rainbow Trout (*Salmo gairdneri*): in several flowing stretches of lower Sisquoc River.

Reptiles and Amphibians:
Pacific Treefrog (*Hyla regilla*): tadpoles seen in pool at "Bear Meadows" 5800 ft
American Toad (*Bufo boreas*):*
Western Fence Lizard (*Sceloporus occidentalis*): common throughout up to summit of Big Pine Mountain
Sagebrush Lizard (*Sceloporus graciosus*): common at upper elevations in open jp and chap.
Side-blotched Lizard (*Uta stansburryana*)*
Southern Alligator Lizard (*Gerrhonotus multicarinatus*): seen twice at lower and mid elevations Upper Bear Camp and Big Pine Canyon
Western Skink (*Eumeces skiltonianus*)*
Western Whiptail (*Cnemidophorus tigris*): seen in chaparral, lower Sisquoc
California Legless Lizard (*Anniella pulchra*)*
Ringneck Snake (*Diadolphis punctatus*)*
Gopher Snake (*Pituophus melanoleucus*): seen in Big Pine Canyon near creek
California Mountain Kingsnake (*Lampropeltis zonata*): a 28 inch individual seen along dry creek bed of lower Big Pine Canyon
Western Aquatic Gartersnake (*Thamnophis couchii*): seen along Sisquoc River.
Western Rattlesnake (*Crotalus viridis*)*

Birds:
Mountain Quail (*Oreortyx pictus*): fairly common, form Sisquoc to crest
Sharp-shinned Hawk (*Accipiter striatus*)*
Cooper's Hawk (*Accipiter cooperi*): seen over mcf twice in 4 days
Red-tailed Hawk (*Buteo jamaicensis*): occasional over mcf and jp
Golden Eagle (*Aquila chrysaetos*): sighted several times over mcf Big Pine Mtn also perched in tall sugar pine.
Prairie Falcon (*Falco mexicanus*): *
Peregrine Falcon (*Falco peregrinus*): *
Turkey Vulture (*Cathartes aura*) occasional overhead throughout
California Condor (*Gymnogyps californianus*): previous to 1986 a regular breeder and year round resident of the area (see text)
American Kestrel (*Falco sparverius*): possible nesting pain in mcf snag near West Big Pine
Mourning Dove (*Zenaida macroura*): uncommon lower Sisquoc drainage

Band-tailed Pigeon (*Columba fasciata*): flocks in mcf and other upper elevation habitats
Greater Roadrunner (*Geococcyx californianus*):*
Western Screech Owl (*Otus kennicottii*): heard upper Bear Camp June 11
Great Horned Owl (*Bubo virginianus*): heard at Upper Bear Camp June 11, Big Pine Mountain June 12
Spotted Owl (*Strix occidentalis*): heard Upper Bear Camp June 11, noted as nesting in area by Hamber
Northern Saw-whet Owl (*Aegolius acadicus*):* Upper Bear Camp
Flammulated Owl (*Otus flammeolus*): * Upper Bear Camp
Northern Pygmy Owl (*Glaucidium gnoma*): *
Common Poorwill (*Phalaenoptilus nuttallii*): heard calling from Upper Bear Camp
White-throated Swift (*Aeronautes saxitilis*): common over cliffs, upper elevations
Vaux Swift (*Chaetura vauxi*): *
Black-chinned Humingbird (*Archilochus alexandri*): *
Costa's Hummingbird (*Calypte costae*): *
Anna's Hummingbird (*Calypte anna*): fairly common lowest to highest elevations
Rufous Hummingbird (*Selasphorus rufus*):*
Allen's Hummingbird (*Selasphorus sasin*): *
Acorn Woodpecker (*Melanerpes formicivorus*): occasional mcf, co
Northern Flicker (*Colaptes auratus*): occasional mcf, jp
Red-breasted Sapsucker (*Sphyrapicus ruber*): breeding in mcf at Upper Bear Camp
Hairy Woodpecker (*Picoides villosus*): occasional mcf, jp
Downy Woodpecker (*Picoides pubescens*): uncommon riparian, lower Sisquoc
White-headed Woodpecker (*Picoides albolarvatus*): common mcf and jp
Nuttall's Woodpecker (*Picoides nuttallii*):*
Ash-throated Flycatcher (*Myiarchus cinerascens*): fairly common from low to high elevations in chap and other open habitats
Western Wood Pewee (*Contopus sordidulus*): common mcf
Olive-sided Flycatcher (*Contopus borealis*): uncommon mcf
Western Flycatcher (*Empidonax difficilis*): occasional lower canyons and Upper Bear Camp
Dusky Flycatcher (*Empidonax oberholseri*) locally common in mc upper slopes Big Pine Mountain
Black Pheobe (*Sayornis nigricans*): uncommon over pools in creek, Big Pine Canyon
Violet-green Swallow (*Tachycineta thalassina*): m common over mcf and mc, and other habitats throughout
Cliff Swallow (*Hirundo pyrrhonota*):*
Purple Martin (*Progne subis*): * likely breeder in mcf on Big Pine Mountain
Common Raven (*Corvus corax*): occasional overhead throughout
American Crow (*Corvus brachyrhynchos*): *
Steller's Jay (*Cyanocitta stelleri*): common mcf, bdf
Scrub Jay (*Aphelocoma caerulescens*): common in chaparral throughout
Clark's Nutcracker (*Nucifraga columbiana*):* mcf
Mountain Chickadee (*Parus gambeli*) common mcf
Plain Titmouse (*Parus inornatus*): fairly common up to crest in co and jp
Bushtit (*Psaltriparus minimus*): occasional in flocks low to high elevations

American Dipper or Water Ouzel (*Cinclus mexicanus*): at waterfalls in Big Pine Canyon and Sisquoc River.
White-breasted Nuthatch (*Sitta carolinensis*): occasional mcf
Red-breasted Nuthatch (*Sitta canadensis*): fairly common mcf
Pygmy Nuthatch (*Sitta pygmaea*): common in flocks in upper mcf
Brown Creeper (*Certhia americana*): common mcf
House Wren (*Troglodytes aedon*): occasional at upper elevations in mc, etc
Winter Wren (*Trogolodytes troglodytes*):* at Bear Camp.
Bewick's Wren (*Thryomanes bewickii*): fairly common in mc, chap. and cp
Rock Wren (*Salpinctes obsoletus*): occasional escarpments near West Big Pine
Canyon Wren (*Catherpes mexicanus*): occasional escarpments near W. Big Pine and Big Pine Canyon
Wrentit (*Chamaea fasciata*): fairly common in chap and mc throughout
California Thrasher (*Toxistoma redivivum*): occasional through in chap and mc
American Robin (*Turdus migratorius*): fairly common mcf
Varied Thrush (*Ixorius naevius*):*
Townsend's Solitaire (*Myadestes townsendi*): * mcf
Hermit Thrush (*Cathartus guttatus*):*
Western Bluebird (*Sialia mexicana*): uncommon jp and mcf
Mountain Bluebird (*Sialia currucoides*): *
Blue-gray Gnatcatcher (*Polioptila caerulea*): common in chap and mc up to crest
Golden-crowned Kinglet (*Regulus satrapa*):*
Cedar Waxwing (*Bombycilla cedrorum*):*
Phainopepla (*Phainopepla nitans*):*
Hutton's Vireo (*Vireo huttoni*): occasional co, cp-chap
Solitary Vireo (*Vireo solitarius*): mcf at Upper Bear Camp, co
Warbling Vireo (Vireo gilvus): fairly common along Sisquoc River riparian and in mcf at Upper Bear Camp
Nashville Warbler (*Vermivora ruficapilla*)*
Yellow Warbler (*Dendroica petechia*): several seen in riparian, Lower Sisquoc, presumed breeding
Yellow-rumped (Audubon's) Warbler (*Dendroica coronata*): occasional mcf, jp, probably breeds
Black-throated Gray Warbler (*Dendroica nigrescens*): fairly common co, cp, mcf
MacGillivray's Warbler (*Oporornis tolmei*):*
Orange-crowned Warbler (*Vermivora celata*): fairly common mc, edge mcf mid to upper elevations
Wilson's Warbler (*Wilsonia pusilla*): occasional along riparian, Sisquoc River. e.g. Lower Bear Camp
Brown-headed Cowbird (*Molothrus ater*):*
Western Tanager (*Piranga ludoviciana*): fairly common mcf, co, cp-chap, etc
Black-chinned Sparrow (*Spizella atrogularis*): common chap and mc also jp
Rufous-crowned Sparrow (*Aimophila ruficeps*):*
Chipping Sparrow (*Spizella passerina*):*
Fox Sparrow (*Passerella iliaca*): common only in mc, particularly bitter cherry-choke cherry phase

Dark-eyed (Oregon) Junco (*Junco hyemalis*): common mcf
Rufous-sided Towhee (*Pipilo erythrophthalmus*): common chap, mc, co throughout
California (Brown) Towhee (*Pipilo crissalis*): occasional chap, lower elevations
Black-headed Grosbeak (*Pheucticus melanocephalus*): fairly common low to high elevations chap. mc, jp, etc.
Purple Finch (*Carpodacus purpureus*): fairly common lower mcf, co, bdf
Cassin's Finch (*Carpodacus cassinii*): common at upper elev. mcf and jp, males can imitate other species (e.g. scrub jay, wren-tit)
Red Crossbill (*Loxia curvirostra*): flocks in cp near Upper Bear Camp
Lesser Goldfinch (*Carduelis psaltria*): common throughout.
Lawrence's Goldfinch (*Carduelis lawrencei*): uncommon, overhead in lower Sisquoc

Mammals:
Black Bear (*Ursus americanus*): common sign seen throughout, individuals seen at Bear Meadow along upper Big Pine Canyon
Mule deer (*Odocoileus hemionus*): several seen in four days throughout
Mountain Lion (*Felis concolor*): tracks seen along trail near West Big Pine
Bobcat (*Lynx rufus*): tracks seen along road near old Alamar Station site.
Coyote (*Canis latrans*): sign seen several places
Gray Fox (*Urocyon cinereoargenteus*): sign seen several places up to crest
Brush Rabbit (*Sylvilagus bachmani*): seen along lower Sisquoc
Blacktail Jackrabbit (*Lepus californicus*)*
Merriam Chipmunk (*Tamias merriami*): common in mcf. jp, mc, chap, cp, etc.
Western Gray Squirrel (*Sciurus griseus*): common in mcf, co, cp
California Ground Squirrel (*Spermophilus beecheyi*): uncommon seen only at "Bear Meadow" ca. 5800 ft
Broad-handed Mole (*Scapanus latimanus*): tunnels seen at Upper Bear Camp, etc.
Valley Pocket Gopher (*Thomomys bottae*): excavations and tunnels at upper elevations as well as along lower Sisquoc River canyon
Pacific Kangaroo Rat (*Dipodomys agilis*):*
California Mouse (*Peromyscus californicus*):* trapped
Brush Mouse (*Peromyscus boylei*): * trapped
Deer Mouse (*Peromyscus maniculatus*): *trapped
Pinyon Mouse (*Peromyscus truei*): *
Dusky-footed Woodrat (*Neotoma fuscipes*): houses seen in cp and in mc up to near summit of Big Pine Mountain.
California Myotis (*Myotis californicus*): * netted at Bluff Camp (about 1.5 miles S of RNA)
Western Pipistrelle (*Pipistrellus hesperius*): *netted at Bluff Camp
Hoary Bat (*Lasiurus cinereus*); *
Pallid Bat (*Antrozous pallidus*): *netted at Bluff Camp

D2: Results of a 20 minute census for birds conducted on a 700 x 100 m strip of mixed conifer forest at Upper Bear Camp, Big Pine Mountain RNA.

Species	density (per ha)
Brown creeper	1.00
Dark-eyed junco	0.71
Western wood pewee	0.71
Steller's jay	0.71
Mountain chickadee	0.57
Red-breasted nuthatch	0.43
White-headed woodpecker	0.43
Warbling vireo	0.43
Western tanager	0.43
Purple finch	0.29
American robin	0.29
Western flycatcher	0.29
Rufous-sided towhee	0.29
Black-headed grosbeak	0.14
Anna's hummingbird	0.14
Olive-sided flycatcher	0.14
Acorn woodpecker	0.14
Orange-crowned warbler	0.14
White-breasted nuthatch	0.14
House wren	0.14
Ash-throated flycatcher	0.14
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Total	7.70

Appendix E: Summaries of vegetation survey data

Table 1: Sampling data for trees on 24 10 x 10 m plots between about 6080 and 6800 ft (1853-2073 m) on north and northwest facing slopes of Big Pine Mountain

Species	density (per ha)	frequency	cover (m^2/ha)	relative density	relative frequency	relative cover	importance value
whiter fir	245.8	0.917	70.13	0.711	0.537	0.645	189.3
incense-cedar	41.7	0.333	22.00	0.121	0.195	0.202	51.8
Jeffrey pine	54.2	0.417	16.00	0.157	0.244	0.147	54.8
Sugar pine	4.2	0.042	0.63	0.012	0.025	0.006	4.3
Totals	345.8	1.709	108.76	1.000	1.000	1.000	300.0

Table 2: Density and frequency values of saplings and seedlings on the same 24 plots sampled in Table 1.

Species	density (trees/ha)	Frequency
White fir	66.7	0.333
Canyon live oak	20.8	0.208
Jeffrey pine	4.2	0.042
Sugar pine	4.2	0.042
Totals	95.9	0.625

Table 3: Herb and shrub cover and frequency on the same 24 plots sampled in Table 1 and 2.

Species	frequency	mean % cover
Lupinus elatus	0.58	1.88
Angelica tomentosa	0.33	0.98
Elymnus glausus	0.17	0.21
Symphoricarpos parishii	0.08	0.16
Erigeron foliosus	0.25	0.13
Amorpha californica	0.04	0.13
Eriogonum nudum	0.45	0.08
Tauschia parishii	0.04	0.08
Arceuthobium campylopodum	0.04	0.08
Arabis remanda	0.04	0.08
Gayophytum diffusum parvifolium	0.21	0
Phacelia curvipes	0.21	0
Claytonia spathulata	0.13	0
Galium aparine	0.13	0
Mentzelia Montana	0.13	0
Viola purpurea xerophyta	0.08	0
Bromus marginatus	0.08	0
Ribes roezlii	0.08	0
Silene lemmonii	0.08	0
Allophyllum gilioides	0.04	0
Chenopodium sp.	0.04	0
Cryptantha intermedia	0.04	0
Erysimum capitatum	0.04	0
Gilia modocensis	0.04	0
Lotus nevadensis	0.04	0
Phacelia distans	0.04	0
Pyrola picta aphylla	0.04	0
Sambucus caerulea	0.04	0
Thermopsis macrophylla	0.04	0
Zauschneria californica latifolia	0.04	0
Total mean cover		3.79

Table 4: Tree sampling data on 15 10 x 10 m plots in mixed conifer forest on alluvial bench near Upper Bear Camp, Big Pine Mountain RNA.

Species	density (per ha)	frequency	cover (m^2/ha)	relative density	relative freq.	relative cover	importance value
white fir	340.0	0.867	41.86	0.422	0.317	0.335	107.4
incense-cedar	233.3	0.733	47.84	0.289	0.268	0.383	94.0
canyon live oak	173.3	0.667	3.75	0.215	0.244	0.030	48.9
Jeffrey pine	26.7	0.267	20.55	0.033	0.098	0.165	29.6
sugar pine	6.7	0.067	10.78	0.008	0.025	0.086	11.9
big-leaf maple	13.3	0.067	0.17	0.017	0.025	0.001	4.3
coast live oak	13.3	0.067	0.01	0.017	0.025	0.000	4.2
Totals	806.6	2.735	124.96	1.001	1.001	1.001	300.3

Table 5: Herb and shrub frequency and cover on 15 10 x 10 m plots in mixed conifer forest at Upper Bear Camp, Big Pine Mountain RNA

Species	frequency	mean % cover
Amorpha californica	0.20	0.33
Prunus virginia demissa	0.13	0.33
Erigeron foliosus	0.13	0.07
Solidago californica	0.20	0.07
Linanthus androsaceus	0.13	0.20
Eriogonum nudum	0.20	0
Clarkia rhomboidea	0.13	0
Gayophytum diffusum parvifolium	0.13	0
Lotus sp.	0.13	0
Phacelia curvipes	0.13	0
Angelica tomentosa	0.07	0
Calyptridium monandrum	0.07	0
Corethrogyne filaginifolia	0.07	0
Marah fabaceus agrestis	0.07	0
Mimulus johnstonii	0.07	0
Total mean cover		1.00

Table 6: Summary of data for trees on seven 10 x 10 m plots sampled in Jeffrey pine forest near junction of Big Pine-Buckhorn Road and Mission Pines Trail 6500-6300 ft, Big Pine Mountain RNA.

Species	density	frequency (per ha)	cover (m^2/ha)	relative density	relative frequency	relative cover	importance value
Jeffrey pine	300.0	1.000	38.44	0.429	0.500	0.795	172.4
canyon live oak	342.9	0.571	7.35	0.490	0.286	0.152	92.8
white fir	42.9	0.286	1.17	0.061	0.143	0.024	22.8
sugar pine	14.3	0.143	1.42	0.020	0.072	0.029	12.1
Totals	700.0	2.000	48.38	1.000	1.000	1.000	300.0

Table 7: Frequency and cover of herbs and shrubs on seven 10 x 10 m plots in Jeffrey Pine forest near junction of Big Pine-Buckhorn Road and Mission Pines Trail, 6500-6300 ft, Big Pine Mountain RNA

Species	frequency	mean % cover
Symphoricarpos parishii	0.71	1.43
Arctostaphylos parryana	0.14	1.00
Viola purpurea *xerophyta*	0.71	.57
Galium andrewsii	0.57	0.43
Eriogonum wrightii	0.28	0.28
Vicia americana	0.43	0.14
Ceanothus integerrimus	0.14	0.14
Garrya flavescens	0.14	0.14
Keckiella breviflora	0.14	0.14
Lupinus excubitus austromontanus	0.14	0.14
Eriogonum umbellatum	0.28	0
Poa scabrella	0.28	0
Sanicula graveolens	0.28	0
Silene lemmonii	0.28	0
Tauschia parishii	0.28	0
Balsamorhiza deltoidea	0.14	0
Bromas tectorum	0.14	0
Chrysothamnus nausiosus	0.14	0
Dichelostemma pulchella	0.14	0
Erigeron foliosus	0.14	0
Eriophyllum confertiflorum	0.14	0
Lupinus elatus	0.14	0
Rhamnus californica tomentella	0.14	0
Sitanion hystrix	0.14	0
Tauschia hartwegii	0.14	0
Total cover		4.41